Project Specifications

CONTRACT & RELATED DOCUMENTS

FACILITY UPGRADES AT CHARLIE CRAIG HATCHERY

12/20/2024

CERTIFICATE OF AUTHORIZATION
FISHER & ARNOLD, INC.
No. 248
ARKANSAS

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 14044
JASON MacDONALD

COMMISSIONERS:

Stan Jones, Chairman
J.D. Neely, Vice Chairman
Brandon Adams
Anne Marie Doramus
Rob Finley
Phillip Tappan
Bill Jones
Dr. Michelle Evans-White, Ex Officio

GENERAL SPECIFICATIONS

ADVERTISEMENT FOR BIDS 1

BID SUBMISSION REQUIREMENT 3

PROPOSAL FORM 5

BOND 9

CONTRACT 11

INSTRUCTIONS TO BIDDERS 25

I. Contract Documents 25

II. Bidders 25

III. Proposals 25

IV. Modification Of Bids 25

V. Interpretation Of Documents 26

VI. General Conditions Of The Construction Contract 26

VII. Bond Requirements 26

VIII. Contractor's Insurance Requirements 28

IX. Examination Of Drawings, Specifications, Site Of Work 28

X. Responsibility Of Contractors/ Build America, Buy America 29

XI. Over $20,000.00 Bid Proposal 31

XII. Taxes 31

LIEN RELEASE REQUIREMENT 33

GENERAL SPECIFICATIONS 35

Section 1 - - Definition Of Terms 35

Section 2 -- Proposal Requirements & Conditions 36

2.1 Contents of the Proposal Forms 37

2.2 Familiarity with Proposed Work 37

2.3 Preparation of Proposal 37

2.4 Rejection of Irregular Proposals 37

2.5 Guaranty to Accompany Proposals 37

2.6 Delivery of Proposals 37

2.7 Withdrawal of Proposals 37

2.8 Disqualification of Bidders 38

2.9 Competency of Bidders 38

2.10 Contract Documents 39

2.11 Taxes 39

Section 3 -- State License For Contractors 39

Section 4 -- Scope Of The Work 39

4.1 Intent of Plans and Specifications 39

4.2 Special Work 39

4.3 Alterations of Plans or Character of Work 40

4.4 Extra Work 40

4.5 Removal and Disposal of Structures and Obstructions....40
4.6 Use of Materials Found on the Job....40
4.7 Final Clearing of the Work Sites....40
Section 5 -- Award Of Contract....41
Section 6 -- Subletting Or Assigning Contracts....41
Section 7 -- Responsibility For Damage Claims....41
Section 8 -- No Waiver Of Legal Rights....42
Section 9 -- Prosecution & Progress....43
9.1 Prosecution of Work....43
9.2 Limitations of Operation....44
9.3 Character of Workmen and Equipment....44
9.4 Temporary Suspension of Work....44
9.5 Failure to Complete Work on Time....45
9.6 Default and Termination of Contract....45
Section 10 -- Control Of The Work....46
10.1 Authority of the Resident or Project Engineer....46
10.2 Referee in Case of Disputes....47
10.3 Conformity with Plans and Allowable Deviations....47
10.4 Cooperation of the Contractor....47
10.5 Lines, Grades and Measurements....47
10.6 Duties of Resident or Project Engineers and Inspectors....47
10.7 Inspection....48
10.8 Removal of Defective and Unauthorized Work....48
10.9 Final Inspection....49
Section 11 -- Legal Relations & Responsibility To The Public....49
11.1 Laws To Be Observed....49
11.2 Trench or Excavation Safety Systems…..……49
11.3 Use of Explosives....49
11.4 Preservation and Restoration of Property....50
11.5 Contractor's Insurance....50
11.6 No Waiver of Legal Rights....50
Section 12 -- Measurement & Payment....51
12.1 Measurement of Quantities....51
12.2 Scope of Payment....51
12.3 Payment and Compensation for Altered Quantities....52
12.4 Extra and Force Account Work....52
12.5 Claims and Damages....53
12.6 Freight Rates....53
12.7 Partial Payments....53
12.8 Acceptance and Final Payment....54
12.9 One-Year Guarantee Period....54
SPECIAL PROVISIONS....55
Employment of Labor....55
Non-Discrimination in Employment....55
SPECIFICATION

ADVERTISEMENT FOR BIDS
Arkansas State Game and Fish Commission

Sealed bids will be received by the Arkansas State Game and Fish Commission at the C.B. Charlie Craig State Hatchery, 977 W Fish Hatchery Rd, Centerton, AR 72719 {36°21'04"N, 94°17'46"W} until ***2:00 p.m., Tuesday, February 18, 2025*** and then publicly opened and read for the furnishing of all work required for the Facility Upgrades - Charlie Craig State Hatchery, 977 W Fish Hatchery Rd, Centerton, Benton County, AR 72719 {36°21'04"N, 94°17'46"W}, all in strict accordance with plans, specifications and contract drawings.

This project is under the strict adherence to the "Build America, Buy America" Act. It shall be bid and built according to these standards. For further information, please reference the **"INSTRUCTIONS TO BIDDERS, SECTION X, BUILD AMERICA, AMERICA"** of the bid specification documents. More information can also be found here: https://www.doi.gov/grants/buyamerica.

There will a mandatory onsite job site pre-bid meeting at ***10:30 a.m., Tuesday, January 28, 2025*** at the project site at C.B. Charlie Craig Hatchery, 977 W Fish Hatchery Rd, Centerton, AR 72719 {36°21'04"N 94°17'46"W}. **All prospective bidders are required to attend the meeting.**

For additional information and clarification contact: Jerry Gomez at 501-263-5815 or Jerry.Gomez@agfc.ar.gov.

ARKANSAS STATE GAME AND FISH COMMISSION

_____
Austin Booth, Director

BID SUBMISSION REQUIREMENT

Submit Bid in Sealed Envelope Marked with:

1. Name of Contractor Submitting Bid
2. Marked as "BID"
3. Name of Project to be Bid
4. Current Arkansas General Contractors License Number
5. Marked "DO NOT OPEN"
6. ATTN: Engineering and Construction
7. Time and Day of Bid Opening

To Mail Bid:

Enclose the *FIRST* envelope in a second envelope addressed to:

Arkansas State Game and Fish Commission/ BUSINESS NAME
ATTN: Jerry Gomez
2 Natural Resources Drive
Little Rock, AR 72205

BID ENCLOSED

For Additional Information and Clarification, Please Contact:

CONTACT NAME, CONTACT TITLE
2 Natural Resources Drive
Little Rock, AR 72205
501-227-2152
jerry.gomez@agfc.ar.gov

PROPOSAL FORM

Proposal of _____

Address: _____ Phone: _____

for the Facility Upgrades at Charlie Craig Hatchery at Centerton, Benton County, Arkansas, in accordance with the Standard Specifications of the Arkansas State Game and Fish Commission, the Special Provisions attached hereto and the plans on file in the office of 2 Natural Resource Drive, Little Rock AR 72205, for the total sum of:

($_____),$_____

BID SCHEDULE

Item No	Description	Quantity	Unit	Unit Price	Total Cost
1	Mobilization	1	L.S.	$_____	$_____
2	8" SDR-21 PVC Pipe	5,443	L.F.	$_____	$_____
3	18" SDR-21 PVC PIPE	12,060	L.F.	$_____	$_____
4	10" SDR-21 PVC PIPE	3,950	L.F.	$_____	$_____
5	24" SDR-26 PVC Pipe	90	L.F.	$_____	$_____
6	60" Manholes	1	Ea.	$_____	$_____
7	72" Manholes	3	Ea..	$_____	$_____
8	96" Manholes	3	Ea.	$_____	$_____
9	Recirculating Pump Station	1	L.S.	$_____	$_____
10	Pond Water Storage Tank	1	L.S.	$_____	$_____
11	50,000-Gal Steel Water Storage Tank	1	L.S.	$_____	$_____
12	ARV Structures	3	Ea.	$_____	$_____
13	Spring Building Tie-In	1	L.S	$_____	$_____
14	Spring Pump Station	1	L.S	$_____	$_____
15	Junction Structure No. 1	1	L.S.	$_____	$_____
16	Junction Structure No. 2	1	L.S.	$_____	$_____
17	Kettle Structure	32	Ea.	$_____	$_____

Item No	Description	Quantity	Unit	Unit Price	Total Cost
18	Headwalls	10	Ea.	$_____	$_____
19	Tie Into Existing Pipes	3	Ea.	$_____	$_____
20	Hatchery Building	1	L.S.	$_____	$_____
21	Unclassified Excavation	106,503	Cu.YD	$_____	$_____
22	Compacted Embankment	116,622	Cu.Yd	$_____	$_____
23	Erosion Control/SWPPP	1	L.S.	$_____	$_____
24	72” Manholes	3	Ea..	$_____	$_____
25	Trench and Excavation Safety System as required by ACT 291 of the 1993 Arkansas General Assembly	1	L.S.	$_____	$_____
26	6” Class VII Gravel	1	L.S.	$_____	$_____
27	Site Improvements	1	L.S.	$_____	$_____
28	Site Electric	1	L.S	$_____	$_____

***NOTE:** Prices indicating the total amount of the bid must be shown in both words and figures. Written prices will control in case of a discrepancy. Deductive alternates may be as an accumulated total or as individual deletion items.*

Proposals received until 2:00 P.M., February 18, 2025

TO THE ARKANSAS STATE GAME AND FISH COMMISSION:

Gentlemen: The following proposal is made on behalf of _____

_____

(Name of those interested)

a ❑ Partnership, ❑ Individual, ❑ Joint Venture, ❑ Corporation existing under the laws of _____ and no others. The proposal is made without collusion on the part of any person, firm or corporation. I hereby certify that _____ carefully examined the Plans and the Specification hereinafter listed, and the Special Provisions and Form of Contract, and the site of the work throughout its whole extent. On the basis of the Plans, Specifications, Special Provisions, and Form of Contract, the undersigned proposed to furnish all necessary machinery, equipment, tools, labor and other means of construction, and to furnish all materials as specified, in the manner and at the time prescribed, and to finish the entire project within the time hereinafter proposed.

The undersigned agrees, upon receipt of written **notice of the acceptance** of this bid, to execute the contract form contained in these specifications, in accordance with the bid accepted within five (5) days after notification that the bid has been accepted, and give bonds with good and sufficient surety, or securities, for the faithful performance of the contract, and for the protection of all persons supplying labor and materials in the prosecution of the work within ten (10) days after the prescribed forms are presented for signature.

Performance will begin within ten (10) calendar days after the receipt of notice to proceed and will complete the entire work within **five hundred and fifty (550)** calendar days from the date of the execution of the contract. ***Days will not be charged for AGFC material delays.***

Receipt is hereby acknowledged of Addendum No. _____, Dated _____.

Receipt is hereby specifically acknowledged, and complete examination is hereby expressly guaranteed of the following Specification parts containing the following listed items: General Clauses and Covenants, Schedule of Pay Items, Proposal, Contract, and Bond Forms.

The undersigned further proposed to perform all extra work that may be required, on the basis provided in the Specifications, and to give such work personal attention, and to secure economic performance.

The undersigned further proposed to execute the contract agreement, and to furnish satisfactory bond within ten (10) days after he has received notice that he has been awarded the contract. The undersigned further agrees to begin work when ordered by the Engineer, or within ten (10) days thereafter, and to complete the work within **five hundred and fifty (550)** calendar days.

Signed: _____

Title: _____

Address: _____

_____

Phone: _____

* Contractor's License Number: AR _____

CORPORATE SEAL

BOND

KNOW ALL MEN BY THESE PRESENTS:

THAT WE, _____ The Principal, and _____ of _____, as Surety, are held and firmly bound unto the State of Arkansas for the use and benefit of the Arkansas State Game and Fish Commission, and its successors and its assigns in the penal sum of _____ ($_____) Dollars, lawful money of the United States of America to be paid to said Arkansas State Game and Fish Commission, to which payment, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, or assigns, jointly and severally by these presents.

Signed, sealed, and delivered this _____ day of _____, 20__ .

The condition of this Bond is as follows: That, whereas, said _____

_____as principal, has entered into a contract with the Arkansas State Game and Fish Commission of the State of Arkansas for the construction of that certain project in Arkansas County, to wit:

Facility Upgrades at Charlie Craig Hatchery Now, Therefore, if the above bounded

_____

_____

shall in all things stand and abide by and well and truly observe, do keep and perform all and singular, the terms, covenants, guarantees and agreements in said Contract to be observed, kept, done and performed, and each of them, at the time and in the manner and form therein specified, and shall do and perform all the labor and work and shall furnish all the material as specified in said Contract and in strict accordance with the terms of said Contract and the Plans and Specifications thereto attached, and made a part thereof, and shall indemnify and save harmless said Arkansas State Game and Fish Commission against any loss or damage of whatever kind and character, arising or occasioned by deed of negligence of said principal, his agents, servants, and employees, in the prosecution of the work or by reason of improper safeguards or incomplete protection to the work and shall pay all bills for material, labor supplies entered into contingent and incident to the said construction of said work, or used in the course of performance of the work, and shall complete said work within the time specified in said Contract, and shall guarantee all work against faulty materials or poor workmanship during the construction period and for one year after the date of completion of the contract, then this obligation shall be null and void; otherwise to remain in full force and effect.

The Surety hereon further agrees that lack of knowledge by the Surety of any delay in the progress of the work by the Contractor shall not operate as a defense by the Surety to any claim or suit on this bond, it being understood that the Surety shall receive notice of all steps looking to the cancellation of the Contract, and/or the re-letting of the work.

The Surety Company hereon further agrees to pay all claims for which the said Contractor is liable under the Provisions of Act #82 of the Acts of 1935, except that nothing

in this Bond shall be construed as assuming liability for the purchase price of any major equipment under what is commonly called a Sales Rental Agreement.

Unpaid claims for all items as provided in the said Act #82 of the Acts of 1935, excepting the purchase price or sales rental price of all major equipment, shall have a right of action on this Bond, but payments thereon shall be postponed until all claims of the Arkansas State Game and Fish Commission have been paid in full.

WITNESS OUR HANDS this _____ day of _____, 20_____.

_____ _____

Surety Principal

By _____ By _____

Resident Agent, State of AR

Filed with the Arkansas State Game and Fish Commission for approval this _____ day of _____, 20_____.

_____

AGFC Contract No: TO BE ASSIGNED BY LEGAL

CONSTRUCTION CONTRACT FOR SERVICES

between

ARKANSAS STATE GAME AND FISH COMMISSION

and

NAME OF CONTRACTOR

THIS CONTRACT, effective as of the date of the last signature hereto, is made by and between the **ARKANSAS STATE GAME AND FISH COMMISSION**, 2 Natural Resources Dr., Little Rock, AR 72205, hereinafter called "**COMMISSION**," and:

Name: **NAME OF CONTRACTOR**

Representative:

Federal ID:

Address:

Phone #:

Email:

Hereinafter called the "**CONTRACTOR**."

1. TERM

The term of this Contract will begin at 12:01 a.m. (Central Time) on January 1st, 2001, and shall end at 11:59 p.m. (Central Time) on January 2nd, 2001 (the "End Date"). The work shall be completely finished by the End Date.

2. GENERAL

The purpose of this Contract is to in exact accordance with the Plans and Specifications on file in the office of the COMMISSION at 2 Natural Resources Drive, Little Rock, Arkansas, 72205, and to the entire satisfaction of the COMMISSION. A copy of the Specifications also is attached hereto as Exhibit B. All of CONTRACTOR's work shall be subject to monitoring and inspection by the COMMISSION.

3. CALCULATION AND RENDERING OF COMPENSATION

The CONTRACTOR in consideration for performance of the outlined services as specified below and in all exhibits contained herein shall be paid by the COMMISSION a sum of money not to exceed $0.00 (the "Contract Sum"), to be paid in the following manner: Upon completion of the work to the COMMISSION's satisfaction, the CONTRACTOR shall submit an invoice, which will be processed for payment under normal COMMISSION accounting practices and consistent with the terms of this Contract.

4. SERVICES

Project Name:

Project Number:

Project Site:

CONTRACTOR shall be responsible for performing the following services in exact accordance with the Plans and Specifications:

Description of services and any materials to be provided by the Commission

A. The CONTRACTOR shall provide its services in compliance with the terms and conditions as specified herein. CONTRACTOR agrees to furnish and pay for all labor, materials (other than those provided by the COMMISSION pursuant to paragraph 4.0, if any), tools, and equipment necessary to complete the services described herein. The services shall be done in a manner, which meets the COMMISSION'S satisfaction and in full compliance with all applicable laws, rules and regulations. Except for advising the CONTRACTOR of what is to be done and the results expected, the COMMISSION shall have no direct supervision over the CONTRACTOR. The CONTRACTOR will pursue the completion of services as an independent contractor using its own methods. The CONTRACTOR is solely responsible for the results of the work.

B. The CONTRACTOR shall inspect and document the existing conditions of the project site at the beginning of the term of this Contract. A representative of the COMMISSION shall be present during this inspection. The CONTRACTOR shall provide photographic and/or video documentation, which CONTRACTOR shall submit to the Commission prior to beginning the work.

C. The CONTRACTOR shall exercise due care to minimize any damages to trees and general property in and around the project site. The CONTRACTOR shall repair any damages caused by the CONTRACTOR's equipment in a timely manner at no expense to the COMMISSION. The work areas shall be left clear of debris and cleaned, as reasonably practical under the conditions of this project.

D. The CONTRACTOR shall use equipment and perform work in a manner to prevent damages to the COMMISSION's infrastructure facilities and adjacent rights-of-way, roadways, and levees. The

CONTRACTOR shall repair any damages caused by the CONTRACTOR's equipment in a timely manner at no expense to the COMMISSION. All tracked equipment shall be approved by the COMMISSION prior to use. Any damage to private property shall be repaired at the expense of the CONTRACTOR.

E. The CONTRACTOR shall conduct its work so as not to interfere with the activities of federal, state, and local governments or agencies, or of any public utilities.

F. The COMMISSION reserves the right to inspect the site and review operations at any time. The COMMISSION's inspection of the site and review of operations shall in no way constitute acceptance or approval of the quality of the work or the methods used for construction.

G. All work shall be accomplished in a safe manner in accordance with applicable OSHA standards and requirements.

5. PERFORMANCE SCHEDULE

A. The CONTRACTOR shall commence performance **within ten (10) days** of receipt of notice to proceed.

B. All work under this Contract shall be performed during daylight, beginning no earlier than thirty minutes before sunrise and ending no later than thirty minutes after sunset. The CONTRACTOR may work seven days per week, including holidays.

C. The CONTRACTOR must complete performance within the time period and cost limit enumerated in paragraphs 1.0 ("Term") and 3.0 ("Calculation and Rendering of Compensation"), unless the COMMISSION agrees otherwise by written change order. Both parties, pursuant to applicable state and federal law, will equitably negotiate subsequent changes in completion time and cost.

6. EQUIPMENT

A. All trucks and other equipment must be operated in compliance with all applicable federal, state, and local rules and regulations. The CONTRACTOR is responsible for ensuring all equipment complies with federal, state and local laws. The CONTRACTOR prior to use shall inspect all equipment.

B. Prior to commencing the work, the CONTRACTOR shall present for inspection to the COMMISSION all trucks, trailers, or other equipment that will be used during the work. Such inspection shall not constitute an approval of such trucks, trailers or equipment or a warranty of the safety or suitability of the same.

C. All equipment designated for use under this Contract shall be used only for activities described herein during the working hours of this Contract. The CONTRACTOR shall not solicit work from

private citizens or others to be performed in the designated work areas during the period of this Contract.

D. The CONTRACTOR agrees to maintain all equipment in a safe operating condition. All equipment shall have proper safety devices and shields. All appropriate safety/warning signs shall be in place while and where work is in progress. The CONTRACTOR shall exercise due care in performing the work described herein to avoid damage or risk to persons or property.

E. The CONTRACTOR shall remove all of its equipment from COMMISSION premises within thirty (30) calendar days of the expiration, termination, or completion of this Contract. Equipment not removed by the CONTRACTOR within thirty (30) calendar days shall be deemed abandoned and subject to such disposal as AGFC may deem appropriate at the CONTRACTOR's expense.

7. REPORTING

A. The CONTRACTOR shall prepare and submit daily operational reports throughout the duration of the work. Daily reports shall document the CONTRACTOR's activities and progress and shall be submitted to the COMMISSION each day for the term of the Contract. Each report shall contain, at a minimum, the following information:

- CONTRACTOR's Name;
- Contract Number;
- Location of work;
- Day of Report; and
- Statements documenting progress by area and estimating time to completion.

B. The CONTRACTOR shall immediately contact the COMMISSION if CONTRACTOR encounters any unexpected objects, materials, obstacles or impediments.

8. OTHER CONSIDERATIONS

A. The CONTRACTOR will be responsible for obtaining applicable environmental and regulatory permits prior to the CONTRACTOR commencing operations.

B. The COMMISSION shall have the right to suspend the CONTRACTOR's operations due to inclement weather or other conditions that COMMISSION, in its discretion, deems unacceptable. Unless the conditions are caused by the CONTRACTOR, such suspension shall be deemed an event of Force Majeure (as defined below).

C. The CONTRACTOR shall employ as many local residents and subcontractors as reasonably possible for performance of this Contract.

9. LEGAL COMPLIANCE

The CONTRACTOR shall at all time observe and fully comply with any and all Federal, State, and local laws, statutes, orders, ordinances, and regulations.

10. NATIONAL HISTORIC PRESERVATION ACT COMPLIANCE

If the CONTRACTOR encounters the following while performing under this Contract, it shall immediately stop all work in the vicinity of the discovery and take reasonable measures to avoid or minimize harm to the finds: archeological deposits, including but not limited to pottery or ceramics, stone tools, projectile points, dugout canoes, metal implements, historical building material, that could be associated with Native American, early European, or American settlements; historic resources (as defined by Section 301 of the National Historic Preservation Act ("NHPA"), "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on the National Register, including artifacts, records, and material remains related to such a property or resource"); or bones or human remains. The CONTRACTOR shall immediately notify the COMMISSION and shall not resume work in any areas identified until (a) appropriate measures have been taken to ensure that the project is in compliance with the NHPA and (b) the COMMISSION authorizes the resumption of work. Additional conditions may apply. The CONTRACTOR shall insert this paragraph in all subcontracts related to this Contract.

11. INSURANCE

In addition to the insurance requirements contained in the Specifications, the CONTRACTOR shall maintain during the term of this Contract (and, where indicated, for a period of time after completion of the work) the insurance coverages in the amounts and upon the terms as stated in the AGFC INSURANCE RIDER attached hereto and incorporated herein. Prior to commencing operations hereunder, CONTRACTOR shall furnish to the COMMISSION a Certificate of Insurance that evidences such coverage and is satisfactory to the COMMISSION. Should CONTRACTOR fail to furnish current evidence upon demand of any insurance required hereunder, or in the event of cancellation or adverse material change in any such insurance, the COMMISSION may, at its option, suspend this Contract until insurance is obtained or terminate this Contract immediately without further action.

12. EQUAL EMPLOYMENT OPPORTUNITY

The CONTRACTOR agrees not to discriminate in its employment practices or subcontracts with regard to race, color, sex, age, religion, national origin, or disability.

13. LIABILITY

It is clearly understood and agreed that the CONTRACTOR, in consideration of the amounts due under this Contract, shall be solely responsible for all manner of claims, causes of action or liability arising out of any accident, injury or damage to the CONTRACTOR, its equipment or property, to its employees or agents and to any third party's person or property while conducting the activity described in this Contract.

The CONTRACTOR shall indemnify, defend, protect and hold harmless the COMMISSION and its Commissioners, Director and employees from or against any and all claims, causes of action, liability, damages and expenses of whatsoever nature, including attorneys' fees, arising from or directly related to the CONTRACTOR's services under this Contract. This Contract shall be deemed and construed as binding solely between the two parties and shall not be deemed or construed as conferring any benefit or indemnification on behalf of any third party. Nothing in this Contract shall be deemed or construed as an admission of liability or as a waiver of the COMMISSION's sovereign immunity. The obligations of this paragraph shall survive the expiration or termination of this Contract.

14. TERMINATION

If, at any time during the progress of the Contract, the work is not performed in an efficient, satisfactory and timely manner as agreed in this Contract, the COMMISSION may, without bias to any other right or remedy, after seven (7) days written notice to the CONTRACTOR, terminate this Contract paying only for work satisfactorily completed prior to termination.

15. NON-APPROPRIATION CLAUSE

In the event the Arkansas General Assembly fails to appropriate sufficient funds or make monies available for any fiscal year covered by the term of this Contract for the services to be provided by the CONTRACTOR, this Contract shall be terminated on the last day of the last fiscal year for which sufficient funds were appropriated or monies made available for such purposes. This provision shall not be construed to abridge any other right of termination the COMMISSION may have.

16. NON-WAIVER

No waiver by the COMMISSION of any breach of any provision of this Contract shall constitute a waiver of any prior, concurrent or subsequent breach of the same or any other provision hereof, and no waiver shall be effective unless made in writing and signed by an authorized representative of the COMMISSION. No delay or omission by the COMMISSION in the exercise of any right or remedy upon any breach by the CONTRACTOR shall impair such right or remedy or be construed as a waiver.

17. LIQUIDATED DAMAGES

In the event the CONTRACTOR fails to complete the project by the End Date, in lieu of other rights and remedies available at law and equity, the COMMISSION may elect to charge the CONTRACTOR liquidated damages in the per day amount provided below until each and every element of the work is completed by the CONTRACTOR. At any time after liquidated damages begin to accrue, the COMMISSION may elect to hire a third-party to complete the work and the CONTRACTOR shall be liable for all costs and expenses incurred by the COMMISSION in hiring such third-party and shall immediately pay the COMMISSION the same upon demand. The parties acknowledge that: (i) it would be impractical to fix the actual damages suffered by the COMMISSION as a result of the CONTRACTOR's failure to

perform as required hereunder; and (ii) the amount of the liquidated damages represents a fair and reasonable compensation to the COMMISSION for such default.

Amount of Construction Contract	***Amount of Liquidated Damages Per Day***
Less than $50,000	$120.00
$50,000 or more but less than $100,000	$150.00
$100,000 or more but less than $500,000	$310.00
$500,000 or more but less than $1,000,000	$400.00
$1,000,000 or more but less than $2,000,000	$500.00
$2,000,000 or more but less than $5,000,000	$580.00
$5,000,000 or more but less than $10,000,000	$760.00
$10,000,000 or more	$1,280.00

18. <u>FORCE MAJEURE</u>

A. For purposes of this Contract, Force Majeure shall mean any event beyond the control of the CONTRACTOR that delays the performance of any obligation under this Contract despite the CONTRACTOR's best efforts to fulfill the obligation. "Best efforts" includes anticipating any potential force majeure event and addressing the effects of any such event (a) as it is occurring and (b) after it has occurred, to prevent or minimize any resulting delay to the greatest extent possible. Force Majeure does not include the CONTRACTOR's financial inability to perform any obligation under this Contract. Failure to apply for a required permit or approval or to provide in a timely manner all information required to obtain a required permit or approval that is necessary to meet the requirements of this Contract, or failure of the CONTRACTOR to approve contracts shall not, in any event, be considered Force Majeure events.

B. The CONTRACTOR shall notify the COMMISSION orally and by electronic or facsimile transmission as soon as possible, but not later than five (5) days after the time the CONTRACTOR first knew of, or in the exercise of reasonable diligence under the circumstances should have known of, any event which might constitute a Force Majeure event. The written notice the CONTRACTOR submits pursuant to this paragraph shall indicate whether the CONTRACTOR claims that the delay should be excused due to a Force Majeure event. The notice shall describe in detail the basis for the CONTRACTOR's contention that it experienced a Force Majeure delay, the anticipated length of the delay, the precise cause or causes of the delay, the measures taken or to be taken to prevent or minimize the delay, and the timetable by which those measures will be implemented. The CONTRACTOR shall adopt all reasonable measures to avoid or minimize such delay. Failure to so notify the COMMISSION shall render the claim of Force Majeure void and of no effect as to the

event in question, and shall be a waiver of the CONTRACTOR's right to obtain an extension of time for its obligations based on such event.

C. If the COMMISSION finds that a delay in performance is, or was, caused by a Force Majeure event, the COMMISSION shall extend the time for performance, in writing, for a period to compensate for the delay resulting from such event, and liquidated damages shall not be due for such a period.

19. ASSIGNMENT

Neither party to this Contract shall assign this Contract nor any interest in it without written consent of the other party; nor shall the CONTRACTOR subcontract any portion of the work without first obtaining the written permission of the COMMISSION. In the event the COMMISSION permits any subcontracting of the work, the CONTRACTOR shall be responsible for ensuring that all subcontractors comply with the terms of this Contract and all applicable laws, rules and regulations.

20. APPLICABLE LAW

This Contract has been made and entered into in the State of Arkansas. Any and all disputes under this Contract shall be governed by the laws of the State of Arkansas applicable to contracts entered into and performed entirely within the State of Arkansas without reference to principles of conflict of laws. With respect to any claim for monetary damages against the COMMISSION, the appropriate venue shall be in the Arkansas State Claims Commission, Pulaski County, Arkansas.

21. ENTIRE AGREEMENT

This Contract and its exhibits constitute the entire agreement between the parties hereto and may not be amended or modified except by written agreement signed by both parties. All additions or deletions to this Contract must be made by written change orders and agreed to by both parties before being signed.

22. NOTICES

A. At the time of award, the CONTRACTOR shall designate, in writing, a representative to receive any notice required hereunder and who shall be available at the local work site during all times that the CONTRACTOR is performing work in accordance herewith. A copy of said designation shall be provided to the COMMISSION's authorized agent at the time of award.

B. The only COMMISSION personnel authorized to receive any notice required hereunder is the COMMISSION's authorized agent (with a copy to the COMMISSION Director). Said notice must be hand-delivered during normal business hours to the location(s) designated by the COMMISSION. The COMMISSION's authorized agent and Director are:

Reid Phifer, Assistant Chief of Operations Arkansas State Game and Fish Commission 2 Natural Resources Drive Little Rock, AR 72205	Director Arkansas State Game and Fish Commission 2 Natural Resources Dr Little Rock, AR 72205

23. EXHIBITS

The parties agree that the following exhibits shall be part of this Contract for all purposes:

- Statement of Assurance and Compliance (Exhibit A);
- Specifications (Exhibit B);
- Proposal and Bid Schedule Submitted by CONTRACTOR (Exhibit C); and
- Contract and Grant Disclosure and Certification Form (Exhibit D).
- Plans and Drawings available to CONTRACTOR and on file in the office of the COMMISSION at Little Rock, Arkansas, are incorporated by reference, but are not physically attached as Exhibits hereto.

24. ORDER OF PRECEDENCE

In the event that there is any conflict, contradiction, or ambiguity between any documents, exhibits, and attachments that form part of this Contract, the same shall be resolved by giving precedence in the following order:

A. The body of this Contract and any written amendments (change orders) thereto (later having precedence over earlier).

B. Statement of Assurance and Compliance (Exhibit A).

C. Specifications (Exhibit B).

D. Proposal and Bid Schedule Submitted by CONTRACTOR (Exhibit C).

E. Other documents, plans, exhibits, and attachments that form part of this Contract.

In the event of a conflict between good practice and the requirements of the COMMISSION or its authorized agent, the matter shall be promptly submitted to the COMMISSION's authorized agent, who shall promptly have a determination made in writing in accordance with provisions contained in the Specifications. Any adjustment by the CONTRACTOR without such a determination shall be at its own risk and expense.

25. AUTHORIZED SIGNATURES OF THE PARTIES

*** In accordance with the AGFC Purchasing Policy, only the AGFC Director is authorized to sign and bind the agency to a contract for a budgeted expenditure exceeding $1,000,000.00. Other AGFC personnel having written delegated authority may be authorized to sign and bind the agency to a contract for budgeted expenditures only as follows: AGFC Chief of Staff up to $1,000,000.00; AGFC Deputy Directors up to $500,000.00; AGFC Division Chiefs up to $250,000.00; AGFC Assistant Division Chief up to $75,000.00; and other personnel up to $25,000.00. Additionally, only the AGFC Director or Chief of Staff is authorized to sign and bind the agency to any contract for a non-budgeted expenditure, which may not exceed $500,000.00 unless approved by Commission Minute Order. Notwithstanding the above, the AGFC Director is authorized to sign and bind the agency to any contract for a budgeted expenditure, regardless of amount.**

ARKANSAS STATE GAME AND FISH COMMISSION

INSURANCE RIDER

Insurance Requirements for AGFC Contractors

CONTRACTOR shall maintain during the term of the Contract (and, where indicated, for a period of time after completion of the work) the following insurance coverages in the following amounts and upon the following terms:

Insurance Type	**Amount**
Automobile Liability	Commercial: $1,000,000 per occurrence Combined Single Limit
Commercial General Liability	$1,000,000 per occurrence; $2,000,000 aggregate limit
Workers' Compensation	Statutorily required limits, but at least $500,000
Builder's Risk	100% of the total insurable value of contract sum of work *Installation floater can be substituted in instances without construction
Professional Liability	$1,000,000 per occurrence; $2,000,000 aggregate limit

*** An Umbrella or Excess Liability insurance policy also may be used to supplement the CONTRACTOR's primary insurance policy limits to satisfy the full policy limits required by the Contract.**

Insurance Coverage Details

Automobile Liability: Must include coverage for both bodily injury and property damage. Commercial policies must include owned, hired and non-owned coverage. Where a personal policy is allowed, the policy must include coverage for business use, and the certificate of insurance must include reference to the business use coverage.

Commercial General Liability: In addition to bodily injury and property damage, must include personal injury coverage with employment exclusion deleted and contractual liability. Such coverage must include products and completed operations.

Workers' Compensation: Must fully cover all employees and supervisors participating in CONTRACTOR's operations under the Contract. If CONTRACTOR does not carry Workers' Compensation coverage because it does not or will not employ any person in any matter throughout the term of the contract, or is otherwise exempt from the Workers' Compensation coverage requirements under Arkansas law, then CONTRACTOR must provide a certificate of non-coverage issued by the Arkansas Workers' Compensation Commission (or the equivalent governmental authority if CONTRACTOR's home state is not Arkansas).

Builder's Risk: Must cover damage for capital improvement projects. Perils to be insured are fire, lightning, vandalism, malicious mischief, explosion, riot and civil commotion, smoke, sprinkler leakage, water damage, windstorm, hail and property theft on the insurable portion of the project on a 100-percent completed value basis or per project aggregate basis against damage to the equipment, structures, or materials.

Professional Liability: Must include negligent acts, errors and omissions, and other breaches of the applicable standards of care established by Arkansas laws or regulations. Must be maintained both during the course of the Contract and after the completion of services under the Contract for a period of three (3) years after substantial completion of the project.

Requirements:

- Professional services (engineers, architects, attorneys, surveyors, others with advanced degrees/training) not related to construction:

$1,000,000 per occurrence; $2,000,000 aggregate limit.

- Professional services related to construction:

Construction Cost	Insurance Amount
less than $1,000,000 $1,000,000-$4,999,999 $5,000,000 +	$1,000,000 per occurrence; $2,000,000 aggregate limit $2,000,000 per occurrence; $2,000,000 aggregate limit $5,000,000 per occurrence; $5,000,000 aggregate limit

Aircraft Liability: Must cover public and passenger liability with a Combined Single Limit. Separate polices may be substituted for a Combined Single Limit policy if together they provide the equivalent or better coverage and limits. Coverage must include unowned/renter's insurance if CONTRACTOR does not own the aircraft to be used under the Contract.

UAV/UAS (Drone) Liability: Must include coverage for bodily injury and property damage. Coverage must include unowned/renter's insurance if CONTRACTOR does not own the drone to be used under the Contract.

Pollution Liability: Coverage must include costs and liabilities attributable to bodily injury; property damage, including loss of use of damaged property or of property that has not been physically injured; clean-up cost; and defenses, including costs and expenses (including attorney's fees) incurred in the investigation, defense or settlement of claims. If coverage is written on a claims-made basis, CONTRACTOR must represent that any retroactive dates applicable to coverage under the policy precedes the effective date of the letter and that continuous coverage will be maintained or an extended discovery period will be exercised for a period of three (3) years (or as required by law) beginning from the time that services under the contract are completed. If the scope of work as defined in the Contract includes the disposal of any hazardous or non-hazardous materials from the project site, CONTRACTOR must furnish to the COMMISSION evidence of pollution liability insurance maintained by the disposal site operator for losses arising from the insured facility accepting waste under the Contract. Such coverage must be maintained in amounts conforming to applicable laws, rules and regulations.

Quality of Insurer

All policies must be issued by an insurer which has a claims paying ability rating of "A:X" or better or better by A.M. Best Rating Services or not less than "A" by Standard and Poor's Rating Service, or has an equivalent rating as established by another nationally-recognized statistical rating organization satisfactory to the COMMISSION.

All policies shall be provided by insurers qualified to write the respective insurance in the State of Arkansas and be in such form and include such provisions as are generally considered standard provisions for the type of insurance involved.

Certificates of Insurance

Prior to commencing operations under this Contract, CONTRACTOR shall provide a Certificate of Insurance, satisfactory to the COMMISSION, evidencing the required insurance coverage(s) in the required amounts and upon the required terms. The certificate should include all required endorsements.

Endorsements; Required Policy Language

Insurance policies shall contain the following endorsement(s) and/or policy language:

Additional Insured Endorsement. The COMMISSION shall be named as an Additional Insured in the following insurance policies:

- Automobile Liability
- Commercial General Liability
- Pollution Liability
- Commercial Umbrella/Excess Liability

The Additional Insured endorsement must be noted on the certificate of insurance or other proof satisfactory to the COMMISSION.

Waiver of Subrogation. All policies must include a waiver of subrogation provision to prevent the insurance company from recovering monetary damages from the COMMISSION. The waiver of subrogation must be noted on the certificate of insurance or other proof satisfactory to the COMMISSION.

Notice of Cancellation Endorsement. Each insurance policy shall contain a clause providing that it shall not be canceled by the insurance company without written notice to the COMMISSION of intention to cancel that is in accordance with Ark. Code Ann. § 23-66-206 or otherwise granting the COMMISSION the same rights as the named insured in the event of cancellation. This endorsement must be noted on the certificate of insurance or other proof satisfactory to the COMMISSION.

By signing below, Contractor certifies that it (1) has obtained the required insurance coverages in the required amounts and upon the required terms as indicated in this AGFC Insurance Rider; (2) has provided the Commission with certificates of insurance evidencing the same; and (3) will maintain such coverages for the durations stated in this AGFC Insurance Rider.

INSTRUCTIONS TO BIDDERS

I. Contract Documents

Complete copies of the plans, specifications, and contract documents are on file at the office of the Arkansas State Game and Fish Commission, Little Rock, Arkansas OR Fisher Arnold, inc.

II. Bidders

Bidders shall read the specifications, examine the plans, and make their own estimates of the existing facilities and the difficulties which will attend the execution of the work called for by the proposed contract, including local conditions, uncertainty of weather, and all other contingencies. Bidders shall satisfy themselves by personal examination of the location of the proposed work, and by such means as they may choose, as to actual conditions and requirements.

III. Proposals

A. Proposals shall be in strict accordance with the prescribed form. Any modification therefrom may be considered as sufficient cause for rejection.

B. Proposals shall show lump sum amount.

C. Proposals must be signed, in writing, by an individual authorized to bind the Bidder.

D. The General Contractor submitting bid shall include the Contractor's current Arkansas Contractor's License Number in the space provided at the bottom of Proposal Page 2, or bid will be rejected.

E. Each proposal must be accompanied by a surety bond or certified check in the amount of at least five percent (5%) of the bid and made payable to the Arkansas State Game and Fish Commission. The check or bond is required as a guarantee that if the bid is accepted, the Bidder will then enter into a contract and execute bond. The contract bond shall be filed with the clerk of the Circuit Court of Benton County, Arkansas.

F. Proposals must be in a sealed envelope marked as directed on page two of this book of specifications. The sealed envelope need only contain the four pages of this book of specifications comprising the Proposal Form which must be clearly, accurately, and completely filled out and prepared as a sealed bid.

IV. Modification Of Bids

No modification of bids already submitted will be considered unless such modifications are received prior to the hour set for opening. Telegraphic modifications will be rejected unless they are confirmed in writing over the signature of the Bidder within forty-eight (48) hours of the time sent, and before the opening of the bids.

V. Interpretation Of Documents

If any person contemplating submitting a bid for the proposed contract is in doubt as to the meaning of any part of the proposed contract documents, he may submit to the Commission a written request for an interpretation, thereof, prior to ninety-six (96) hours of opening bids. The person submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be made only by Addendum duly issued and a copy of such Addendum will be mailed or delivered to each person receiving a set of such documents. The Commission will not be responsible for any other explanations or interpretations of the proposed documents.

VI. General Conditions Of The Construction Contract

The Bidder's attention is particularly directed to the General and Detailed Specifications. The undersigned also proposes to furnish a contract bond in an amount equal to 100% of the total amount of the bid, and this bond shall not only serve to guarantee the completion of the work on the part of the undersigned but also to guarantee the quality of both workmanship and material, until the work is finally accepted and the provisions of Plans, Specifications, and Special Provisions fulfilled.

All bids shall be submitted on printed forms contained in the book of specifications and contract documents in accordance with the instructions to Bidders and will become a part of the proposed contract. Plans and specifications, the latter containing instructions to Bidders, Proposal Form, Contract Form, Bond Form, etc., are enclosed in the book of specifications and contract documents which will be furnished to each Bidder by the Operations Division, Arkansas State Game and Fish Commission, 2 Natural resources Drive, Little Rock, Arkansas 72205 or, Fisher Arnold, inc. and 9180 Crestwyn Hills Dr, Memphis, TN 38125. A non-refundable charge of ($ 100) will be made for each set of plans and specifications. Plan fee must be received before bid will be accepted.

VII. Bond Requirements

Each proposal must be accompanied by a surety bond or certified check in the amount of at least five percent (5%) of the bid and made payable to the Arkansas State Game and Fish Commission. The check or bond is required as a guarantee that if the bid is accepted, the Bidder will then enter into a contract and execute bond. The contract bond shall be filed with the clerk of the Circuit Court of Benton County, Arkansas.

The Commission reserves the right to accept or reject, in whole or in part, any and all bids, to waive informalities therein, or to accept bids with variations from specifications where efficiency of operation or quality of the product will not be impaired or will otherwise be of benefit to the Commission. The decision of the Commission or its authorized representative in the exercise of this reservation shall be final. All rights or remedies of Bidders in conflict with this reservation are expressly waived by submission or a bid or bids.

Contractors submitting bids must be licensed under the terms of Act 124 of the Acts of 1939, Arkansas General Assembly, as amended and the Contractor's license number must appear on the face of the envelope containing his bid.

Bid Guarantee & Performance Bonds

Each bid proposal shall include with it a bid bond in the amount of 5% of the total bid offered. It shall be in the form of a certified check, postal money order or insurance surety bond made payable to the Owner.

Under $20,000.00 Bid Proposal

A. A 5% bid surety is required with each proposal. This surety shall be retained until project completion. (Act 758 of 1987).

B. On certain projects this office may require a Performance and Payment bond.

Over $20,000.00 Bid Proposal/Contracts

A. A 5% bid surety is required with each proposal.

B. A performance and Payment bond shall be furnished by the successful Bidder within 10 days after receipt of the Intent to Award notice. Failure to furnish the required bonds may cause forfeiture of bid guarantee to the Owner as liquidated damages (Act 757 of 1987).

C. The Contractor shall furnish a "Performance and Payment Bond" in the amount equal to 100% of the contract price as security for the faithful performance of this contract and for payment of all indebtedness for labor and materials furnished or performed in connection with this contract. The bond shall be written by a surety company which is qualified and is authorized to do business in the State of Arkansas and must be executed by a resident local agent who shall be entitled to full commission paid local agents and who is licensed by the Insurance Commissioner to represent the surety company executing said bond and filing with said bond, his power of attorney as his authority. The mere countersigning of a bond will not be sufficient. The bond shall be written in favor of the Owner and executed pursuant to the terms of Act 351 of 1953 of the Arkansas State Legislature, as amended. An original and two (2) copies of the bond must be furnished, with power of attorney attached to each. The Contractor shall file (not record) the original with the Clerk in the Circuit Court of the County in which the work is to be performed is located. The Contractor is to pay all expense incident to the filing of the bond. The remaining two copies should be certified by the Clerk to evidence the filing of the original and these two copies submitted to the Arkansas State Game and Fish Commission, Operations Division.

VIII. Contractor's Insurance Requirements

The Contractor shall purchase and maintain such insurance as will protect him from claims set forth which may arise out of or result from the Contractor's operations under the Contract, whether such operations be by himself or by anyone directly or indirectly employed by any of them, or by anyone for whose acts made of them may be liable;

A. Claims under Workmen's Compensation, Disability Benefit and other similar benefit act;

B. Claims for damages because of bodily injury, occupational sickness or disease, or death of his employees;

C. Claims for damages because of bodily injury, sickness or disease, or death of any person other than his employees;

D. Claims for damages insured by usual personal injury liability coverage which are sustained.

   1. by any person as a result of an offense directly or indirectly related to the employment of such a person by the Contractor, or

   2. by any person; and

E. Claims under comprehensive general liability for damages because of injury to or destruction of tangible property including loss of use resulting therefrom. Coverage for "completed operation shall be required under this comprehensive liability section."

F. Builder's Risk - All Risk Insurance shall be written in an amount equal to 100% of the total insurable value of the contract sum of the work. Coverage to be in the name of the Contractor and the Owner.

Only insurance companies admitted and licensed by the Arkansas State Insurance Commission (AR Code 22-9-402) shall write policies. They must be executed by a resident local agent. Certificate of Insurance shall be filed with the Owner prior to contract award and shall contain a provision that the policy coverage will not be cancelled unless fifteen days prior written notice is given.

IX. Examination of Drawings, Specifications, Site of Work

Before submitting a bid, each Bidder shall carefully examine the drawings, read the specifications and all other contract documents, and visit the site of work. Each Bidder shall fully inform himself prior to bidding as to all existing conditions and limitations under which the work is to be performed and he shall include in his bid a sum to cover the cost of all items necessary to perform the work as set forth in the Contract Documents. No allowance will be made to any Bidder because of lack of such examination or knowledge. The submission of a bid shall be construed as conclusive evidence that the Bidder has made such examination.

X. Responsibility of Contractors

Contractors are presumed to be familiar with all federal, state, county and city laws, ordinances and regulations that affect those persons engaged or employed in such work, materials, or equipment used and the other conditions affecting the work. Bidders shall comply with all such laws, ordinances and regulations.

Paragraph X. Notice of Applicability of the Build America, Buy America (BABA) Act Rider.

[x] **(Check if applicable)** This Contract will use funds awarded under a Federal financial assistance program to construct, alter, maintain, or repair an infrastructure project as defined in the Build America, Buy America (BABA) Act, Pub. L. No. 117-58, §§ 70901-52; and, therefore, all of the iron, steel, manufactured products, and construction materials used in this infrastructure project must be produced in the United States, unless a waiver of the requirements has been approved by the awarding Federal agency. Has a waiver been approved? [X] No [ ] Yes, only for _____ [describe and attach waiver]. Contractor has read, understood, and agrees to the terms and conditions of the BABA Rider attached hereto and incorporated herein by reference and will comply with the BABA Act as it applies to performance under this Contract. Contractor will include this provision and the BABA Rider in all subcontracts related to this Contract.

Build America, Buy America (BABA) Act Rider

Relevant BABA Definitions:

- INFRASTRUCTURE.—The term ‘‘infrastructure’’ includes, at a minimum, the structures, facilities, and equipment for, in the United States— (A) roads, highways, and bridges; (B) public transportation; (C) dams, ports, harbors, and other maritime facilities; (D) intercity passenger and freight railroads; (E) freight and intermodal facilities; (F) airports; (G) water systems, including drinking water and wastewater systems; (H) electrical transmission facilities and systems; (I) utilities; (J) broadband infrastructure; and (K) buildings and real property.

- PRODUCED IN THE UNITED STATES.—The term ‘‘produced in the United States’’ means— (A) in the case of iron or steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States; (B) in the case of manufactured products, that— (i) the manufactured product was manufactured in the United States; and (ii) the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation; and (C) in the case of construction materials, that all manufacturing processes for the construction material occurred in the United States.

With respect to work under this Contract performed on “infrastructure,” Contractor acknowledges to and for the benefit of the Commission that it understands the work is being funded with monies made available by a Federal financial assistance award and that the expenditure of such monies is subject to the BABA Act that requires all iron, steel,

manufactured products, and construction materials used in the work (whether by Contractor or its (sub)contractors) be produced in the United States (the "BABA Requirements"). The BABA Requirements do not apply to the following:

- tools, equipment, and supplies, such as temporary scaffolding, brought to the construction site and removed at or before the completion of the infrastructure project; or,
- equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project but are not an integral part of or permanently affixed to the structure.

Contractor hereby represents and warrants to and for the benefit of the Commission that (a) Contractor has reviewed and understands the BABA Requirements; (b) all of the iron, steel, manufactured products, and construction materials used in the work will be or have been produced in the United States in a manner that complies with the BABA Requirements, unless a waiver of the requirements is approved by the awarding Federal agency; and (c) Contractor will provide any further verified information, certification, or assurance of compliance with this BABA Rider and the BABA Requirements, or information necessary to support a waiver of the BABA Requirements, as may be requested by the Commission, including from each (sub)contractor. Notwithstanding any other provision of this Contract, Contractor's failure to comply with this BABA Rider or the BABA Requirements will permit the Commission to recover any Federal financial assistance funds paid to Contractor and any damages against Contractor including any loss, expense, or cost (including without limitation attorney's fees) incurred by the Commission resulting from any such failure to comply (including without limitation any impairment or loss of funding, whether in whole or in part, from the awarding Federal agency or the State of Arkansas or any damages owed to the awarding Federal agency or the State of Arkansas by the Commission). The Commission and Contractor agree that the awarding Federal agency and the State of Arkansas are third party beneficiaries and may enforce the requirements of this Contract.

Upon request by the Commission, the awarding Federal agency may waive the BABA Requirements if it determines that (1) applying the BABA Requirements would be inconsistent with the public interest; (2) types of iron, steel, manufactured products, or construction materials are not produced in the United States in sufficient and reasonably available quantities or of a satisfactory quality; or (3) inclusion of iron, steel, manufactured products, or construction materials produced in the United States will increase the cost of the overall project by more than 25 percent. **Unless otherwise specified in the Contract, no waiver has been approved for this project, and Contractor must comply with all BABA Requirements.** Contractor should notify the Commission if it believes this infrastructure project fits one of more of the waiver criteria and provide written justification of such. The Commission, in its sole discretion, will determine whether to request a waiver from the awarding Federal agency. The Commission will notify Contractor of any waiver approved for this infrastructure project and attach a copy of the waiver to the Contract. Additional guidance on the BABA Requirements and waiver process can be found at https://fawiki.fws.gov/display/WSFR/Build+America%2C+Buy+America+%28BABA%29+Act and https://www.whitehouse.gov/omb/management/made-in-america/build-america-buy-america-act-federal-financial-assistance/.

XI. Over $20,000.00 Bid Proposal

Contractors must be licensed the day the project bids.

A. All Bidders shall conform to the requirements of Act 150 of 1965 as amended, Arkansas State Licensing Law for Contractors.

B. Proposals shall conform to Act 159 of 1949 as amended. The licensed Subcontractors name and license number shall be listed on the bid proposal form. Also submit in a separate sealed envelope marked "Subcontractor's Bids" the name and amount of each Subcontractor listed on Form of Proposal.

XII. Taxes

The Contractor shall include in his bid all State Sales Tax, Social Security Taxes, State Unemployment Insurance, and all other items of like nature. It is the intent that the bid shall represent the total cost to the Owner of all work included in the contract.

There are no provisions for a Contractor to avoid taxes by using the tax exempt number of a state agency, board, commission or institutions.

LIEN RELEASE REQUIREMENT

THE CONTRACTOR IS REQUIRED TO PRESENT TO THE COMMISSION LIEN WAIVERS BY ALL SUPPLIERS, STATING THAT THEY HAVE BEEN PAID IN FULL FOR SUPPLIES PROVIDED UNDER THE CONTRACT, BEFORE THE COMMISSION PAYS THE CONTRACTOR IN FULL.

GENERAL SPECIFICATIONS

Section 1 - - Definition of Terms

Whenever in these specifications, contract and bond, the following terms, or pronouns in place of them, are used, the intent and meaning shall be interpreted as follows:

State: State of Arkansas

Commission: Arkansas State Game and Fish Commission

Owner: Arkansas State Game and Fish Commission

Director: Chief Executive Officer, Arkansas State Game and Fish Commission

Chief of Operations: Chief Project Representative, Arkansas State Game and Fish Commission

Attorney: Attorney, Arkansas State Game and Fish Commission

Resident Project Representative: An authorized representative of the Arkansas Game and Fish Commission assigned to supervise all phases of construction work for the Commission and give general directions for carrying on the work included under these specifications. The Resident Project Engineer will work under the supervision of the Chief Engineer.

Design Engineer: The Consulting Engineers who have been employed by the owner for this work, or their duly authorized agents.

Inspector: An authorized representative of the Commission assigned to make all necessary inspections of material furnished and of the work performed by the Contractor. Inspectors will work under the supervision of the Chief Engineer and Resident or Project Engineer.

Treasurer: Treasurer of the State of Arkansas

Laboratory: The testing laboratory officially designated by the Commission

Bidder: Any individual, firm or corporation submitting a proposal for the work contemplated, acting directly or through a duly authorized representative.

Contractor: The person, firm or corporation with whom contact has been made directly or through accredited representatives, that may have entered into a contract with the Arkansas State Game and Fish Commission for any of the work included under these specifications. The contracting officer authorized to represent the Commission is the Director.

Surety: The corporate body or individual which is bound with and for the Contractor, who is primarily liable for the payment of all debts pertaining to and for the acceptable performance of the work for which the contract has been made.

Proposal: The approved form on which the Bidder is to, or has submitted, his, their, or its proposal for the work contemplated.

Proposal Guaranty: The certified check or the security designated in the proposal to be furnished by the Bidder, guaranteeing good faith and agreeing to contract with the Commission if the work of construction is awarded to him.

Plans: The officially approved complete construction plans, working drawings and supplemental drawings, or exact reproductions thereof, which show the location, character, dimensions and necessary details of the work to be done, and which are to be considered as part of the contract supplementary to these specifications.

Specifications: The directions, provisions and requirements contained herein, together with all written agreements made or to be made, setting out or relating to the method and manner of performing the work, or to the quantities and qualities of materials and labor to be furnished under the contract.

Special Provisions: Specific clauses additional to these General Specifications, setting forth conditions peculiar to the project under consideration. In case of any discrepancy between these General Specifications and the Special Provisions, the Special Provisions are to govern.

Contract: The written agreement covering the performance of the work and the furnishing of all labor and material in the complete construction of the project under consideration. The contract shall include the "Proposal", "Plans", "Specifications", and "Contract Bond", also any and all supplemental agreements required to complete the construction of the project in a substantial manner acceptable to the Owner.

Contract Bond: The form of security furnished by the Contractor and his Surety as a guarantee of good faith that he will execute the work in accordance with the terms of the Contract.

Supplemental Agreement: A written agreement between the Contractor and the Owner, covering alterations and unforeseen work incidental to the project but necessary to attain desired results.

The Work: All the work specified herein or indicated on the Plans as the contemplated improvement.

Section 2 -- Proposal Requirements & Conditions

2.1 Contents of the Proposal Forms

The Game and Fish Commission will furnish the Bidders with Proposal forms which will state the location and description of the work to be done, kinds of work to be performed, the amount of proposal guaranty (which must accompany the proposal), the date, and the time and place of opening the proposals. All papers bound with or attached to the proposal form a necessary part thereof and must not be detached.

2.2 Familiarity with Proposed Work

The Bidder must examine carefully the site of the work contemplated, the Proposal, Plans, Specifications, Instructions to Bidders, Special Provisions, and Contract Form before submitting his proposal, and otherwise familiarize himself with the character and extent of the proposed construction. Submission of a proposal shall be considered prima fascia evidence that the Bidder has made such examination.

2.3 Preparation of Proposal

Proposals shall be made on standard proposal blank forms furnished by the Commission. Bidders must enter their lump sum or unit price in both words and figures. The Bidder agrees to complete the work within the time set by the Commission and shown on the proposal. Proposals must be signed. If the proposal is made by an individual, his name and post office address must be shown. If made by a firm or partnership, the name and post office address of the member of the firm or partnership signing the proposal must be shown. If made by a corporation, the person signing the proposal must show his post office address and the name of the State under laws of which the corporation is chartered.

2.4 Rejection of Irregular Proposals

Proposals will be considered irregular and may be rejected if they show serious omissions, alterations of form, additions not called for, conditions or unauthorized alternate bids, or irregularities of any kind.

2.5 Guaranty to Accompany Proposals

No proposal will be considered unless accompanied by Proposal Guaranty of the character and amount indicated in the proposal form, made payable to the Arkansas State Game and Fish Commission.

2.6 Delivery of Proposals

All bids must be submitted in sealed envelopes bearing on the outside the name of the Bidder, his address, and the title of the project for which the bid is submitted. If forwarded by mail, the sealed envelope containing the proposal, and marked as directed above, must be enclosed in another envelope addressed to AGFC Austin Booth, Arkansas State Game and Fish Commission, Operations Division, 2 Natural Resources Drive, Little Rock, AR 72205, preferably by registered mail; if forwarded otherwise than by mail, it shall be delivered to the Chief Engineer, Arkansas State Game and Fish Commission.

2.7 Withdrawal of Proposals

No proposal can be withdrawn after it is filed unless the Bidder makes his request to the Commission prior to the time set for the opening of bids, or unless the Commission fails to accept it within 60 days after the date fixed for opening of bids.

2.8 Disqualification of Bidders

Only one proposal from any individual, firm, partnership or corporation, whether under the same or under different names, will be considered. Should it appear to the Commission that any Bidder is interested in more than one proposal for the work contemplated, all proposals in which such Bidder is interested will be rejected.

2.9 Competency of Bidders

Only reliable Bidders capable, in the opinion of the Commission, of performing the class of work contemplated will be considered in awarding this bid. If requested by the Commission, the Bidder must present satisfactory evidence that he has been regularly engaged in the particular type or types of work bid upon, giving the length of time so engaged, and that he is fully prepared with the necessary capital, material, machinery and skilled workmen to carry out the contract.

Each prospective Bidder will, upon request, be required to file with the Commission a Financial Statement, Statement of Work in Progress, Experience Record and Schedule of Equipment and list, by name, of Supervisory and Skilled Personnel available to place on the project.

Contractors will be rated in accordance with the maximum amount of work that it is deemed they can satisfactorily prosecute through any given period, generally such amount not to exceed ten times the net quick assets reflected in the current financial statement. The maximum amount of work considered will include the unfinished value of going contracts. The rating, less the unfinished value of going contracts, will determine the amount of additional work that the Contractor may be allowed to undertake. Proposal Forms covering projects of value in excess of the amount that the Contractor may be allowed to undertake will not be issued. In addition to the above information, the Bidder must submit an affidavit which must be filed at the time the proposal forms are issued, citing active contracts in force and the unfinished value of such work. Proposal Forms will not be issued until such affidavit is on file and the amount of work the Contractor may be allowed to undertake is so determined.

A charge of **one hundred dollars and no/100 ($100.00)** will be made for each set of plans and specifications. Payment will be made at the time proposals or plans are received and no refund will be allowed.

Proposals must be accompanied by either a certified or cashier's check drawn on a solvent bank or trust company or a Bidder's guarantee shall be made payable to the Arkansas State Game and Fish Commission and in the amount shown in the proposal form. A lesser amount will not be accepted. Certified or Cashier’s checks or Bidder's bond must be furnished with each proposal submitted.

Proposals carrying riders or qualifications to be bid as submitted will be rejected as irregular.

Before any contract is awarded, the Bidder may be required to furnish a complete list of the origin, composition and manufacture of any and all materials to be used in construction of the project, together with samples to be used in construction of the project, together with samples to be used for testing by the Owner.

2.10 Contract Documents

The *"Advertisement for Bid,"* the *"Proposal,"* the *"Bond,"* the *"Instruction to Bidders,"* the *"Specifications"* (both General and Detailed), and the *"Special Provisions"* for prosecuting the work are each and all essential and component parts to the agreement governing the work to be done. What is called for by one shall be as binding as if called for by all.

2.11 Taxes

All bid prices, whether by units or otherwise, shall include all State and local sales or use taxes. No amount above the contract price will be paid for claims for such taxes.

Section 3 -- State License for Contractors

Attention of Bidders is directed to Act 124 of the Acts of Arkansas, approved February 24, 1939, being an "Act to Regulate the Practices of General Contracting in the State of Arkansas" as amended by Act 217 of the Acts of the General Assembly of Arkansas for the year 1945, approved March 20, 1945, and further amended by Act 153 of Acts of the General Assembly of Arkansas for the year 1951, approved February 23, 1951.

Unless otherwise clearly stipulated by the Commission, the prospective Bidder must show evidence of license with the Contractors Licensing Board before he will be furnished with a proposal form and no unlicensed Contractor will be permitted to bid on work of the Arkansas State Game and Fish Commission.

Section 4 -- Scope of the Work

4.1 Intent of Plans and Specifications

The intent is to prescribe a complete work of improvement which the Contractor undertakes to do, in full compliance with the Plans, these Specifications, the Special Provisions, Proposal and Contract. The Contractor shall perform all phases of the work in accordance with all terms outlined in the Specifications and Special Provisions and to the lines and dimensions as shown on the Plans. He shall furnish, unless otherwise provided in the Specifications, in the Special Provisions, or in the Contract, all implements, machinery, tools, materials, supplies and labor necessary to the satisfactory prosecution and completion of the work.

4.2 Special Work

Proposed construction or requirements not covered by these Specifications will be covered by Special Provisions and performed or complied with by the Contractor.

4.3 Alterations of Plans or Character of Work

The Commission shall have the right to increase or decrease the extent of the work, to change location or gradient, or the dimensions of any part of the work in such quantities that do not increase or decrease the original amount of the contract award in excess of 25% of such award based upon unit bid prices. Such changes shall not be considered as a waiver of any conditions of the contract nor invalidate any of the provisions thereof, and the Contractor shall perform the work as increased or decreased within such limits at unit bid prices and no allowance will be made for anticipated profits on such increases or decreases so incurred. Any increase in the extent of the work that exceeds 25% of the contract award shall be considered "extra work" as to the excess thereof and the price or prices for such excess shall be governed by Part 4.4, "Extra Work" of this Section.

4.4 Extra Work

Before any unforeseen work not included in the Contract, for which there is no quantity and price included, is started a supplemental agreement shall be signed by either contracting parties, or a written order from the Director to do the work on a Force Account basis given the Contractor.

4.5 Removal and Disposal of Structures and Obstructions

All existing fences, buildings, drainage structures or other obstructions upon or within the limits of the entire project shall be removed and reset or disposed of by the Contractor as directed by the Resident or Project Engineer at no cost to the Owner.

4.6 Use of Materials Found on the Job

All materials found on the job or on Commission owned property shall remain the property of the State. Any such materials may be used by the Contractor on the project provided he has detailed written permission of the Resident or Project Engineer, including location of the source of the materials and a statement as to where and how the materials are to be used.

4.7 Final Clearing of the Work Sites

Upon completion of the work and before acceptance and final payment shall be made, the Contractor shall clean and remove from all work sites and adjacent property, all false work, all surplus and discarded materials, rubbish and temporary structures, restore in acceptable manner all property, both public or private, which has been damaged during the prosecution of the work, and shall leave the entire area of the work under contract in a neat and presentable manner.

Section 5 -- Award of Contract

The award of the contract, if awarded, will be to the lowest qualified and responsible Bidder whose proposal shall comply with all the requirements necessary to render it formal. The award, if made, will be within Sixty (60) days after the opening of the proposals, but in no case will the award be made until all necessary investigations are made as to the responsibility of the Bidder to whom it is proposed to award the contract.

All proposal guarantees will be returned as soon as possible to the unsuccessful Bidders when the contract and bond has been executed. Should no award be made within Sixty (60) days, all proposals will be rejected and all guarantees will be returned.

The successful Bidder entering into a contract for any portion of the work will be required to give the Owner surety in the sum equal to 100% of the total amount of the contract awarded. The form of the bond shall be approved by the Director and the surety shall be acceptable to the Commission. Surety form must be recorded as a document of record by the County Clerk in the county where the work is to be performed.

No contract is binding upon the Commission until it has been executed by the Commission and delivered to the Contractor.

Within ten (10) days after the contract has been awarded, the successful Bidder shall sign the necessary agreements, entering into a contract with the Commission, and return them to the Director, Little Rock, Arkansas.

Failure to furnish the required surety within ten (10) days after notices of award shall be just cause for the annulment of the award, and it is understood by the Bidder, in the event of the annulment of the award, that the proposal guaranty accompanying the proposal shall become the property of the Commission, not as a penalty, but as liquidated damages.

Section 6 -- Subletting or Assigning Contracts

The Contractor will not be permitted to sublet, assign, sell, transfer, or otherwise dispose of the Contract or any portion thereof, or of his right, title or interest therein to any individual, firm or corporation without written consent of the Commission, and/or Chief Engineer. In case such approval is given the Contractor must file with the Director three (3) certified copies of all Sub-Contracts. No Sub-Contract, or transfer of contract, shall in any case release the Contractor of his liability under this Contract and Bond.

Section 7 -- Responsibility for Damage Claims

The Contractor shall assume all responsibility for damages sustained by persons or property due to the carrying on of the work, and he shall indemnify and save harmless the State and all its officers, agents and employees from all suits, actions or

claims of any character brought for or on account of any injuries or damages sustained by persons or property by or from said Contractor, his agents or employees, or in consequence of any neglect in safe guarding the work, or on account of any acts or omission, neglect or misconduct of said Contractor, his agents or employees.

Should any suit or suits, action or actions, claim or claims for injuries or damages sustained in connection with the prosecution of the work arise, so much of the money due the said Contractor by virtue of this contract, as shall be considered by the Commission, may be retained for the use of the State. In case insufficient money is due, his Surety shall be liable until such suit or suits, action or actions, claim or claims for injuries or damages as aforesaid shall have been settled and suitable evidence to that effect furnished the Commission

Section 8 -- No Waiver of Legal Rights

The Commission or the Director shall not be precluded or estopped by any measurements, estimates or certificate, made or given by them or by any agent or employee of the Commission or any time either before or after the completion and acceptance of the project, and payment thereof pursuant to any measurement, estimate, or certificate, from showing the true and correct amount and character of the work performed, and materials furnished by the Contractor, or from showing at any time that such measurements, estimates or certificate is untrue or incorrectly made in any particular, or that the work or materials, or any part thereof, do not conform in fact to the Specification and Contract, and the Commission, the Director, the Chief Engineer shall have the right to reject the whole or any part of the aforesaid work or materials, should the said measurements, estimates, certificate or payments be found or be known to be inconsistent with the terms of the Contract or otherwise improperly given, and the Commission shall not be precluded and estopped, notwithstanding any such measurement, estimate, certificate and payment in accordance therewith, from damages as it may sustain by reason of his failure to comply with the terms of the Plans, Specifications and Contract. Neither the acceptance by the Commission, Director, Chief Engineer or any agent or employee of the Commission, not any certification by the Commission for payment of money, non-payment for, nor acceptance of, the whole or any part of the work by the Commission, the Director, Chief Engineer nor any extension of time not any possession taken by the Commission, not any power herein reserved by the Commission, nor any right to damages herein provided, nor any waiver of any other or subsequent breach.

In carrying out any of the above provisions or in exercising any granted power of authority in this Contract, there shall be no liability upon said Director, Chief Engineer or authorized assistants, either personally or as officials of the State, it being understood that in such matters they act as agents and representatives of the State.

Section 9 -- Prosecution & Progress

9.1 Prosecution of Work & Computation of Contract Time for Completion

It is hereby understood and mutually agreed, by and between the Contractor and the Owner, that the date of beginning and the time for completion as specified in the Contract of the work to be done hereunder are ESSENTIAL CONDITIONS of this Contract; and it is further mutually understood and agreed that the work embraced in this Contract shall be commenced on a date to be specified in the 'NOTICE TO PROCEED.'

The Contractor agrees that said work shall be prosecuted regularly, diligently, and uninterruptedly at such rate of progress as will ensure full completion thereof within the time specified. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for the completion of the work described herein, is a reasonable time for the completion of the same, taking into consideration the average climatic range and usual industrial conditions prevailing in this locality.

If the said Contractor shall neglect, fail or refuse to complete the work within the time herein specified, or any proper extension thereof granted by the Owner, then the Contractor does hereby agree, as a part consideration for the awarding of this Contract, to pay to the Owner the amount specified in the Contract, not as a penalty but as liquidated damages for such breach of contract as hereinafter set forth, for each and every calendar day that the Contractor shall be in default after the time stipulated in the Contract for completing the work.

The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain and said amount shall be retained from time to time by the Owner from current periodical estimates.

It is further agreed that time is of the essence of each and every portion of this Contract and of the Specifications wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the Contract an additional time is allowed for the completion of any work, the new time limit fixed by such extension shall be of the essence of this Contract. Provided, that the Contractor shall not be charged with liquidated damages or any excess cost when the Owner determines that the Contractor is without fault and the Contractor's reasons for the time extension are acceptable to the Owner; provided further, that the Contractor shall not be charged with liquidated damages or any excess cost when the delay in completion of the work is due;

(a) To any preference, priority or allocation order duly issued by the Government;

(b) To unforeseeable cause beyond the control and without the fault of negligence of the Contractor, including, but not restricted to, acts of God, or of the public enemy, acts of the Owner, acts of another contractor in the performance of a contract with the Owner, fires, floods, epidemics,

quarantine restrictions, strikes, freight embargoes, and severe weather conditions; or

(c) To any delays of Subcontractors or suppliers occasioned by any of the clauses specified in subsections (a) and (b) of this article.

Provided further, that the Contractor shall, within ten (10) days from the beginning of such delay, unless the Owner shall grant a further period of time prior to the date of final settlement of the Contract, notify the Owner, in writing, of the causes of the delay, who shall ascertain the facts and extent of the delay and notify the Contractor within a reasonable time of its decision in the matter.

9.2 Limitations of Operation

At any time when in the judgment of the Resident or Project Engineer, the Contractor has neglected to properly dress or finish work in progress, the Resident or Project Engineer may require the Contractor to finish such sections before work is started on any additional sections.

9.3 Character of Workmen and Equipment

The Contractor shall employ such superintendents, foremen and workmen as are careful and competent. Whenever the Resident or Project Engineer shall determine that any person employed by the Contractor is, in his opinion, incompetent, unfaithful, disorderly or insubordinate, such person shall, upon notice, be discharged from the work and shall not again be employed on it without the written consent of the Resident or Project Engineer.

Should the Contractor fail to remove such person or persons or fail to furnish suitable or sufficient machinery, equipment or force for the proper prosecution of the work, the Resident or Project Engineer may withhold all estimates which are, or may become, due or may suspend the work until such orders are complied with. The equipment used on any portion of the work shall be such that no injury to the project or adjacent property results from its use. No item or items of machinery or equipment, after once being placed on the work, shall be removed without formal consent of the Resident or Project Engineer.

9.4 Temporary Suspension of Work

The Commission, Director, Chief Engineer shall have the authority to suspend the work wholly or in part for such period or periods as may be deemed necessary, due to unsuitable weather, or such other condition as unfavorable for the suitable prosecution of the work, or for such time as is due to the failure on the part of the Contractor to carry out orders given or perform any or all provisions of the Contract. The Contractor shall not suspend the work nor remove any equipment, tools, lumber, or other materials unless given written permission by the Resident or Project Engineer.

The only allowance made for such suspensions will be an equivalent extension of time for completion of the contract.

9.5 Failure to Complete Work on Time

Since time is a vital element in this Contract, it is agreed by the Contractor that should he fail to complete the work as set forth in the Specifications and within the time stipulated in the Contract, there shall be deducted from any monies due or which may thereafter become due him, not as a penalty, but as ascertained and liquidated damages, the following amounts per day;

Amount of Contract	*Amount of Liquidated Damages Per Day*
Less than $50,000	$120.00
More than $50,000 but less than $100,000	$150.00
More than $100,000 but less than $500,000	$310.00
More than $500,000 but less than $1,000,000	$400.00
More than $1,000,000 but less than $2,000,000	$500.00
More than $2,000,000 but less than $5,000,000	$580.00
More than $5,000,000 but less than $10,000,000	$760.00
More than $10,000,000	$1,280.00

Should the amount otherwise due the Contractor be less than the amount of such ascertained and liquidated damages, the Contractor and his Surety shall be liable to the State for such deficiency.

9.6 Default and Termination of Contract

If the Contractor:

A. Fails to begin the work under the contract within the time specified in the "Work Order," or

B. Fails to perform the work with sufficient workmen and equipment or with sufficient materials to assure the prompt completion of said work, or

C. Performs the work unsuitably or neglects or refuses to remove materials or to perform anew such work as may be rejected as unacceptable and unsuitable, or,

D. Discontinues the prosecution of the work, or

E. Fails to resume work which has been discontinued within a reasonable time after notice to do so, or

F. Becomes insolvent or is declared bankrupt, or commits any act of bankruptcy or insolvency, or

G. Allows any final judgment to stand against him unsatisfied for a period of ten (10) days, or

H. Makes an assignment for the benefit of creditors, or

I. For any other cause whatsoever, fails to carry on the work in an acceptable manner, the Resident or Project Engineer will give notice in writing to the Contractor and his Surety of such delay, neglect, or default.

If the Contractor or Surety, within a period of ten (10) days after such notice, shall not proceed in accordance therewith, then the Commission will, upon written notification from the Resident or Project Engineer of the fact of such delay, neglect or default and the Contractor's failure to comply with such notice, have full power and authority without violating the contract, to take the prosecution of the work out of the hands of the Contractor. The Commission may appropriate or use any of all materials and equipment on the ground as may be suitable and acceptable and may enter into an agreement for the completion of said contract according to the terms and provisions thereof, or use such other methods as in the opinion of the Resident or Project Engineer will be required for the completion of said contract in an acceptable manner.

All costs and charges incurred by the Commission, together with the cost of completing the work under contract, will be deducted from any monies due or which may become due said Contractor. If such expense exceeds the sum which would have been payable under the contract, the Contractor and the Surety shall be liable and shall pay to the Commission the amount of such excess.

Section 10 -- Control of The Work

10.1 Authority of the Resident or Project Engineer

The work shall be done under the direct supervision of the Resident or Project Engineer who is placed in charge of the work by the Chief Engineer and who shall, in turn, work under the supervision of the Chief Engineer. The Resident or Project Engineer and Chief Engineer shall decide any and all questions which may arise as to the acceptability of materials furnished and work performed, as to the manner of performance and the rate of progress of the work, and shall decide all questions which may arise as to the interpretation of the plans and specifications, and all questions as to the acceptable fulfillment of the Contract on the part of the Contractor, and as to disputes and mutual rights between the Contractor and Sub-Contractors under these specifications affecting the integrity of the work, and as to compensation.

The Resident or Project Engineer shall determine the amount and quantity of the several kinds of work performed and materials furnished which are to be paid for under the Contract, and such decisions and estimates shall be final and conclusive, and such estimate, in case any question arises, shall be a condition precedent to the right of the Contractor to receive any money due him under the Contract. He shall have executive authority to enforce and make effective such decisions and orders as the Contractor fails promptly to carry out.

10.2 Referee in Case of Disputes

In order to prevent misunderstandings and litigation, it is mutually agreed by both parties to this Contract that a Committee made up of the Director, Chief Engineer and Attorney shall act as referee in all questions arising under the terms of the Contract between the parties hereto, and that the decision of the Committee, in such cases, shall be final and binding on both parties alike.

10.3 Conformity with Plans and Allowable Deviations

The location, details and dimensions of the work contemplated must be performed in strict accordance with approved plans, profiles and cross-sections on file in the office of the Arkansas State Game and Fish Commission. Any deviation from the plans, or other details as may be required, will be determined in all cases by the Resident or Project Engineer and authorized in writing by the Chief Engineer. The Contractor shall not take advantage of any error or omission in the plans, or of any discrepancy, he shall immediately call it to the attention of the Resident or Project Engineer who, in turn, shall call for a decision from the Chief Engineer.

10.4 Cooperation of the Contractor

The Contractor will be furnished with two (2) copies of the Plans, Specifications and Special Provisions, and he shall have available on the work at all times one copy of said Plans, Specifications and Special Provisions. He shall give the work his constant attention to facilitate the progress thereof, and shall cooperate with the Resident or Project Engineer in every way possible. He shall have at all times a competent, reliable, English speaking superintendent on the job authorized to receive orders and to act for him. Such superintendent shall be furnished by the Contractor and be present at all times work is in progress, regardless of how much of the work may be sublet.

10.5 Lines, Grades and Measurements

The Contractor shall lay out his own work using horizontal and vertical survey control pints furnished by the Design Engineer, and he shall be responsible for all work executed by him under the Contract. He shall verify all figures and elevations before proceeding with the work and will be held responsible for any error resulting from his failure to do so.

Construction layout is subsidiary to the various items of work.

The Contractor must satisfy himself before commencing work as to the correctness and meaning of all stakes, measurements and marks. No claim will be entertained on account of alleged inaccuracies unless the Contractor notifies the Resident or Project Engineer thereof in writing in time for the Resident or Project Engineer to verify or check such stakes or marks before the work is commenced.

10.6 Duties of Resident or Project Engineers and Inspectors

Resident or Project Engineers and Inspectors employed by the Arkansas State Game and Fish Commission shall be authorized to inspect all work done and materials

furnished. Such inspection may extend to or on any part of the work and to the preparation or manufacture of the materials to be used.

The Contractor shall set construction stakes establishing lines and grades for all construction work, shall furnish the Contractor all necessary information relating to lines and grades and shall give general directions for carrying on the work in conformity with the plans and specifications.

An inspector shall be placed on the project to report to the Resident or Project Engineer as to the progress of the work and the manner in which it is being performed, and to report whenever it appears that the materials being furnished by the Contractor fail to fulfill the requirements of the specifications and contract. The Inspector shall call the attention of the Contractor to any such failure or other infringement, but the Inspector shall not relieve the Contractor from any obligations to perform all work strictly in accordance with the requirements of these specifications. Should a dispute arise between the Inspector and the Contractor as to material furnished or the manner of performing the work, the Inspector shall have authority to reject the materials or suspend the work until the question at issue is decided by proper authority. Inspectors shall in no case act as foreman or perform other duties for the Contractor nor interfere with the management of the work of the Contractor.

Neither Resident or Project Engineers nor Inspectors shall be authorized to, in any manner, issue orders, approve or accept any portion of the work which is contrary to the plans, specifications and contract.

10.7 Inspection

The Contractor shall furnish the Resident or Project Engineer or Inspector such reasonable amount of help as may be desired for ascertaining whether or not the work is performed in accordance with the requirements and the intent of the Plans, Specifications and Contract. The Contractor, if the Resident or Project Engineer requests, shall remove or uncover such portion of the finished work as he may direct before the final acceptance of the work. After the examination, the Contractor shall restore said portion of the work to the standard required by the specifications. Replacing of parts or materials so removed shall not be paid for directly but considered incidental work. No work done or materials used without suitable supervision or inspection by the Resident or Project Engineer or the Inspector will be paid for by the Commission.

When any branch of the United States Government is to pay a portion of the cost of the work covered by this Contract, the work shall be subject to the inspection and approval of the representatives of the Federal Government. Such inspection shall in no sense make the Federal Government a party to this Contract.

10.8 Removal of Defective and Unauthorized Work

All work which has been rejected shall be remedied or removed and replaced in acceptable manner by the Contractor at his own expense, and no compensation shall be allowed him for such removal or replacement. Work done beyond the lines and grades shown on the plans or as given, except as herein provided, or any extra work

done without written authority, will be considered as unauthorized and at the expense of the Contractor and will not be paid for by the Commission. Work so done shall be removed by the Contractor at his own expense, if so directed by the Owner.

10.9 Final Inspection

Upon request from the Contractor for all work done under this Contract, the Resident or Project Engineer shall make a preliminary inspection, and if the project is ready for a complete final inspection, he will notify the office of the Chief Engineer so that the Director may delegate a party authorized to accept or reject any or all parts of the work for the Commission.

Section 11 -- Legal Relations & Responsibility To The Public

11.1 Laws to Be Observed

The Contractor must familiarize himself and comply with all Federal, State, County and local laws, ordinances or regulations, controlling the action or operation of those engaged upon the work or affecting materials used, and govern himself in accordance with them. He shall indemnify and save harmless the State and all of its officers, agents and servants against any claim or liability arising from or based on the violation of any such laws, by-laws, ordinances, regulations, orders or decrees, whether by himself or his employees.

11.2 Trench or Excavation Safety Systems

Trench or excavation safety systems covers the compliance with Act 291 of 1993 to require the inclusion in all bids for Public Works projects, a separate price pay item for “Trench or Excavation Safety Systems”.

Standard specifications shall conform to the current edition of Occupational Safety and Health Administration Standard for Excavation and Trenches Safety System, 29CFR, Subpart P.

“Competent Person” as defined in the Standard Specification shall be the General Contractor’s General Superintendent.

Construction methods shall in accordance with the current edition of Occupational Safety and Health Administration Standard for Excavation and Trenches Safety System, 29CFR 1926, Subpart P.

Trench or excavation safety systems shall be paid for at the lump sum price for “Trench or Excavation Safety Systems” in the bid schedule. The lump sum price shall be full compensation for benching, sloping, sheeting, shoring, shielding, or any other protective system that provides the necessary protection to comply with Act 291 or 1993.

11.3 Use of Explosives

When the use of explosives is necessary for the prosecution of the work, the Contractor shall use the utmost care, so as not to endanger life or property and whenever directed, the number and size of charges shall be reduced. All explosives

shall be stored in a secure manner, and all such storage places shall be marked clearly, "DANGEROUS EXPLOSIVES" and shall be in care of competent watchmen.

11.4 Preservation and Restoration of Property

The Contractor shall not trespass on private property, nor store any material or equipment, nor damage any fences, building, or other property. In case of any damage or injury to public or private property by or on account of any act, omission, neglect or misconduct in the execution of the work, the Contractor shall restore, at his own expense, such property to a condition equal to that existing before such damages were done.

11.5 Contractor's Insurance

A. ***General***. The Contractor shall not commence work under this contract until he has obtained all insurance required under this paragraph and such insurance has been approved by the Owner, nor shall the Contractor allow any Subcontractor to commence work on his subcontract until all similar insurance required of the Subcontractor has been obtained and approved.

B. ***Public Liability and Property Damage Insurance:*** The Contractor shall take out and maintain during the life of the contract such public liability and property damage insurance as shall protect him and any Subcontractor performing work covered by the contract from claims for damages for personal injury, including accidental death, as well as from claims for property damages, which may arise from operation under this contract, whether such operation be by himself or by any Subcontractor or by anyone directly employed by either of them and the amounts of such insurance shall be as follows:

C. ***Public Liability Insurance*** in an amount not less than $250,000 for injuries, including accidental death, to any one person, and subject to the same limit for each person, in an amount not less than $250,000 on account of one accident, and Property Damages Insurance in an amount not less than $250,000 each occurrence , $500,000 aggregate.

D. ***Proof of Carriage of Insurance:*** The Contractor shall furnish to the Resident or Project Engineer two copies of certificates with satisfactory proof of carriage of the insurance required.

11.6 No Waiver of Legal Rights

The Commission, the Director or any of its agents or representatives shall not be precluded or estopped by any measurements, estimates or certificate, made or given by them, under any provision or provisions of the Contract, at any time either before or after the completion and acceptance of the work, and payment thereof pursuant to any measurement, estimate or certificate from showing the true and correct amount and character of the work performed, and materials furnished by the Contractor, or from showing at any time that such measurements, estimate or certificate is untrue or incorrectly made in any particular, or that work or materials, or any part thereof, do not conform in fact to the Specifications and Contract, and the Commission, the Director, the Chief Engineer shall have the right to reject the whole or any part of the

aforesaid work or materials, should the said measurements, estimates, certificates or payments be found or be known to be inconsistent with the terms of the Contract or otherwise improperly given, and the Commission shall not be precluded and estopped, notwithstanding any such measurements, estimate, certificate and payment in accordance therewith, from demanding and recovering from the Contractor and his Surety such damages as it may sustain by reason of his failure to comply with the terms of the Specifications and Contract.

Section 12 -- Measurement & Payment

12.1 Measurement of Quantities

All work completed under the Contract shall be measured by the Resident or Project Engineer according to the United States Standard Measures and Weights unless otherwise agreed upon in writing. The actual quantities only will be paid for, and no conventional measurements will be allowed unless specified herein. The method of measurement and the basis of payment will be more clearly set forth in the Special Provision pertinent to each individual contract item.

12.2 Scope of Payment

The Contractor shall receive and accept the compensation herein provided, in full payment, for furnishing all materials, labor, tools, equipment and labor of all classes and performing all work contemplated and embraced under the Contract; also, for all loss or damage arising out of the nature of the work, or from action of the elements, or from any unforeseen difficulties or obstructions which may arise or be encountered during the prosecution of the work until its final acceptance by the Commission, and for all risks of every description connected with the prosecution of the work, also for all expenses incurred by, or in consequence of, the temporary suspension of discontinuance of the work as herein specified, and for any infringement of patent, trade mark or copyright, and for completing the work in an acceptable manner according to the Plans and Specifications. The payment of any current or final estimate, or of any retained percentage, shall in no way and no degree prejudice or affect the obligation of the Contractor, at his cost and expense, to repair, correct, renew or replace any defects or imperfections in the construction of the work and its appurtenances; or in the strength of, or quality of materials used therein or thereabout, or relieve the Contractor from the payment of any and all damages due or attributed to such defects; provided that such defects, imperfections or damages shall be discovered on or before the final acceptance of the entire work. No retained percentage payable under the Contract, or any part thereof, shall become due and payable, if the Commission so elects, until the Contractor shall satisfy the Commission, that he has fully settled or paid for all materials and equipment used in or upon the work, and labor done in connection therewith, and the Commission, if it so elects, may pay any or all of such balances wholly or in part and deduct the amount or amounts so paid from the final estimate.

12.3 Payment and Compensation for Altered Quantities

When alterations in plans or quantities of work are ordered and performed, and when such alterations result in an increase or a decrease of the quantity of work to be performed, the Contractor shall accept payment in accordance with a negotiable price agreed to in writing by both parties.

12.4 Extra and Force Account Work

Extra and Force Account Work ordered and accepted, shall be paid for under a "Supplemental Agreement" or as "Force Account," as agreed upon as herein provided, and, in all cases, the work to be done and method of payment shall be agreed upon in writing before the work is started. When alterations in the Plans or in the work are productive of increased or decreased quantities beyond the percentages as hereinbefore given, a fair and equitable sum to be fixed and shown in "Supplemental Agreement," signed by both contracting parties shall be added to or deducted from the contract amount as the case may be. The Supplemental Agreement may be any practical form desired, or the work may be done on a Force Account Basis. Payment for work done under a Supplemental Agreement based upon actual cost of the work, or work done on a Force Account Basis shall be made in accordance with the following:

A. For the superintendent, foreman and all labor used on the specific operation, the Contractor shall receive the current local rate of wage, for each and every hour that said superintendent, foreman and labor are actually engaged in such work, to which shall be added an amount equal to 15% thereof. Only the actual amount of insurance paid by the Contractor on the labor used shall be allowed. No charge shall be made by the Contractor for organization or overhead expense. The number of laborers and foremen employed on the work shall be subject to regulation by the Resident or Project Engineer, and the number so employed shall not exceed the number the Resident or Project Engineer deems most practical and economical for the work.

B. For all materials used, if furnished by the Contractor, the Contractor shall receive the actual cost of such materials, including freight, hauling and handling charges, as shown by original receipted bills or certified statements, to which cost shall be added a sum equal to 15% thereof.

C. For any machine power tools or equipment, including fuel and lubricants, which may be deemed necessary or desirable to use, the Resident or Project Engineer shall allow the Contractor the hourly rental for each tool or piece of equipment as set forth in the Associated General Contractors Rental Codes for the State of Arkansas and to which sum no percentage will be added. The cost of necessary repairs to such tools and equipment must be borne by the Contractor.

D. The compensation as herein provided shall be received by the Contractor as payment in full for Extra Work done under a "Supplemental Agreement" or work done on a "Force Account" basis, and shall include the proper supervision of the work as well as the furnishing of such small tools and equipment as may be required and the labor employed, without additional compensation other than as provided in Clauses (a), (b), and (c) of this Section. The Contractor's

representative and the Inspector or Resident or Project Engineer shall compare and equalize records of the Extra Work done under a "Supplemental Agreement" based upon the actual cost of the work, or work done on a "Force Account" basis at the completion of certain units of the work or at intervals considered most practical. Copies of those records shall be made in triplicate, upon suitable forms provided for this purpose, and signed by both the Inspector or Resident or Project Engineer and the Contractor's representative, two (2) copies being forwarded to the office of the Chief Engineer and one (1) "Supplemental Agreement" based upon actual cost of the work, or work done on a "Force Account" basis shall be submitted to the Resident or Project Engineer, by the Contractor, upon certified statements to which shall be attached original receipted bills or certified statements covering the cost of and the freight charges on all materials used in such work, and said statements shall be filed not later than the tenth day of the month following that in which the work was actually performed, and shall include all labor, equipment and materials accounts properly chargeable to the work.

12.5 Claims and Damages

Any claim for damages, or for any other matter or cause, must be made in writing to the Resident or Project Engineer at the time alleged damage occurs, or the cause of claim arises. One (1) copy of the alleged claim must be mailed to the Director and two (2) copies to the office of the Chief Engineer. Unless such claim is so prevented before the next estimate, it shall be held without recourse, that the Contractor was waived such claim and he shall not be entitled to receive pay therefor.

12.6 Freight Rates

No allowance or deduction will be made for any increase or decrease in freight rates.

12.7 Partial Payments

The Resident or Project Engineer will make in writing at monthly intervals, an estimate of the materials in place and the amount of work performed during the preceding month or period and the value thereof will be based upon percentage of work completed.

Ninety percent (90%) of the amount of the Resident or Project Engineer's estimate will be allowed the Contractor within the (10) days after the close of the estimate period, the balance will be retained by the Commission pending completion and acceptance of the work.

The Resident or Project Engineer may in any estimate include the value of reinforcing steel, structural steel or steel wire mesh delivered to the job site or placed in acceptable storage places but not incorporated into the work at the time of such estimate, provided the total value of such materials, including freight charges, appearing in any one estimate is not less than Five Thousand Dollars ($5,000). Receipted bills for all materials payments allowed on an estimate must accompany the estimate. All estimates in which materials allowances are made shall be approved by the Director before payment and the Contractor shall be responsible for the storage

and safekeeping in acceptable condition of all materials for which payments have been allowed.

After 50% of the work in money value under any contract is completed, the sum held as retainage by the commission may be reduced by payment to the Contractor on estimate approved by the Director until the amount retained is not less than Ten Thousand Dollars ($10,000), or such sum as in the judgment of the Chief Engineer, may be required to protect the interest of the State and insure satisfactory completion of the work, provided the Contractor shall file with the Commission before any release of retainage: (1) an Affidavit, to the effect that all claims have been fully satisfied for all materials, labor, supplies, and other items entered into contingent and incident to the construction under the contract; (2) the written consent of the Surety to such payment; and, (3) any other document which may be required by any provision of the contract. Upon completion and final acceptance, the amount of retainage may be reduced by payment to the Contractor as provided above adjustment in final quantities.

12.8 Acceptance and Final Payment

The Commission, upon the receipt of the Resident or Project Engineer's Certification of Completion and Final Estimate, and upon receipt of satisfactory evidence from the Contractor that all persons furnishing labor or materials have been paid in full, and all persons claiming damages to property or person because of the carrying on of this work have been settled with or their claims dismissed, or the issues joined, shall certify the Estimate for final payment after previous payments have been deducted, and shall notify the Contractor and his Surety of the acceptance of the work. On delivery of the final payment, the Contractor shall sign a written acceptance of the final estimate as payment in full for the work done. All prior partial estimates and payments shall be subject to correction in the final estimate and payment.

12.9 One-Year Guarantee Period

A. The Contractor shall guarantee the work against faulty workmanship and/or materials for a period of one (1) year, from the date of acceptance of the work by the Owner.

B. At the time of acceptance of the work by the Owner, the Contractor shall furnish to the Owner a maintenance bond in the amount of fifty percent (50%) of the amount of the final estimate. The maintenance bond shall be issued by a Surety acceptable to the Owner and shall guarantee the work against faulty workmanship and/or materials for the one-year maintenance period.

C. At the end of the one-year maintenance period, the Resident or Project Engineer with the Contractor shall make an inspection of the work. The Contractor immediately shall repair and correct any and all defects that have resulted from faulty workmanship and/or materials, following such repair and correction the Owner will accept full maintenance of the work.

SPECIAL PROVISIONS

Employment of Labor

The only restriction placed on the employment of labor or on the scale of pay will be the requirements of the Fair Labor Standards Act (Federal Wage-Hour Law) as well as other applicable labor laws, and the requirements contained elsewhere in the Specifications and/or Special Provision. In all cases, the scale of pay shall not be less than minimum wage for unskilled labor. The Contractor will be expected to employ Arkansas labor as far as possible.

Non-Discrimination in Employment

In connection with the performance of work under this contract, the Contractor agrees not to discriminate against any employee because of race, religion, color, or national origin. The aforesaid provision shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post hereafter in conspicuous places, available for employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of the non-discrimination clause.

The Contractor further agrees to insert the foregoing provision in all subcontracts hereunder, except Subcontractors for standard commercial supplies or raw materials.

The State further agrees that it will cooperate actively with the administering agency and the President's Committee on Equal Employment Opportunity in obtaining the compliance of Contractors and Subcontractors with the equal opportunity clause and the rules, regulations and relevant orders of the Committee, that it will furnish the administering agency and the Committee such information as they may require for the supervision of such compliance, and that it will otherwise assist the administering agency in the discharge of the agency's primary responsibility for securing compliance. The State further agrees that it will refrain from entering into any contract or contract modification subject to Executive Order 11114 with a Contractor debarred from, or who has not demonstrated eligibility for, Government contracts and Federally assisted construction contracts pursuant to Part III, subpart D, of Executive Order 10925 and will carry out such sanctions and penalties for violation of the equal opportunity clause as may be imposed upon Contractors and Subcontractors by the administering agency or the Committee pursuant to Part III, Subpart D, of Executive Order 10925. In addition, the State agrees that if it fails or refuses to comply with these undertakings, the administering agency may cancel, terminate or suspend in whole or in part this grant (contract, loan, insurance, guarantee), may refrain from extending any further assistance under any of its programs subject to Executive Order 11114 until satisfactory assurance of future compliance has been received from such applicant, or may refer the case to the Department of Justice for appropriate legal proceedings.

The regulations of the Secretary of Labor applicable to Contractors and Subcontractors (29 CFR Part 3) made pursuant to the Copeland Act (18 U.S.C. Sec. 874) are made a part of this agreement by reference. The State will comply with these regulations and any amendment or modification thereof and the State Prime Contractor will be responsible for the submission of statements required of Subcontractors thereunder. The foregoing shall apply except as the Secretary of Labor may specifically provide for reasonable limitations, variations, tolerances and exemptions.

Scope of Work

Project: Facility Upgrades at Charlie Craig Fish Hatchery

Location: 977 West Fish Hatchery Road Centerton, AR 72719

Description: The work consists generally of constructing a Fish Hatchery building with new tanks, heat exchanger, hatch batteries, mussel and shad equipment, and office. The overall site pond system will be upgraded with additional ponds, new incoming and outgoing piping and outlet structures, a new recirculation pump station, weir structures and pumps for the spring water. Work will require grading, excavation, and removal of portions of concrete structures and piping, trenching, erosion control measures, coordination with utility entities and all other necessary related work to complete the project as shown on the plans and/or described in the specifications.

Misc.

Safety: The contractor shall furnish all necessary equipment to protect the public during the construction.

Erosion Control: The contractor shall be responsible for the control of sediment and erosion during construction.

Specifications

For questions please call

Arkansas Game and Fishe
Jerry Gomez
2 Natural Resources Drive
Little Rock, AR 72205

501-263-5815

Fisher Arnold
Jason MacDonald
404 Creath Avenue
Jonesboro AR 72401

Exhibit A

Statement of Assurance and Compliance

The designated representative of the CONTRACTOR (CONTRACTOR's Agent) certifies that:

1. The CONTRACTOR and its principals in this bid are not presently debarred, suspended, proposed for debarment, declared ineligible, sentenced to denial of Federal benefits by a State or Federal court, or voluntarily excluded from covered transactions by any Federal department or agency.

2. The CONTRACTOR and its principals have not been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or Local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property.

3. The CONTRACTOR and its principals are not presently indicted for or otherwise criminally or civil charged by a governmental entity (Federal, State or Local) with commission of any of the offenses enumerated in paragraph 2 of this certification.

4. The CONTRACTOR and its principals have not had one or more public transactions (Federal, State or Local) terminated for cause or default.

5. The CONTRACTOR shall comply with Executive Order 11246 of September 24, 1965, entitled ‘‘Equal Employment Opportunity,’’ as amended by Executive Order 11375 of October 13, 1967, and as supplemented in Department of Labor regulations (41 CFR chapter 60). (All construction contracts awarded in excess of $10,000 by grantees and their contractors or subgrantees.)

6. The CONTRACTOR shall comply with the Copeland ‘‘Anti-Kickback’’ Act (18 U.S.C. 874) as supplemented in Department of Labor regulations (29 CFR Part 3). (All contracts and subgrants for construction or repair.)

7. The CONTRACTOR is not guilty of collusion with the vendors possibly interested in this bid or in determining prices to be submitted.

8. The CONTRACTOR shall comply with the Davis-Bacon Act (40 U.S.C. 276a to 276a–7) as supplemented by Department of Labor regulations (29 CFR part 5). (Construction contracts in excess of $2,000 awarded by grantees and sub grantees when required by Federal grant program legislation.)

9. The CONTRACTOR shall comply with Sections 103 and 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 327–330) as supplemented by Department of Labor regulations (29 CFR

Part 5). (Construction contracts awarded by grantees and subgrantees in excess of $2000, and in excess of $2,500 for other contracts which involve the employment of mechanics or laborers.)

10. The CONTRACTOR shall comply with all applicable standards, orders, or requirements issued under section 306 of the Clean Air Act (42 U.S.C. 1857(h)), section 508 of the Clean Water Act (33 U.S.C. 1368), Executive Order 11738, and Environmental Protection Agency regulations (40 CFR part 15). (Contracts, subcontracts, and subgrants of amounts in excess of $100,000.)

11. The CONTRACTOR shall comply with all applicable mandatory standards and policies relating to energy efficiency contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act (Pub. L. 94–163, 89 Stat. 871).

12. The CONTRACTOR shall provide access by the COMMISSION, the Federal grantor agency and Comptroller General of the United States (if Federal grant funds are used for this Contract), or any of their duly authorized representatives to any books, documents, papers, and records of the CONTRACTOR which are directly pertinent to that specific contract for the purpose of making audit, examination, excerpts, and transcriptions.

13. The CONTRACTOR shall retain all required records for three years after the COMMISSION makes final payments and all other pending matters are closed.

14. If this Contract indicates that the COMMISSION is using Federal grant funds to pay CONTRACTOR, the CONTRACTOR shall comply with all uniform grant administration requirements required by State and Federal statutes, rules and regulations, including but not limited to, the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 93-288, as amended, Title 44 of the Code of Federal Regulations, applicable OMB Circulars, and policy guidance issued by the Federal Emergency Management Agency (FEMA). The CONTRACTOR shall also comply with all applicable FEMA requirements, including but not limited to, FEMA 325, P.A. Debris Management Guide; FEMA 321, P.A. Policy Digest and FEMA 322, P.A. Guide.

15. The CONTRACTOR shall include language in all contracts that binds the CONTRACTOR, subcontractor or consultant to the terms and conditions of this Contract with the COMMISSION. Contractual arrangements with contractors, subcontractors or consultants shall in no way relieve the CONTRACTOR of its responsibilities to ensure that all funds provided through this Contract are administered in accordance with all federal and state requirements.

16. The CONTRACTOR shall comply with all applicable requirements of all other Federal, State, County and City laws, executive orders, regulations, ordinances, and policies.

17. The CONTRACTOR shall comply to the “Build America, Buy America” Act. It shall be bid and built according to these standards. For further information, please reference the “BUILD AMERICA, BUY AMERICA” section within the full Request for Proposal documents. More information can also be found here:

https://fawiki.fws.gov/display/WSFR/Build+America%2C+Buy+America+%28BABA%29+Act and https://www.whitehouse.gov/omb/management/made-in-america/build-america-buy-america-act-federal-financial-assistance/. The Bipartisan Infrastructure Law (BIL) was enacted on November 15, 2021 (BIL Build America, Buy America Act Publication L. No. 117-58). This provision expands the Buy America requirements beyond what was only required for steel and iron products. The steel and iron provisions have not changed with the new law. Buy America requirements are in effect only on Federal-Aid contracts and all construction materials shall be produced/manufactured in the United States. Items specifically excluded from this requirement are cement and cementitious materials; aggregates such as stone, sand, or gravel; aggregate binding agents or additives (including asphalt binders). All other materials permanently incorporated into the project will be subject to Buy America requirements.

(A.) Definitions. Build America, Buy America provisions specified for manufactured products in Section 70912(6)(B) of the Infrastructure Investment and Job Act (IIJA) do not apply to federal-aid construction projects per FHWA's existing statutory requirement applicable to manufactured products. A "manufactured product" is considered to be an item that undergoes one or more manufacturing processes before the item can be used on a construction project.

All construction materials shall be produced in the United States. This means all manufacturing processes to produce the construction materials shall occur in the United States. All manufacturing processes for construction materials shall mean the final manufacturing process and the immediately preceding manufacturing stage for the construction material.

(B.) Compliance. The Contractor shall ensure that all manufacturing processes for each covered product comply with this Buy America Provision. Non-conforming products shall be replaced at no expense to the Department. It is the contractor's responsibility to assure all submittals required for Buy America are submitted to the Engineer prior to the products and or materials being incorporated into the project.

Buy America requirements do not apply to temporary elements not permanently incorporated into a project. This includes falsework, temporary sheet piling, detour bridges, temporary elements left in place at the contractor's convenience, unless the contract plans and specifications require steel or iron components or imply that the item be left in place, or items that are simply moved from one place to another within the same project. Buy America only applies to construction materials that are consumed in, incorporated into, or affixed to an infrastructure project. As such, it does not apply to tools, equipment, and supplies, such as temporary scaffolding, removed at or before completion of the project.

(C). Certification. The contractor shall provide a certification from the supplier for each construction material, stating that it meets the provisions of this specification or the Build America/Buy America act, prior to incorporating any construction material into the project. The supplier certifying may be the original manufacturer, fabricator, or vendor provided the supplier has sufficient control and

knowledge of the manufacturing process to accept responsibility and certify full and complete conformance with the certification.

Exhibit B

Specifications

SECTION 00 01 10
TABLE OF CONTENTS

SPECIFICATIONS

DIVISION 01 -- GENERAL REQUIREMENTS

01 11 00 - Summary of Work

01 20 00 – Measurement and Basis of Payment

01 30 00 – Administrative Requirements

01 33 00 – Shop Drawings, Product Data, and Samples

01 45 23 - Testing Laboratory Services

01 45 33 - Code-Required Special Inspections

01 55 26 - Traffic Regulation

01 56 00 - Barriers

01 57 00 - Temporary Controls

01 57 33 - Security

01 60 00 - Product Requirements

01 70 00 - Contract Closeout

01 74 00 - Cleaning

01 78 00 – Project Record Documents

DIVISION 02 -- EXISTING CONDITIONS

02 06 14 - Geotechnical Data

02 20 00 – Preparatory and Restoration Work

DIVISION 03 -- CONCRETE

03 10 00 - Concrete Formwork

03 15 00 – Expansion, Construction, and Control Joints

03 20 00 - Concrete Reinforcement

03 30 00 - Cast-in-Place Concrete

03 35 11 - Concrete Floor Finishes

03 40 00 - Precast Concrete

DIVISION 04 -- MASONRY

04 20 01 - Masonry

DIVISION 05 -- METALS

05 10 00 - Structural Steel

05 40 00 - Cold-Formed Metal Framing

05 50 00 - Metal Fabrications

DIVISION 06 -- WOOD, PLASTICS, AND COMPOSITES

06 10 00 - Rough Carpentry

DIVISION 07 -- THERMAL AND MOISTURE PROTECTION

07 19 00 - Water Repellents

07 21 00 - Thermal Insulation

07 92 00 - Joint Sealants

DIVISION 08 -- OPENINGS

08 11 13 - Hollow Metal Doors and Frames

08 36 13 - Sectional Doors

08 71 00 - Door Hardware

08 80 00 - Glazing

DIVISION 09 -- FINISHES

09 05 61 - Common Work Results for Flooring Preparation

09 21 16 - Gypsum Board Assemblies

09 67 00 - Fluid-Applied Flooring

09 77 00 - Fiberglass Reinforced Wall Panels

09 90 00 - Painting and Coating

09 97 13.24 – Protective Coatings

DIVISION 10 -- SPECIALTIES

10 14 00 - Signage

10 14 14 - Building Plaques

10 28 00 - Toilet Accessories

10 43 00 - Emergency Aid Specialties

10 44 00 - Fire Protection Specialties

DIVISION 13 -- SPECIAL CONSTRUCTION

13 34 19 - Metal Building Systems

DIVISION 22 -- PLUMBING

22 05 00 – Common Work Results for Plumbing

22 05 13 – Common Electrical Requirements for Plumbing Equipment

22 05 16 – Expansion Compensation for Pluming

22 05 19 – Meters and Gauges for Plumbing

22 05 48 – Vibration and Seismic Controls for Plumbing

22 05 53 – Identification for Plumbing Piping and Equipment

22 07 19 – Plumbing Piping Insulation

22 10 05 – Plumbing Piping

22 10 06 – Plumbing Piping Specialties

22 30 00 –Pluming Equipment

22 40 00 –Plumbing Fixtures

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

23 05 00 – Common Work Results for Heating, Ventilating, and Air Conditioning

23 05 29 – Hangers & Supports for HVAC Piping and Equipment

23 05 53 – Identification for HVAC Piping and Equipment

23 05 93 – Testing, Adjusting and Balancing for HVAC

23 07 13 – Duct Insulation for HVAC

23 07 19 – HVAC Piping Insulation

23 09 23 –HVAC Controls

23 23 00 – Refrigerant and Condensate Piping

23 31 00 –HVAC Ducts and Casings

23 33 00 – Air Duct Accessories

23 34 23 – Power Ventilators

23 37 00 – Air Inlets and Outlets

23 55 33 – Gas Fired Unit Heaters

23 81 26 – Ducted Mini-Splits

DIVISION 26 -- ELECTRICAL

26 05 00 – Common Work Results for Electrical

26 05 01 – Electrical Demolition

26 05 02 – Equipment Wiring Systems

26 05 19 – Low-Voltage Electrical Power Conductors and Cable

26 05 26 – Grounding and Bonding for Electrical Systems

26 05 29 – Hangers and Supports for Electrical Systems

26 05 33 – Raceway and Boxes for Electrical Systems

26 05 53 – Identification for Electrical Systems

26 05 73 – Arc Flash Hazard Analysis/Short/Circuit/Coordination Study

26 22 13 – Low-Voltage Transformers

26 24 16 – Panelboards

26 26 00 –Low Voltage Electrical Distribution

26 27 26 – Wiring Devices

26 28 16 – Enclosed Switches and Circuit Breakers

26 29 13 – Enclosed Motor Controllers

26 32 13 – Engine Generators

26 36 23 – Enclosed Transfer Switch Service Entrance Rated NEMA 3R

26 43 00 – Transient Voltage Surge Suppression

26 50 00 – Lighting

DIVISION 31 -- EARTHWORK

31 10 00 – Clearing and Grubbing

31 20 00 – Site Grading and Filling

31 23 00 – Foundation Excavating and Backfilling

31 23 33 - Trenching Backfilling and Compaction

31 23 34 – Trench and Excavation Safety Systems

31 25 00 – Erosion Control

31 37 00 - Rip Rap

31 31 16 - Termite Control

DIVISION 32 -- EXTERIOR IMPROVEMENTS

32 01 17 - Asphalt Pavement Repair

32 11 23 - Aggregate Base Courses

32 12 16 - Asphalt Paving

32 13 13 - Concrete Paving

32 13 76 – Sidewalks

32 92 00 – Seeding and Sodding

DIVISION 33 -- UTILITIES

33 11 35 – Vertical Turbine High Service Pumps

33 16 23 – Ground-Supported Flat-Bottom Water Storage Tank

33 30 00 - Sewerage Systems

33 40 00 – Pipe Culverts and Storm Sewers

33 49 00 - Storm Drainage Structures

33 49 13 - Separation of Pipe Utilities

END OF SECTION

SECTION 01 11 00

SUMMARY OF WORK

PART 1 - GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS/REQUIREMENTS INCLUDED

A. The work consists generally of constructing a Fish Hatchery building with new tanks, heat exchanger, hatch batteries, mussel and shad equipment, and office. The overall site pond system will be upgraded with additional ponds, new incoming and outgoing piping and outlet structures, a new recirculation pump station, weir structures and pumps for the spring water. Work will require grading, excavation, and removal of portions of concrete structures and piping, trenching, erosion control measures, coordination with utility entities and all other necessary related work to complete the project as shown on the plans and/or described in the specifications.

1.02 RELATED REQUIREMENTS

A. Conditions of the Contract.

B. Construction Schedule.

1.03 CONTRACTS

A. Construct the Work for the contract unit prices/lump sum, as applicable as shown on the Bid Form.

1.04 WORK BY OTHERS

A. Work on the Project which will be executed prior to or concurrent with the Work of this Contract, and which is excluded from this Contract, if any, is: None.

1.05 WORK SEQUENCE

A. Coordinate the construction schedule and operations with the Owner's Representative.

B. Construct the work in stages to provide for public convenience as follows:

1. Do not close off public use of facilities or roadways until completion of one stage of construction that will provide alternative usage.

1.06 CONTRACTOR'S USE OF PREMISES

A. Contractor shall limit his use of the premises for Work and for storage, to allow for:
1. Work by other Contractors.
2. Owner occupancy.
3. Public use.

B. Coordinate use of premises under direction of Owner's representative.

C. Assume full responsibility for the protection and safekeeping of products under this Contract, stored on the site.

D. Move any stored products, under Contractor's control, which interfere with operations of the Owner or separate contractor.

E. Obtain and pay for the use of additional storage or work areas needed for operations.

PART 2 - PRODUCTS

(Not used)

PART 3 - EXECUTION

(Not used)

END OF SECTION

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preconstruction meeting.

B. Site mobilization meeting.

C. Progress meetings.

D. Submittals for review, information, and project closeout.

E. Number of copies of submittals.

F. Requests for Interpretation (RFI) procedures.

G. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 00 72 00 - General Conditions: Dates for applications for payment.

B. Section 01 60 00 - Product Requirements: General product requirements.

C. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.

D. Section 01 78 00 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 REFERENCE STANDARDS

A. AIA G716 - Request for Information; 2004.

B. AIA G810 - Transmittal Letter; 2001.

C. Make the following types of submittals to Architect:
   1. Requests for Interpretation (RFI).
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion.
   11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Architect will schedule a meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.

C. Agenda:
   1. Execution of Owner-Contractor Agreement.

2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
5. Submission of initial Submittal schedule.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
7. Scheduling.
8. Scheduling activities of a Geotechnical Engineer, if applicable.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.02 SITE MOBILIZATION MEETING

A. Architect will schedule meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:
1. Contractor.
2. Owner.
3. Architect.
4. Contractor's superintendent.
5. Major subcontractors.

C. Agenda:
1. Use of premises by Owner and Contractor.
2. Owner's requirements.
3. Construction facilities and controls provided by Owner.
4. Temporary utilities provided by Owner.
5. Survey and building layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Application for payment procedures.
9. Procedures for testing.
10. Procedures for maintaining record documents.
11. Requirements for start-up of equipment.
12. Inspection and acceptance of equipment put into service during construction period.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
1. Contractor.
2. Owner.
3. Architect.
4. Contractor's superintendent.
5. Major subcontractors.

D. Agenda:
1. Review minutes of previous meetings.
2. Review of work progress.

3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of RFIs log and status of responses.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Other business relating to work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

F. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.
1. Delivery Medium: Via email.
2. File Naming: Include project identification, date and time of view, and view identification.
3. Point of View Sketch: Include digital copy of point of view sketch with each electronic submittal; include point of view identification in each photo file name.
4. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.
5. Photo CD(s): Provide 1 copy including all photos cumulative to date and PDF file(s), with files organized in separate folders by submittal date.

3.04 REQUESTS FOR INTERPRETATION (RFI)

A. Definition: A request seeking one of the following:
1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
2. A resolution to an issue which has arisen due to field conditions and affects design intent.

B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
1. Prepare a separate RFI for each specific item.
a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
b. Do not forward requests which solely require internal coordination between subcontractors.
2. Prepare in a format and with content acceptable to Owner.
a. Use AIA G716 - Request for Information .
3. Prepare using an electronic version of the form appended to this section.

D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::

a. Approval of submittals (use procedures specified elsewhere in this section).
b. Approval of substitutions (see Section - 01 60 00 - Product Requirements)
c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).

3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
   a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.

E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
1. Official Project name and number, and any additional required identifiers established in Contract Documents.
2. Owner's, Architect's, and Contractor's names.
3. Discrete and consecutive RFI number, and descriptive subject/title.
4. Issue date, and requested reply date.
5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
1. Indicate current status of every RFI. Update log promptly and on a regular basis.
2. Note dates of when each request is made, and when a response is received.
3. Highlight items requiring priority or expedited response.
4. Highlight items for which a timely response has not been received to date.

H. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.

1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.05 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
   1. Submit at the same time as the preliminary schedule specified in Section - 01 32 16 - Construction Progress Schedule.
   2. Coordinate with Contractor's construction schedule and schedule of values.
   3. Format schedule to allow tracking of status of submittals throughout duration of construction.
   4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
   5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
      a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.06 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

3.07 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Sustainability design submittals and reports.
   3. Certificates.
   4. Test reports.
   5. Inspection reports.
   6. Manufacturer's instructions.
   7. Manufacturer's field reports.
   8. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

3.08 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.09 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Extra Copies at Project Closeout: See Section 01 78 00.

C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.10 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Use a separate transmittal for each item.
   2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
   3. Transmit using approved form options.
      a. Use Form AIA G810.
      b. Use form generated by Electronic Document Submittal Service software.
   4. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
   5. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
   6. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
      a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
   7. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
      a. Send submittals in electronic format via email to Architect.
   8. Schedule submittals to expedite the Project, and coordinate submission of related items.
      a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
      b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
      c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.

9. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
10. When revised for resubmission, identify all changes made since previous submission.
11. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
12. Submittals not requested will be recognized, and will be returned "Not Reviewed",

B. Product Data Procedures:
1. Submit only information required by individual specification sections.
2. Collect required information into a single submittal.
3. Submit concurrently with related shop drawing submittal.
4. Do not submit (Material) Safety Data Sheets for materials or products.
5. Submit sustainable design reporting submittals under separate cover.

C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
2. Do not reproduce Contract Documents to create shop drawings.
3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:
1. Transmit related items together as single package.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.

3.11 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

D. Architect's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
a. "Approved", or language with same legal meaning.
b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
2) Non-responsive resubmittals may be rejected.
2. Not Authorizing fabrication, delivery, and installation:
a. "Revise and Resubmit".
1) Resubmit revised item, with review notations acknowledged and incorporated.
2) Non-responsive resubmittals may be rejected.
b. "Rejected".

1) Submit item complying with requirements of Contract Documents.

E. Architect's and consultants' actions on items submitted for information:
   1. Items for which no action was taken:
      a. "Received" - to notify the Contractor that the submittal has been received for record only.
   2. Items for which action was taken:
      a. "Reviewed" - no further action is required from Contractor.

END OF SECTION

SECTION 01 33 00

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Submit Shop Drawings, Product Data and Samples required by Contract Documents.

1.02 RELATED REQUIREMENTS

A. Conditions of the Contract

B. Equipment Pre-qualification Requirements (if required)

C. Section 01 78 00: Project Record Documents

D. Designate in the construction schedule, or in a separate coordinated schedule, the dates for submission and the dates that reviewed Shop Drawings, Product Data and Samples will be needed.

1.03 SHOP DRAWINGS

A. Drawings shall be presented in a clear and thorough manner.

1. Details shall be identified by reference to sheet and detail, schedule, room numbers, etc. shown on Contract Drawings.

B. Minimum sheet size: 8-1/2" x 11"

1.04 PRODUCT DATA

A. Preparation:

1. Clearly mark each copy to identify pertinent products or models.
2. Show performance characteristics and capacities.
3. Show dimensions and clearances required.
4. Show wiring or piping diagrams and controls.

B. Manufacturer's standard schematic drawings and diagrams:

1. Modify drawings and diagrams to delete information which is not applicable to the Work.
2. Supplement standard information to provide information specifically applicable to the Work.

1.05 SAMPLES

A. Office samples shall be of sufficient size and quantity to clearly illustrate:

1. Functional characteristics of the product, with integrally related parts and attachment devices.
2. Full range of color, texture and pattern.

1.06 CONTRACTOR RESPONSIBILITIES

A. Review Shop Drawings, Product Data and Samples prior to submission.

B. Determine and verify:

1. Field measurements.
2. Field construction criteria.
3. Catalog numbers and similar data.
4. Conformance with specifications.

C. Coordinate each submittal with requirements of the Work and of the Contract Documents.

D. Notify the Owner's Representative in writing, at time of submission, of any deviations in the submittals from requirements of the Contract Documents.

E. Begin no fabrication or work which requires submittals until return of submittals with Owner's Representative approval.

1.07 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Work or in the work of any other contractor.

B. Number of submittals required:

1. Shop Drawings: Submit the number of opaque reproductions which the Contractor requires, plus three copies which will be retained by the Engineer.
2. Product Data: Submit the number of copies which the Contractor requires, plus three which will be retained by the Owner's Representative.
3. Samples: Submit the number stated in each specification section.

C. Submittals shall contain:

1. The date of submission and the dates of any previous submissions.
2. The project title and number.
3. Contract identification.
4. The names of:
   a. Contractor
   b. Supplier
   c. Manufacturer
5. Identification of the project, with the specification section number.
6. Field dimensions clearly identified as such.
7. Relation to adjacent or critical features of the Work or materials.
8. Applicable standards, such as ASTM or Federal Specification numbers.
9. Identification of deviations from Contract Documents.
10. Identification of revisions on re-submittals.
11. An 8" x 3" blank space for Contractor and Design Professionals' stamps.
12. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the Work.

1.08 RESUBMISSION REQUIREMENTS

A. Make any corrections or changes in the submittals required by the Design Professional and resubmit until approved.

B. Shop Drawings and Product Data:

1. Revise initial drawings or data and resubmit as specified for the initial submittal.
2. Indicate any changes which have been made other than those requested by the Design Professional.

C. Samples: Submit new samples as required for initial submittal.

1.09 DISTRIBUTION

A. Distribute reproductions of Shop Drawings and copies of Product Data which carry the Engineer stamp of approval to:

1. Job site file
2. Record documents file
3. Other affected contractors
4. Subcontractors
5. Supplier or fabricator

B. Distribute samples which carry the Design Professional stamp of approval as directed by Owner's Representative.

1.10 ENGINEER DUTIES

A. Review submittals with reasonable promptness and in accordance with schedule.

B. Affix stamp and initials or signature, and indicate requirements for re-submittal, or approval of submittal.

C. Return submittals to Contractor for distribution, or for resubmission.

PART 2 – PRODUCTS

(Not used)

PART 3 - EXECUTION

(Not used)

END OF SECTION

SECTION 01 45 23

TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor will employ, and pay for, services of an independent testing laboratory, acceptable to the Owner's Representative, to perform specified services. See respective specification sections for required services.

1.02 RELATED DOCUMENTS

A. Conditions of the Contract

B. Section 31 20 00: Site Grading and Filling

C. Section 03 33 00: Cast in Place Concrete

1.03 QUALIFICATION OF LABORATORIES

A. Meet "Recommended Requirements for Independent Laboratory Qualifications," edition which is current when Agreement is signed by Owner and Contractor, published by American Council of Independent Laboratories.

B. Meet basic requirements of ASTM E 329, "Standards for Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction."

C. Be licensed to operate in the State in which the work is performed.

D. Have properly calibrated equipment, calibrated within the past 12 months by devices of accuracy traceable to either:
   1. National Bureau of Standards; or
   2. Accepted values of natural physical constants.

1.04 LABORATORY DUTIES

A. Cooperate with Owner's Representative and Contractor and provide qualified personnel promptly on notice.

B. Perform specified inspections, sampling and testing of materials and methods of construction:
   1. Comply with specified standards, ASTM, other recognized authorities, and as specified.
   2. Ascertain compliance with requirements of Contract Documents.

C. Promptly notify Owner's Representative and Contractor of irregularities or deficiencies in Work which are observed during performance of duties.

D. Promptly submit three copies of reports of inspections and tests to Engineer, and submit two copies of those reports to Contractor at the project site.

   1. Date issued;
   2. Project title, number, and location;
   3. Testing laboratory name and address;
   4. Name and signature of inspector;
   5. Date of inspection and sampling;
   6. Date of test;
   7. Identification of product and specifications section;
   8. Type of inspection or test; and
   9. Observations regarding compliance with Contract Documents.

1.05 LIMITATIONS OF AUTHORITY

A. Laboratory is not authorized to:

   1. Release, revoke, alter, or enlarge on, requirements of Contract Documents.
   2. Approve or accept any portion of the Work.
   3. Perform any duties of the Contractor.

1.06 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with Laboratory personnel and provide access to Work.

B. Provide to Laboratory, representative samples of materials to be tested, in required quantities.

C. Furnish copies of mill test reports.

D. Furnish casual labor and facilities:

1. To provide access to work to be tested;
2. To obtain and handle samples at the site;
3. To facilitate inspections and tests; and
4. For Laboratory's exclusive use for storage and curing of test samples.

E. Notify Laboratory sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests.

F. Pay Laboratory travel and labor costs if Laboratory personnel come to job site and find work not ready for testing.

G. Pay for additional tests when initial tests indicate work does not comply with Contract Documents.

END OF SECTION

SECTION 01 45 33
CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Code-required special inspections.

B. Testing services incidental to special inspections.

C. Submittals.

D. Fabricators' field services.

1.02 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018).

B. AISC 341 - Seismic Provisions for Structural Steel Buildings; 2016 (Revised 2020).

C. AISC 360 - Specification for Structural Steel Buildings; 2016 (Revised 2021).

D. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

E. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2021a.

F. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete; 2017.

G. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2023.

H. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2021.

I. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2021.

J. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.

K. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018.

L. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2018.

M. ICC (IBC)-2009 - International Building Code; 2009.

1.03 SUBMITTALS

A. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency is required to:
   1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
   2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
   3. Submit certification that Special Inspection Agency is acceptable to AHJ.

B. Test Reports: After each test or inspection, promptly submit at least two copies of report; one to Architect and one to AHJ.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.

f. Location in the Project.
g. Type of test or inspection.
h. Date of test or inspection.
i. Results of test or inspection.
j. Compliance with Contract Documents.

C. Fabricator's Field Reports: Submit reports to Architect and AHJ.
1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in Contract Documents.

1.04 SPECIAL INSPECTION AGENCY

A. Owner or Architect will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by the building code.

B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.05 TESTING AND INSPECTION AGENCIES

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications:
1. Independent firm specializing in performing testing and inspections of the type specified in this section.

B. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL

A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
1. Continuous Special Inspection: Special Inspection Agency is required to be present in the area where the work is being performed and observe the work at all times the work is in progress.
2. Periodic Special Inspection: Special Inspection Agency is required to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

3.02 SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION

A. High-Strength Bolt, Nut and Washer Material:
1. Verify identification markings comply with ASTM standards specified in the approved contract and to AISC 360, Section A3.3; periodic.
2. Submit manufacturer's certificates of compliance; periodic.

B. High-Strength Bolting Installation: Verify items listed below comply with AISC 360, Section M2.5.
1. Snug tight joints; periodic.

C. Weld Filler Material:
1. Verify identification markings comply with AWS standards specified in the approved Contract Documents and to AISC 360, Section A3.5; periodic.
2. Submit manufacturer's certificates of compliance; periodic.

D. Welding:
1. Structural Steel and Cold Formed Steel Deck:

a. Complete and Partial Joint Penetration Groove Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
b. Multipass Fillet Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
c. Single Pass Fillet Welds Less than 5/16 inch Wide: Verify compliance with AWS D1.1/D1.1M; periodic.
d. Plug and Slot Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
e. Single Pass Fillet Welds 5/16 inch or Greater: Verify compliance with AWS D1.1/D1.1M; continuous.
f. Floor and Roof Deck Welds: Verify compliance with AWS D1.3/D1.3M; continuous.

2. Reinforcing Steel: Verify items listed below comply with AWS D1.4/D1.4M and ACI 318, Section 3.5.2.
a. Verification of weldability; periodic.
b. Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames as well as boundary elements of special structural walls of concrete and shear reinforcement; continuous.
c. Shear reinforcement; continuous.
d. Other reinforcing steel; periodic.

E. Steel Frame Joint Details: Verify compliance with approved Contract Documents.
1. Details, bracing and stiffening; periodic.
2. Member locations; periodic.
3. Application of joint details at each connection; periodic.

3.03 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION

A. Reinforcing Steel, Including Prestressing of Tendons and Placement: Verify compliance with approved Contract Documents and ACI 318, Sections 3.5 and 7.1 through 7.7; periodic.

B. Reinforcing Steel Welding: Verify compliance with AWS D1.4/D1.4M and ACI 318, Section 3.5.2; periodic.

C. Anchors Cast in Concrete: Verify compliance with ACI 318, 17.8.2; periodic.

D. Bolts Installed in Concrete: Where allowable loads have been increased or where strength design is used, verify compliance with approved Contract Documents and ACI 318, Sections 8.1.3 and 21.2.8 prior to and during placement of concrete; continuous.

E. Anchors Post-Installed in Hardened Concrete: Verify compliance with ACI 318.
1. Adhesive Anchors: Verify horizontally or upwardly-inclined orientation installations resisting sustained tension loads - Section 17.8.2.4; continuous.
2. Other Mechanical and Adhesive Anchors: Verify as per Chapter 17.8.2; periodic.

F. Design Mix: Verify plastic concrete complies with the design mix in approved Contract Documents and with ACI 318, Chapter 4 and 5.2; periodic.

G. Concrete Sampling Concurrent with Strength Test Sampling: Each time fresh concrete is sampled for strength tests, verify compliance with ASTM C172/C172M, ASTM C31/C31M and ACI 318, Chapter 26.5, 26.12, and record the following, continuous:
1. Slump.
2. Air content.
3. Temperature of concrete.

H. Specified Curing Temperature and Techniques: Verify compliance with approved Contract Documents and ACI 318, Sections 5.11 through 5.13; periodic.

I. Concrete Strength in Situ: Verify concrete strength complies with approved Contract Documents and ACI 318, Section 6.2, for the following.

J. Formwork Shape, Location and Dimensions: Verify compliance with approved Contract Documents and ACI 318, Section 6.1.1; periodic.

3.04 SPECIAL INSPECTIONS FOR SOILS

A. Materials and Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
   1. Design bearing capacity of material below shallow foundations; periodic.
   2. Design depth of excavations and suitability of material at bottom of excavations; periodic.
   3. Materials, densities, lift thicknesses; placement and compaction of backfill: continuous.
   4. Subgrade, prior to placement of compacted fill verify proper preparation; periodic.

B. Testing: Classify and test excavated material; periodic.

3.05 SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE

A. Seismic Force-Resisting Systems: Comply with the quality assurance plan requirements of AISC 341.

B. Structural Steel: Comply with the quality assurance plan requirements of AISC 341.

C. Designated Seismic System Verification: Verify label, anchorage or mounting complies with certificate of compliance provided by manufacturer or fabricator.

D. Structural Observations for Seismic Resistance: Visually observe structural system for general compliance with the approved Contract Documents; periodic.

3.06 TESTING AGENCY DUTIES AND RESPONSIBILITIES

A. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests or inspections specified.

B. Limits on Testing or Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the work.

C. On instructions by Architect, perform re-testing required because of non-compliance with specified requirements, using the same agency.

D. Contractor will pay for re-testing required because of non-compliance with specified requirements.

3.07 CONTRACTOR DUTIES AND RESPONSIBILITIES

A. Contractor Responsibilities, General:
   1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
   2. Cooperate with agency and laboratory personnel; provide access to approved documents at project site, to the work, to manufacturers' facilities, and to fabricators' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to work to be tested or inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested or inspected.

c. To facilitate tests or inspections.
d. To provide storage and curing of test samples.

4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

B. Contractor Responsibilities, Seismic Force-Resisting System, Designated Seismic System, and Seismic Force-Resisting Component: Submit written statement of responsibility for each item listed in the Statement of Special Inspections to AHJ and Owner prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.

END OF SECTION

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SECTION 01 55 26

TRAFFIC REGULATION

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Provide, operate and maintain equipment, services and personnel, with traffic control and protective devices, as required to expedite vehicular traffic flow across construction areas, around detours, on haul routes, at site entrances, on-site access roads, and parking areas.

B. Remove temporary equipment and facilities when no longer required, restore grounds to original, or to specified conditions.

1.02 RELATED REQUIREMENTS

A. Section 01 56 00: Barriers

B. Section 01 57 00: Temporary Controls

1.03 TRAFFIC SIGNALS AND SIGNS

A. Provide and operate traffic control and directional signals required to direct and maintain an orderly flow of traffic in all areas under Contractor's control, or affected by Contractor's operations.

B. Provide traffic control and directional signs, mounted on barricades or standard posts:

1. At each change of direction of a roadway and at each crossroads.
2. At detours.
3. At parking areas.

1.04 FLAGMEN

A. Provide qualified and suitably equipped flagmen when construction operations encroach on traffic lanes, as required for regulation of traffic.

1.05 FLARES AND LIGHTS

A. Provide flares and lights during periods of low visibility:

1. To clearly delineate traffic lanes and to guide traffic.
2. For use by flagmen in directing traffic.

B. Provide illumination of critical traffic and parking areas.

1.06 CONSTRUCTION PARKING CONTROL

A. Control vehicular parking to preclude interference with public traffic or parking, access by emergency vehicles, Owner's operations, or construction operations.

B. Monitor parking of construction personnel's private vehicles.

1. Maintain free vehicular access to and through parking areas.
2. Prohibit parking on or adjacent to access roads, or in non-designated areas.

1.07 HAUL ROUTES AND SITE ACCESS

A. Consult with governing authorities, establish public thoroughfares which will be used as haul routes and site access.

B. Confine construction traffic to designated haul routes.

C. Provide traffic control at critical areas of haul routes to expedite traffic flow, to minimize interference with normal public traffic.

D. All haul routes and site access routes shall be approved by the Owner's Representative or Owner prior to use by the Contractor.

PART 2 - PRODUCTS

(Not used)

PART 3 - EXECUTION

(Not used)

END OF SECTION

SECTION 01 56 00

BARRIERS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Furnish, install and maintain suitable barriers as required to prevent public entry, and to protect the Work, existing facilities, trees and plants from construction operations; remove when no longer needed, or at completion of the Work.

1.02 RELATED REQUIREMENTS

A. Conditions of the Contract

B. Section 01 11 00: Summary of Work

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Materials may be new or used, suitable for the intended purpose, but must not violate requirements of applicable codes and standards.

2.02 BARRIERS

A. Materials generally accepted as industry standards, as appropriate to serve required purpose.

PART 3 - EXECUTION

3.01 GENERAL

A. Install facilities of a neat and reasonably uniform appearance, structurally adequate for required purposes.

B. Maintain barriers during entire construction period.

B. Relocate barriers as required by progress of construction.

3.02 TREE AND PLANT PROTECTION

A. Preserve and protect existing trees and plants at site which are designated to remain, and those adjacent to site.

B. Consult with Owner's Representative and remove agreed-on roots and branches which interfere with construction.

1. Employ qualified tree surgeon to remove, and to treat cuts.

C. Provide temporary barriers to a height of six feet, around each, or around each group, of trees and plants.

D. Protect root zones of trees and plants:

1. Do not allow vehicular traffic or parking.
2. Do not store materials or products.
3. Prevent dumping of refuse or chemically injurious materials or liquids.
4. Prevent puddling or continuous running water.

E. Carefully supervise excavating, grading, filling and subsequent construction operations to prevent damage.

F. Replace, or suitably repair, trees and plants designated to remain which are damaged or destroyed due to construction operations.

3.03 TEMPORARY FENCING

A. Install temporary fencing where shown on plans or as necessary to prevent horses, livestock and public entry to project area during construction.

3.04 REMOVAL

A. Completely remove barricades, including foundations, when construction has progressed to the point that they are no longer needed and when approved by the Owner's Representative.

B. Clean and repair damage caused by installation, fill and grade areas of the site to required elevations and slopes and clean the area.

END OF SECTION

SECTION 01 57 00

TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Provide and maintain methods, equipment, and temporary construction, as necessary to provide controls over environmental conditions at the construction site and related areas under Contractor's control; remove physical evidence of temporary facilities at completion of work.

1.02 RELATED REQUIREMENTS

A. Section 01 55 26: Traffic Regulation

B. Section 01 74 00: Cleaning

1.03 DUST CONTROL

A. Provide positive methods and apply dust control materials to minimize raising dust from construction operation, and provide positive means to prevent airborne dust from dispersing into the atmosphere.

1.04 WATER CONTROL

A. Provide methods to control surface water to prevent damage to the Project, the site, or adjoining properties.

1. Control fill, grading and ditching to direct surface drainage away from excavations, pits, tunnels and other construction areas; and to direct drainage to proper runoff.

B. Provide, operate and maintain hydraulic equipment of adequate capacity to control surface and groundwater.

C. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to any portion of the site or to adjoining areas. Contractor shall abide by all storm water permits issued by City, State, or Federal agencies.

1.05 DEBRIS CONTROL

A. Maintain all areas under Contractor's control free of extraneous debris.

B. Initiate and maintain a specific program to prevent accumulation of debris at construction site, storage and parking areas, or along access roads and haul routes.

1. As specified in Section 01 71 00 – Cleaning, provide containers for deposit of debris.

2. Prohibit overloading of trucks to prevent spillages on access and haul routes.
   a. Provide periodic inspection of traffic areas to enforce requirements.

C. Schedule periodic collection and disposal of debris as specified in Section 01 71 00 - Cleaning.

1. Provide additional collections and disposals of debris whenever the periodic schedule is inadequate to prevent accumulation.

1.06 POLLUTION CONTROL

A. Provide methods, means and facilities required to prevent contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations.

B. Provide equipment and personnel, perform emergency measures required to contain any spillages, and to remove contaminated soils or liquids.

1. Excavate and dispose of any contaminated earth off- site, and replace with suitable compacted fill and topsoil.

C. Take special measures to prevent harmful substances from entering public waters.

1. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams, or in sanitary or storm sewers.

D. Provide systems for control of atmospheric pollutants.
   1. Prevent toxic concentrations of chemicals.
   2. Prevent harmful dispersal of pollutants into the atmosphere.

1.07 EROSION CONTROL

A. Plan and execute construction and earthwork by methods to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.

   1. Hold the areas of bare soil exposed at one time to a minimum.

   2. Provide temporary control measures such as berms, dikes and drains.

B. Construct fills and waste areas by selective placement to eliminate surface silts or clays which will erode.

C. Periodically inspect earthwork to detect any evidence of the start of erosion, apply corrective measures as required to control erosion.

PART 2 - PRODUCTS

(Not used)

PART 3 - EXECUTION

(Not used)

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations.

F. Procedures for Owner-supplied products.

G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Identification of Owner-supplied products.

B. Section 01 25 00 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

C. Section 01 40 00 - Quality Requirements: Product quality monitoring.

D. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

E. Section 01 74 19 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

F. Section 22 05 13 - Common Motor Requirements for Plumbing Equipment: Motors for plumbing equipment.

G. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Motors for HVAC equipment.

1.03 REFERENCE STANDARDS

A. NEMA MG 1 - Motors and Generators; 2018.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. See Section 01 40 00 - Quality Requirements, for additional source quality control requirements.

C. Use of products having any of the following characteristics is not permitted:
   1. Made outside the United States, its territories, Canada, or Mexico.
   2. Made using or containing CFC's or HCFC's.
   3. Made of wood from newly cut old growth timber.
   4. Containing lead, cadmium, or asbestos.

D. Where other criteria are met, Contractor shall give preference to products that:
   1. If used on interior, have lower emissions, as defined in Section 01 61 16.
   2. If wet-applied, have lower VOC content, as defined in Section 01 61 16.
   3. Are extracted, harvested, and/or manufactured closer to the location of the project.
   4. Have longer documented life span under normal use.

E. Provide interchangeable components of the same manufacture for components being replaced.

F. Motors: Refer to Section 21 05 13 - Common Motor Requirements for Fire Suppression Equipment, NEMA MG 1 Type. Specific motor type is specified in individual specification sections.

G. Motors: Refer to Section 22 05 13 - Common Motor Requirements for Plumbing Equipment, NEMA MG 1 Type. Specific motor type is specified in individual specification sections.

H. Motors: Refer to Section 23 05 13 - Common Motor Requirements for HVAC Equipment, NEMA MG 1 Type. Specific motor type is specified in individual specification sections.

I. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.

J. Cord and Plug: Provide minimum 6 foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

D. Products indicated in the color and finish schedules or drawing notes, including aesthetics, such as color, shade, hue, translucence, opacity, pattern or texture, establish the Basis of

Design. Use the Basis of Design or submit a request for substitution for any product not indicated.

E. Where a definate material is indicated as "Basis of Design," it is the intent to set a definate standard and shall be included in the contract amount.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 01 25 00 - Substitution Procedures.

3.02 OWNER-SUPPLIED PRODUCTS

A. See Section 01 10 00 - Summary for identification of Owner-supplied products.

B. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

C. Contractor's Responsibilities:
   1. Review Owner reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

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

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.
   1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.

C. Store and protect products in accordance with manufacturers' instructions.

D. Store with seals and labels intact and legible.

E. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

F. For exterior storage of fabricated products, place on sloped supports above ground.

G. Provide off-site storage and protection when site does not permit on-site storage or protection.
   1. Execute a formal supplemental agreement between Owner and Contractor allowing off-site storage, for each occurrence.

H. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

I. Comply with manufacturer's warranty conditions, if any.

J. Do not store products directly on the ground.

K. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

L. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

M. Prevent contact with material that may cause corrosion, discoloration, or staining.

N. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

O. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 70 00

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the Work.

1.02 RELATED REQUIREMENTS

A. Conditions of the Contract

B. Section 01 74 00: Cleaning

1.03 SUBSTANTIAL COMPLETION

A. When Contractor considers the Work is substantially complete, he shall submit to Owner's Representative:

1. A written notice that the Work, or designated portion thereof, is substantially complete.
2. A list of items to be completed or corrected.

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

C. Should Owner's Representative determine that the Work is not substantially complete:

1. Owner's Representative will promptly notify the Contractor in writing, giving the reasons therefor.
2. Contractor shall remedy the deficiencies in the Work and send a second written notice of substantial completion to the Owner's Representative.
3. Owner's Representative will reinspect the Work.

D. When the Owner's Representative finds that the Work is substantially complete, he will:

1. Prepare and deliver to Owner a list of tentative Certificate of Substantial Completion with a tentative list of items to be completed or corrected before final payment.

2. After consideration of any objections made by the Owner as provided in Conditions of the Contract, and when Owner=s Representative considers the work substantially complete, he will execute and deliver to the Owner and the Contractor a definite Certificate of Substantial Completion with a revised tentative list of items to be completed or corrected.

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. Owner’s Representative will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.

C. Should Owner’s Representative consider that the Work is incomplete or defective:

1. Owner’s Representative will promptly notify the Contractor in writing, listing the incomplete or defective work.
2. Contractor shall take immediate steps to remedy the stated deficiencies in the work and send a second written certification to the Owner’s Representative that the Work is complete.
3. Owner’s Representative will reinspect the work.

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

1.05 CONTRACTOR'S CLOSEOUT SUBMITTALS TO OWNER'S REPRESENTATIVE

A. Evidence of compliance with requirements of governing authorities.

B. Evidence of Payment and Release of Liens: to the requirements of the contract.

C. Certificate of Insurance for Products and Completed Operations, as applicable.

D. Record Drawing of Completed Work.

1.06 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a final statement of accounting to Owner's Representative.

B. 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. Penalties and Bonuses
    f. Deductions for liquidated damages
    g. Other adjustments
3. Total Contract Sum, as adjusted
4. Previous payments
5. Sum remaining due

C. Owner's Representative will prepare a final Change Order, reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders.

1.07 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.

PART 2 - PRODUCTS

(Not used)

PART 3 - EXECUTION

(Not used)

END OF SECTION

SECTION 01 74 00

CLEANING

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

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

1.02 RELATED REQUIREMENTS

A. Conditions of the Contract

B. Section 01 57 00: Temporary Controls

1.03 DISPOSAL REQUIREMENTS

A. 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 hazard 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. Execute periodic cleaning to keep the Work, the site and adjacent

properties free from accumulations of waste materials, rubbish and windblown debris, resulting from construction operations.

B. Provide on-site containers for the collection of waste materials, debris and rubbish.

C. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the site.

3.02 FINAL CLEANING

A. Employ skilled workmen for final cleaning.

B. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.

C. Prior to final completion, Contractor shall conduct an inspection of all work areas, to verify that the entire Work is clean.

END OF SECTION

SECTION 01 78 00

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

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

1. Drawings
2. Specifications
3. Addenda
4 Change Orders and other Modifications to the Contract
5. Engineer Field Orders or written instructions
6. Approved Shop Drawings, Product Data and Samples
7. Field Test Records

1.02 RELATED REQUIREMENTS

A. Conditions of the Contract.

B. Section 01 33 00: Shop Drawings and Product Data Samples

1.03 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and samples in Contractor's field office apart from documents used for construction.

1. Provide files and racks for storage of documents.
2. Provide locked cabinet or secure storage space for storage of samples.

B. File documents and samples in accordance with CSI/CSC format.

C. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.

D. Make documents and samples available at all times for inspection by Owner’s Representative.

1.04 MARKING DEVICES

A. Provide felt tip marking pens for recording information in the color code designated by Owner's Representative.

1.05 RECORDING

A. Label each document "PROJECT RECORD" in neat large printed letters.

B. Record information concurrently with construction progress.
   1. Do not conceal any work until required information is recorded.

1.06 SUBMITTAL

A. At Contract closeout, deliver Record Documents to Owner's Representative for the Owner.

B. Accompany submittal with transmittal letter in duplicate, containing:

   1. Date
   2. Project title and number
   3. Contractor's name and address
   4. Title and number of each Record Document
   5. Signature of Contractor or his authorized representative

PART 2 - PRODUCTS

(Not used)

PART 3 - EXECUTION

(Not used)

END OF SECTION

SECTION 02 06 14

GEOTECHNICAL DATA

By this reference, the Geotechnical Project No. J038326.01, prepared by Geotechnology, Inc. dated March 30, 2021 is included with these specifications.

A copy of the report titled Geotechnical Exploration AGFC Charlie Craig Hatchery Improvement Blytheville, Arkansas is included.

END OF SECTION

GEOTECHNOLOGY

A UES Company

GEOTECHNICAL EXPLORATION
AGFC CHARLIE CRAIG HATCHERY IMPROVEMENT
BENTONVILLE, ARKANSAS

Prepared for:

FISHER ARNOLD
JONESBORO, ARKANSAS

Prepared by:

GEOTECHNOLOGY, LLC
MEMPHIS, TENNESSEE

Date:

AUGUST 24, 2023

Geotechnology Project No.:

J043428.01

SAFETY
QUALITY
INTEGRITY
PARTNERSHIP
OPPORTUNITY
RESPONSIVENESS

GEOTECHNOLOGY
A UES Company

August 24, 2023

Mr. Jason MacDonald, P.E.
Fisher Arnold
404 Creath Avenue
Jonesboro, Arkansas 72401

Re: Geotechnical Exploration
AGFC Charlie Craig Hatchery Improvement
Bentonville, Arkansas
Geotechnology Project No. J043428.01

Dear Mr. MacDonlad:

Presented in this report are the results of the geotechnical exploration performed by Geotechnology, LLC for the referenced project. The report includes our understanding of the project, observed site conditions, conclusions and/or recommendations, and support data as listed in the Table of Contents.

We appreciate the opportunity to provide geotechnical services for this project. If you have any questions regarding this report, or if we can be of any additional service to you, please do not hesitate to contact us.

Respectfully submitted,

GEOTECHNOLOGY, LLC

STATE OF ARKANSAS
LICENSED PROFESSIONAL ENGINEER
No. 19074
DUNCAN BLAKE ADRIAN

8-24-23

Jim House, G.I.T.
Geologist

Duncan Adrian, P.E.
Geotechnical Manager

EJH/DBA:ejh

Copies submitted: Client (email)

TABLE OF CONTENTS

1.0 Introduction 1
2.0 Site Description 1
3.0 Project Information 2
4.0 Geotechnical Exploration 2
5.0 Laboratory Review and Testing 2
5.1 Stratigraphy 3
5.1.1 Predominately Fine-Grained Soils 3
5.1.2 Predominately Coarse-Grained Soils 3
5.2 Groundwater 3
6.0 Conclusions and Recommendations 3
6.1 Geotechnical Concerns 4
6.1.1 High Plasticity and Soft Soils 4
6.2 Site Preparation and Earthwork 4
6.2.1 Site Preparation 5
6.2.2 Proofroll 5
6.2.3 Cut Areas 5
6.2.4 Suitable Fill 5
6.2.5 Fill Placement and Compaction 5
6.3 Seismic Site Classification and Seismic Parameters 6
6.4 Shallow Foundations 7
6.5 Pond Excavation 8
6.6 Pavements 8
6.6.1 Flexible Pavements 8
6.6.2 Rigid Pavements 8
6.7 Utility Construction 9
7.0 Recommended Additional Services 9
8.0 Limitations 10

Appendices
Appendix A – Important Information about This Geotechnical-Engineering Report
Appendix B – Figures
Appendix C – Boring Information
Appendix D – Laboratory Test Data

LIST OF TABLES

Table 1. Depth of Improvement for the Proposed Areas of Construction 4
Table 2. Percent Compaction and Moisture-Conditioning Requirements for Fill and Backfill. 6
Table 3. Relative Density Compaction Requirements for Granular Fill and Backfill. 6
Table 4. Site Class and Seismic Parameters (2% Probability of Exceedance in 50 Years). 7

GEOTECHNOLOGY
A UES Company

GEOTECHNICAL EXPLORATION
AGFC CHARLIE CRAIG HATCHERY IMPROVEMENT
BENTONVILLE, ARKANSAS
August 24, 2023 | Geotechnology Project No. J043428.01

1.0 INTRODUCTION

Geotechnology, LLC has prepared this geotechnical exploration report for the proposed structures and pond to be located at the existing Arkansas Game and Fish Commission (AGFC) Charlie Craig facility in Bentonville, Arkansas. Our services in this report were provided in general accordance with the terms and scope of services described in our proposal P043428.01, dated April 21, 2023. Our services documented in this report were authorized by your signed acceptance of our terms on August 15, 2023.

The purposes of the geotechnical exploration were to develop a general subsurface profile at the site and prepare recommendations for the geotechnical aspects of the design and construction of the project as defined in our proposal. Our scope of services included site reconnaissance, geotechnical borings, laboratory testing, engineering analyses, and preparation of this report. Unless noted otherwise, all dimensions, measurements, depths, and locations in this report should be considered approximate.

A copy of "Important Information about This Geotechnical-Engineering Report," published by the Geotechnical Business Council (GBC) of the Geoprofessional Business Association (GBA), is included in Appendix A for your review. The publication discusses report limitations and ways to manage risk associated with subsurface conditions.

2.0 SITE DESCRIPTION

The project site is located at the existing AGFC Charlie Craig Hatchery facility located at the intersection of Highway 279 and West Fish Hatcher Road in Bentonville, Arkansas as shown on Figure 1 in Appendix B. The site involves four different proposed areas of construction as shown on Figures 2 through 6 in Appendix B. The first proposed area of construction (Area 1) is located on the southeast portion of the facility. An existing structure is located to the northwest and a pond is located to the north. The second proposed area of construction (Area 2) is located on the northeast portion of the facility on a gravel road. Existing ponds and a structure are located to the east of this area. The third proposed area of construction (Area 3) consists of an existing structure on the north-central portion of the facility. The fourth proposed area of construction (Area 4) is relatively flat, covered with grass, and located on the west side of the facility. Generally, the areas of construction are relatively flat, covered with grass or crushed stone, and some trees and vegetation.

3.0 PROJECT INFORMATION

The project consists of the design and construction of three, 12,000 square-foot, single-story shop buildings located in Areas 1, 2, and 3 and one 750,000 square-foot pond located in Area 4. Loading information was not provided, and we have assumed maximum column and wall loads of 50 kips and 4 kips per linear foot (klf), respectively. Grading plans were not provided. We have assumed less than 3 feet of grade change will be required to achieve finished grades for the shops, and we have assumed a maximum pond excavation depth of 12 feet.

4.0 GEOTECHNICAL EXPLORATION

The geotechnical exploration consisted of six borings in the proposed areas of the shop buildings designated as Borings B-1, B-2, and SB-1 through -4. Borings designated as P-1 through -5 were located in the proposed area of the pond. The borings were located in the field by a representative of Geotechnology. The boring locations shown on Figure 2 in Appendix B are approximate; if elevations or more precise locations are required, the client should retain a registered surveyor to establish boring locations and elevations.

The borings were drilled July 19 and 20, 2023 with an ATV-mounted rotary drill rig (Diedrich D-50) advancing hollow-stem augers, as indicated on the boring logs presented in Appendix C. Soil sampling was accomplished ahead of the augers at the depths indicated on the boring logs, using 2-inch-outside-diameter (O.D.) split-spoons in general accordance with the procedures outlined by ASTM D1586. Standard Penetration Tests (SPTs) were performed on the split-spoon samples using an automatic hammer to obtain the standard penetration resistance, or N-value[1], of the sampled material.

The drill crew kept a log of the subsurface profile noting the soil types and stratifications, groundwater, SPT results, and other pertinent data. Observations for groundwater were made in the borings during drilling.

Representative portions of the split-spoon samples were placed in glass jars to preserve sample moisture. The glass jars were marked and labeled in the field for identification, then returned to our laboratory in Memphis.

5.0 LABORATORY REVIEW AND TESTING

Laboratory testing was performed on soil samples to assess engineering and index properties. The soil testing consisted of moisture contents (ASTM D2216), Atterberg limit (ASTM D4318),

[1] The standard penetration resistance, or N-value, is defined as the number of blows required to drive the split-spoon sampler 12 inches with a 140-pound hammer falling 30 inches. Since the split spoon sampler is driven 18 inches or until refusal, the blows for the first 6 inches are for seating the sampler, and the number of blows for the final 12 inches is the N-value. Additionally, “refusal” of the split-spoon sampler occurs when the sampler is driven less than 6 inches with 50 blows of the hammer.

and percent of soils finer than #200 sieve (ASTM D1140). Most of the laboratory test results are presented on the boring logs in Appendix C. The Atterberg limit results are also provided in Appendix D.

The boring logs were prepared by a geotechnical engineer from the field logs, visual classification of the soil samples in the laboratory, and laboratory test results. Terms and symbols used on the boring logs are presented in the Boring Log: Terms and Symbols in Appendix C. Stratification lines on the boring logs indicate approximate changes in strata. The transition between strata could be abrupt or gradual.

5.1 Stratigraphy

The ground surface at the boring locations was generally covered with an approximatge 6 inches of topsoil or gravel. Underlying the topsoil, the soil stratigraphy encountered in the borings consisted of fine-grained soils underlain by coarse-grained soils to the boring termination depth. More specific descriptions of the soil layers are provided below and on the boring logs in Appendix C.

5.1.1 Predominately Fine-Grained Soils

Soils classified as low plasticity, lean clay (CL) and high plasticity, fat clay (CH) with varying amounts of sand were encountered beneath the topsoil and gravel and extended to the maximum depth of exploration (15 feet) in Borings B-1, P-2, P-4, P-5, SB-1, and SB-4. The fine-grained soils were encountered beneath the topsoil and gravel extending to depths ranging from 4 to 8.5 feet in Borings B-2, P-1, P-3, SB-2, and SB-3. Moisture contents of the tested samples ranged from 14 to 52 percent. Atterberg limits performed on select samples yielded liquid limits (LL) between 32 and 74 and plasticity indices (PI) between 17 and 27 percent. SPT N-values measured in the fine-grained soils ranged from 0 to 19 blows per foot (bpf), which in our experience is indicative of very soft to very stiff consistencies.

5.1.2 Predominately Coarse-Grained Soils

Soils classified as clayey sand (SC) with varying amounts of gravel were encountered below the fine-grained soils and extended to the maximum depth of exploration (15 feet) in Borings B-2, P-1, P-3, SB-2, and SB-3. SPT N-values measured in the coarse-grained soils ranged from 6 to greater than 50 bpf, indicative of loose to very dense conditions.

5.2 Groundwater

Groundwater was encountered in Borings B-1, B-2, SB-1, and SB-2 during drilling operations at depths ranging from 6 to 13 feet. Groundwater levels vary over time due to the effects of seasonal variation in precipitation or other factors not evident at the time of exploration.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Geotechnology has prepared the following conclusions and recommendations based on our understanding of the proposed project, the field and laboratory data presented in this report, engineering analyses, and our experience and judgement.

6.1 Geotechnical Concerns

The following geotechnical concerns could influence the project budget and schedule. The geotechnical concerns and recommended methods of remediation should be reviewed thoroughly and Geotechnology should be contacted if additional recommendations may be required.

6.1.1 High Plasticity and Soft Soils

High plasticity, fat clay (CH) was encountered in the upper 5 feet of Borings P-4, SB-1, and SB-4. These soils may be encountered at different depths and locations across the site. High plasticity clays and silts are potentially expansive with changes in moisture content. Structures supported on high plasticity, potentially expansive soils within the drying/wetting zone can undergo distress as the soil shrinks or swells unless these soils are mitigated. In addition, drying/wetting soil expansion is often associated with irrigation.

Wet soils were encountered in the upper 5 feet of the proposed building borings. Additionally, soft soils (soils with an SPT N-value of less than 5 bpf) were encountered in the upper 5 feet of Borings B-1, B-2, and SB-2. Lean clay and silt soils can quickly diminish in strength if disturbed and/or wet, resulting in softening of the soil subgrade below foundations, floor slabs, and pavements. Pavements and structures supported on wet and soft soils could be damaged due to the effects of excessive total or differential settlement as a result of disturbance.

We recommend separating the bottom of slabs, footings, and pavements from the high plasticity clay and soft soils with a buffer zone. This buffer zone should be composed of materials meeting the requirements set forth and should be placed as specified in the subsequent paragraphs. The construction of the buffer may require filling, undercutting, and backfilling, treating the upper zone of clay with lime, or a combination thereof. This buffer zone should extend a minimum of 3 feet below the base of footings and floor slabs and 2 feet below pavements, if any. The buffer zone should extend a minimum of 5 feet beyond building footprints. The estimated depth of improvement for each area is shown in Table 1.

Table 1. Depth of Improvement for the Proposed Areas of Construction

Area	Borings	Depth of Estimated Improvement (feet)
Area 1	B-1 and B-2	5
Area 2	SB-1 and SB-2	5
Area 3	SB-3 and SB-4	0.5 to 1

6.2 Site Preparation and Earthwork

Grading information was not provided. We have assumed than less than 2 feet of cut and/or fill will be required to achieve design grades at the proposed building locations. The following paragraphs outline site grading recommendations for the proposed area of construction.

6.2.1 Site Preparation

In general, cut areas and areas to receive new fill should be stripped of vegetation, fill materials, previous foundations, topsoil, soft or loose soils, and other deleterious materials. Topsoil should be replaced in landscape areas or disposed of off-site.

6.2.2 Proofroll

After performing site preparation and excavations in the cut areas, the exposed subgrade should be proofrolled using a tandem-axle dump truck loaded approximately 20,000 pounds per axle (or equivalent proof-rolling equipment) under the review of the project geotechnical engineer or their representative. This requirement may be waived if the geotechnical engineer determines that proofrolling would disturb an otherwise acceptable subgrade. Soft or yielding soils should be stabilized as directed by the geotechnical engineer.

6.2.3 Cut Areas

After excavation, the top 6 inches of the resulting subgrade should be compacted to a minimum of 98% of the maximum dry unit weight as determined by a standard Proctor test (ASTM D698).

6.2.4 Suitable Fill

Fill materials should consist of natural soils classifying as lean clay, silty sand, clayey sand, or clay gravel (CL, SM, SC, or GC), have a maximum LL of 45 and a PI of no more than 20 percent. Such materials should be free from organic matter, debris, or other deleterious materials, and have a maximum particle size of 2 to 3inches. The onsite soils generally meet these criteria excluding areas with fat clay such as those encountered in Borings P-4, SB-1, and SB-4.

6.2.5 Fill Placement and Compaction

Fill and backfill should be placed in level lifts, up to 8 inches in loose thickness. For soils that exhibit a well-defined moisture density relationship, each lift should be moisture-conditioned to within the acceptable moisture content range provided in Table 2, and compacted with a sheepsfoot roller or self-propelled compactor to at least the minimum percent compaction indicated in Table 2. Moisture-conditioning can include: aeration and drying of wetter soils; wetting drier soils; and/or mixing wetter and drier soils into a uniform blend. For granular soils that do not exhibit a well-defined moisture density relationship, the soils should be compacted to at least the minimum relative densities indicated in Table 3. Thinner lifts should be used for lighter compaction equipment. The backfill should not be flushed or jetted with water in an attempt to obtain compaction.

Table 2. Percent Compaction and Moisture-Conditioning Requirements for Fill and Backfill.

Area	Minimum Percent Compaction[a,b]	Acceptable Moisture Content Range[c]
Structural[d]	95%	±2%
Non-Structural	92%	±2%
Pavement Subgrades	98%	±2%

[a] In reference to the standard Proctor maximum dry unit weight measured by ASTM D698.
[b] For granular soils that do not exhibit a well-defined moisture-density relationship, refer to Table 3 for minimum relative density requirements.
[c] In reference to optimum moisture content as measured by ASTM D698.
[d] Structural Fill and backfill for foundations are defined as fill and backfill located within the zones of influence of structures. The zone of influence of a structure is defined as the area below the footprint and 1V:1H outward and downward projections from the bearing elevation of the structure.

Table 3. Relative Density Compaction Requirements for Granular Fill and Backfill.

Area	Minimum Relative Density[a,b]
Structural[c]	70%
Non-structural	70%
Pavement Base Course	75%

[a] Relative density evaluated from the maximum and minimum index densities measured by ASTM D4253 and D4254, respectively.
[b] For granular soils that exhibit a well-defined moisture density relationship, refer to Table 2 for minimum percent compaction and moisture-conditioning requirements.
[c] Structural fill and backfill for foundations are defined as fill and backfill located within the zone of influence of structures. The zone of influence of a structure is defined as the area below the footprint of the structure and 1V:1H outward and downward projections from the bearing elevation of the structure.

Maintaining the moisture content of bearing and subgrade soils within the acceptable range provided in Table 2 is important during and after construction. The subgrade soils should not be allowed to become wet or dry during or after construction, and measures should be taken to prevent water from ponding on these soils and to reduce drying of these soils.

Asphalt, concrete, or fill should not be placed over frozen or saturated soils, and frozen or saturated soils should not be used as compacted fill or backfill. Upon completion of earthwork, disturbed areas should be stabilized.

Managing site water is important in successful performance of the pavement and foundation systems. Water from surface runoff, downspouts, and subsurface drains should be collected and discharged through a storm water collection system. Positive drainage should be established to promote drainage or surface water away from the structure and reduce ponding of water.

6.3 Seismic Site Classification and Seismic Parameters

The site lies within the influence of the New Madrid Seismic Zone (NMSZ). It is our understanding the proposed construction site will be design in accordance with Chapter 20 of ASCE 7-16 and the 2021 International Building Code (IBC). The 2021 IBC/ASCE 7-16 stipulates structures designed based on an earthquake event with a probability of exceedance of 2% in 50 years.

Based on the results of the field and laboratory testing, our understanding of the vicinity, and our interpretations of the 2021 IBC/ASCE 7-16, it is our opinion the seismic parameters in Table 3 are applicable for this project.

Table 4. Site Class and Seismic Parameters (2% Probability of Exceedance in 50 Years).

Category/ Parameter	Designation/ Value	Reference
S_S	0.149g[a]	Latitude 36.350664°N/Longitude 94.289821°W
S_1	0.087g[a]	
Seismic Site Class	D	Chapter 20 of ASCE 7-16
F_a	1.600	2021 IBC Table 1613.2.3(1)
F_v	2.400	2021 IBC Table 1613.2.3(2)
F_{PGA}	1.600	ASCE 7-16 Table 11.8-1
S_{MS}	0.238g	2021 IBC Equation 16-20
S_{M1}	0.210g	2021 IBC Equation 16-21
S_{DS}	0.159g	2021 IBC Equation 16-22
S_{D1}	0.140g	2021 IBC Equation 16-23
PGA	0.071g	ASCE 7-16 Figure 22-7
PGA_M	0.113g	ASCE 7-16 Equation 11.8-1

[a] S_S and S_1 were computed using the web-based U.S. Seismic Design Maps (https://asce7hazardtool.online/) using the indicated latitude and longitude coordinates of the project site.

6.4 Shallow Foundations

Loading information was not provided. We have assumed maximum column and wall loads of 50 kips and 4 kips per linear foot, respectively. If loads exceed these values or a different foundation system is used, Geotechnology should be contacted to revise recommendations.

Provided the site is prepared as described in Section 6.1 and 6.2 and a buffer zone is established, shallow foundations for the proposed building areas can be proportioned using a maximum net allowable bearing capacity of 2,000 and 1,800 pounds per square foot (psf) for spread and strip footings, respectively. Total and differential settlement of shallow foundations are anticipated to be 1 inch and ¾ of an inch, respectively. These recommendations are based on the conditions that foundation plans are forwarded to Geotechnology for review and the foundation excavations are observed by the geotechnical engineer or their representative. Additional recommendations may be required based on the results of the foundation observations. If the actual loading exceeds those reported, Geotechnology should be contacted to perform additional settlement analyses.

Footing excavations should be made with a smooth-edged backhoe bucket, and foot traffic in the bottom of the excavation should be minimized. Footing excavations should be extended through deleterious materials and/or zones of soft soil, if encountered; the over-excavations can be backfilled with compacted fill, flowable fill, or lean concrete.

For exterior footings, we recommend that the footings bear a minimum of 18 inches below finish grade. An additional 6 inches of embedment is recommended if the erosion of the cover material is not controlled. Drainage should be maintained away from the foundations throughout the life of the structure. Water should never be allowed to pond against the footings.

6.5 Pond Excavation

Fine- and coarse-grained soils were encountered in the borings. The pond depth is unknown at the time of this report, and we assumed approximately 12 feet of cut will be required. The bottom of the pond excavations will be in predominately fine-grained, cohesive soils in Borings P-2, -4, and -5. The eastern portion of the excavation may be in close proximity of more coarse-grained soils as encountered in Borings P-1 and -3. Based on the amount of coarse-grained material encountered in Borings P-1 and -3, the placement of a clay liner may be required if there is desire to maintain a constant water level in the pond. Geotechnology can provide liner recommendations based on the in-situ conditions encountered while excavating the pond.

We recommend maintaining or providing an approximately 3-foot clay liner on the bottom and sides of the pond. Fill material for use in the pond should consist of natural cohesive soil that have a PI of greater than 15 percent, and a fine-grained content of greater than about 90 percent. Such materials should be free from organic matter, debris, or other deleterious materials. The onsite clay soils removed during excavation of the ponds could be used for the liner but may require processing to remove chert pieces. After excavation, the top 6 inches of the resulting subgrade should be compacted to a minimum of 92% of the maximum dry unit weight and +3% of optimum moisture content as determined by a standard Proctor test (ASTM D698).

6.6 Pavements

Pavements are to be placed on stable in-situ soil or compacted fill. The pavement subgrade should be proof-rolled and prepared as recommended in the Site Preparation and Earthwork section of this report. Once the subgrade is prepared, it should be promptly paved to protect it from the weather, as the naturally occurring soils of the area are susceptible to changes in moisture content.

6.6.1 Flexible Pavements

Vehicle loads and traffic patterns were not provided. We have assumed a light-duty, flexible pavement structure will be required for passenger vehicle parking and drive areas. We recommend a minimum 2-inch thick asphalt concrete pavement be constructed over an 8-inch-thick soil cement treated base, or an 8-inch compacted, crushed stone layer. Geotechnology should be contacted if additional pavement designs are required.

6.6.2 Rigid Pavements

We have assumed rigid pavements may be required for portions of the parking and driveway areas. We recommend a 6-inch-thick Portland cement concrete pavement be constructed over a 7-inch-thick soil cement base, or a 7-inch compacted, crushed stone layer. The 28-day compressive strength of the concrete should be a minimum of 4,000 psi.

6.7 Utility Construction

Settlement of trench backfill can result in unsightly depressions and localized pavement failures. The magnitude of settlement can be reduced by mechanically compacting the trench backfill. Select granular backfill can be used for pipe bedding and minimum cover for utilities. The remainder of the utility trenches should be backfilled with flowable fill or compacted clayey soils up to design subgrade elevation to reduce the potential for water collecting in these trenches and being absorbed by the surrounding clays, causing heave of foundations, slabs, pavement, etc.

Granular bedding and backfill that exhibits a well-defined moisture-density relationship should be compacted and moisture-conditioned per the requirements presented in Table 2; otherwise, the granular material should be compacted to at least the minimum relative densities indicated in Table 3 in the Site Preparation and Earthwork section of this report.

Utility trench backfill should be placed in 6- to 8-inch-thick lifts with each lift compacted to at least the specified degree of compaction. Thinner lifts should be used for lighter compaction equipment. The backfill should not be flushed with water in an attempt to obtain compaction.

For utilities within the perimeters of the proposed structure, one of the following options can be implemented to further reduce the potential for water collecting in the utility trenches:

1. Use of flowable fill in place of granular bedding and pipe zone backfill around utility pipes. Provisions should be implemented during construction to keep the pipes from floating in the flowable fill until the flowable fill sets.

2. The bottom of the utility excavation should generally be sloped to drain to collection pipe (underdrain) in the bottom of the utility excavation at its downstream end. The collection pipe should then connect to an outlet, such as the proposed storm sewer system.

3. The granular bedding and pipe zone backfill should be capped with at least 1 foot of compacted clay backfill prior to the granular bedding and backfill collecting water. Additionally, concrete dams or anti-seepage collars should be provided where the utility crosses beneath the exterior footings of the proposed building. These dams or collars should extend at least 6 inches beyond the sides and bottoms of the utility tranches into the in-situ soils to stop water from migrating underneath the building. If groundwater seepage is observed in the utility excavations, this option should not be implemented, but rather one of the other two options.

Prior to placing the bedding and utilities within the utility trench, soft, saturated, and compressible material should be removed from the bottom of the trench to expose stiff soils or bedrock.

7.0 RECOMMENDED ADDITIONAL SERVICES

The conclusions and recommendations given in this report are based on: Geotechnology's understanding of the proposed design and construction, as outlined in this report; site observations; interpretation of the exploration data; and our experience. Since the intent of the

design recommendations is best understood by Geotechnology, we recommend that Geotechnology be included in the final design and construction process, and be retained to review the project plans and specifications to confirm that the recommendations given in this report have been correctly implemented. We recommend that Geotechnology be retained to participate in prebid and preconstruction conferences to reduce the risk of misinterpretation of the conclusions and recommendations in this report relative to the proposed construction of the subject project.

Since actual subsurface conditions between boring locations could vary from those encountered in the borings, our design recommendations are subject to adjustment in the field based on the subsurface conditions encountered during construction. Therefore, we recommend that Geotechnology be retained to provide construction observation services as a continuation of the design process to confirm the recommendations in this report and to revise them accordingly to accommodate differing subsurface conditions. Construction observation is intended to enhance compliance with project plans and specifications. It is not insurance, nor does it constitute a warranty or guarantee of any type. Regardless of construction observation, contractors, suppliers, and others are solely responsible for the quality of their work and for adhering to plans and specifications.

8.0 LIMITATIONS

This report has been prepared on behalf of, and for the exclusive use of, the client for specific application to the named project as described herein. If this report is provided to other parties, it should be provided in its entirety with all supplementary information. In addition, the client should make it clear that the information is provided for factual data only, and not as a warranty of subsurface conditions presented in this report.

Geotechnology has attempted to conduct the services reported herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions. The recommendations and conclusions contained in this report are professional opinions. The report is not a bidding document and should not be used for that purpose.

Our scope for this phase of the project did not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below or around this site. Any statements in this report or on the boring logs regarding odors noted or unusual or suspicious items or conditions observed are strictly for the information of our client. Our scope did not include an assessment of the effects of flooding and erosion of creeks or rivers adjacent to or on the project site.

Our scope did not include: any services to investigate or detect the presence of mold or any other biological contaminants (such as spores, fungus, bacteria, viruses, and the by-products of such organisms) on and around the site; or any services, designed or intended, to prevent or lower the risk of the occurrence of an infestation of mold or other biological contaminants.

The analyses, conclusions, and recommendations contained in this report are based on the data obtained from the geotechnical exploration. The field exploration methods used indicate subsurface conditions only at the specific locations where samples were obtained, only at the time they were obtained, and only to the depths penetrated. Consequently, subsurface conditions could vary gradually, abruptly, and/or nonlinearly between sample locations and/or intervals.

The conclusions or recommendations presented in this report should not be used without Geotechnology's review and assessment if the nature, design, or location of the facilities is changed, if there is a lapse in time between the submittal of this report and the start of work at the site, or if there is a substantial interruption or delay during work at the site. If changes are contemplated or delays occur, Geotechnology must be allowed to review them to assess their impact on the findings, conclusions, and/or design recommendations given in this report. Geotechnology will not be responsible for any claims, damages, or liability associated with any other party's interpretations of the subsurface data or with reuse of the subsurface data or engineering analyses in this report.

The recommendations included in this report have been based in part on assumptions about variations in site stratigraphy that can be evaluated further during earthwork and foundation construction. Geotechnology should be retained to perform construction observation and continue its geotechnical engineering service using observational methods. Geotechnology cannot assume liability for the adequacy of its recommendations when they are used in the field without Geotechnology being retained to observe construction.

APPENDIX A – IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL-ENGINEERING REPORT

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GEOTECHNICAL BUSINESS COUNCIL
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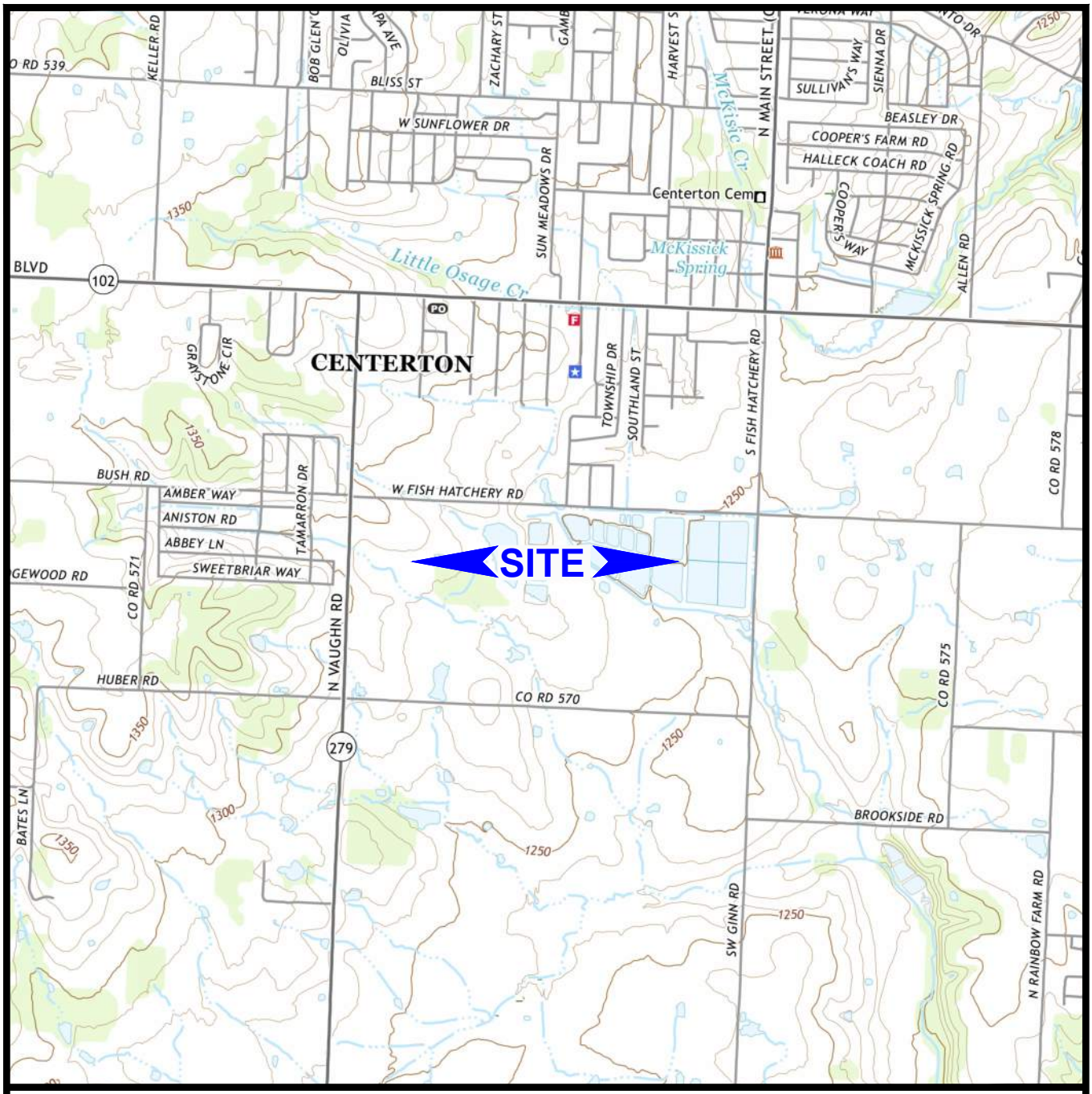
APPENDIX B – FIGURES

Figure 1 - Site Location and Topography

Figure 2 – Aerial Photograph of Site and Boring Locations



NOTES

1. Plan adapted from a 7.5 minute U.S.G.S. map for Centerton, Arkansas quadrangle, last revised in 2020.

0 2,000 4,000

SCALE IN FEET

Drawn By: WAH	Ck'd By: EJH	App'vd By: DBA
Date: 7-21-23	Date: 8-24-23	Date: 8-24-23

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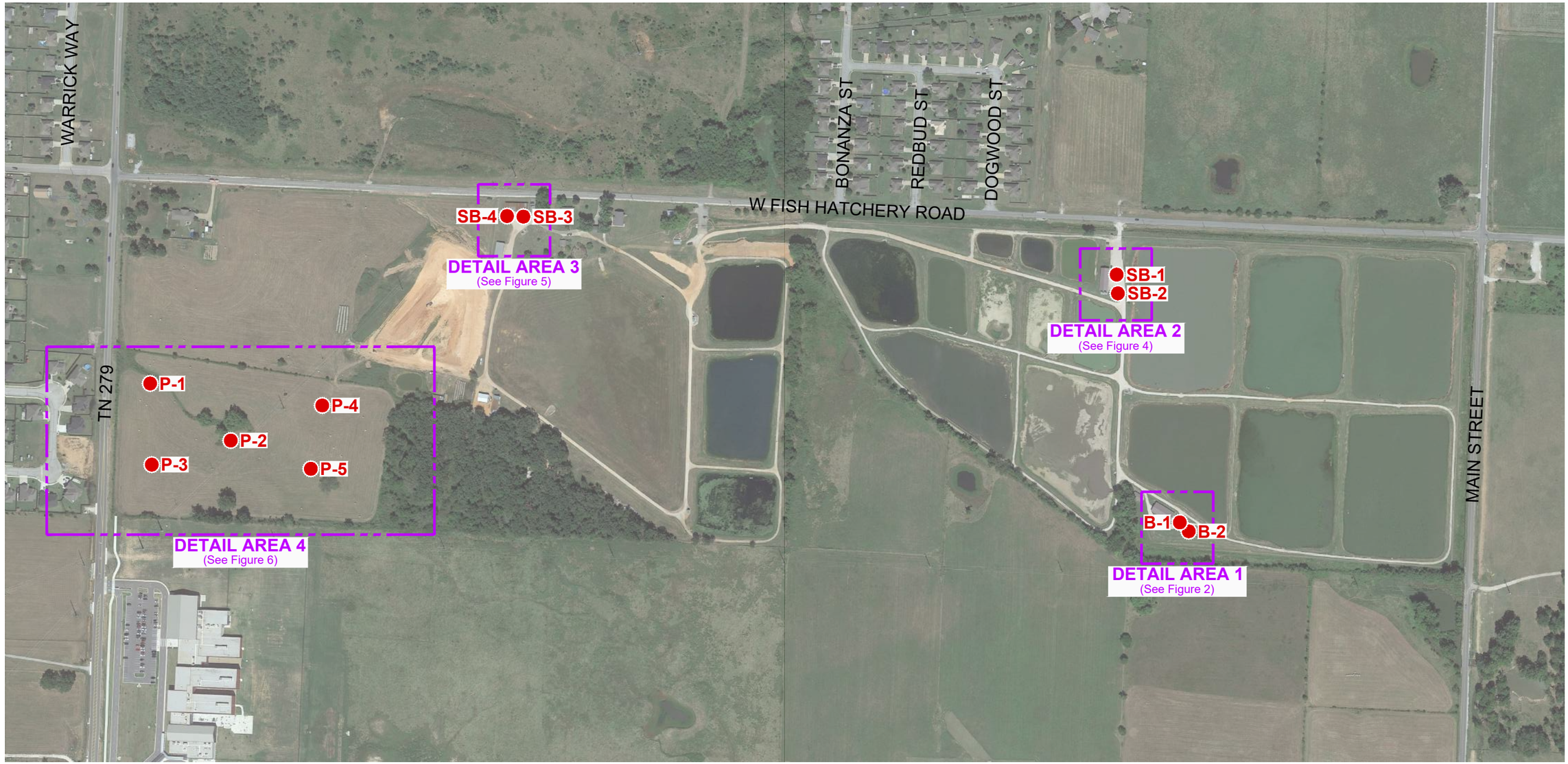
SITE LOCATION AND TOPOGRAPHY

Project Number	FIGURE 1
J043428.01	



NOTES

1. Plan adapted from a September 7, 2021 aerial photograph courtesy of Google Earth.
2. Borings were located in the field with reference to site features and are shown approximate only.

LEGEND

● Boring Location

0 200 400 800

SCALE IN FEET

N

Drawn By: WAH	Ck'd By: EJH	App'vd By: DBA
Date: 7-21-23	Date: 8-24-23	Date: 8-24-23

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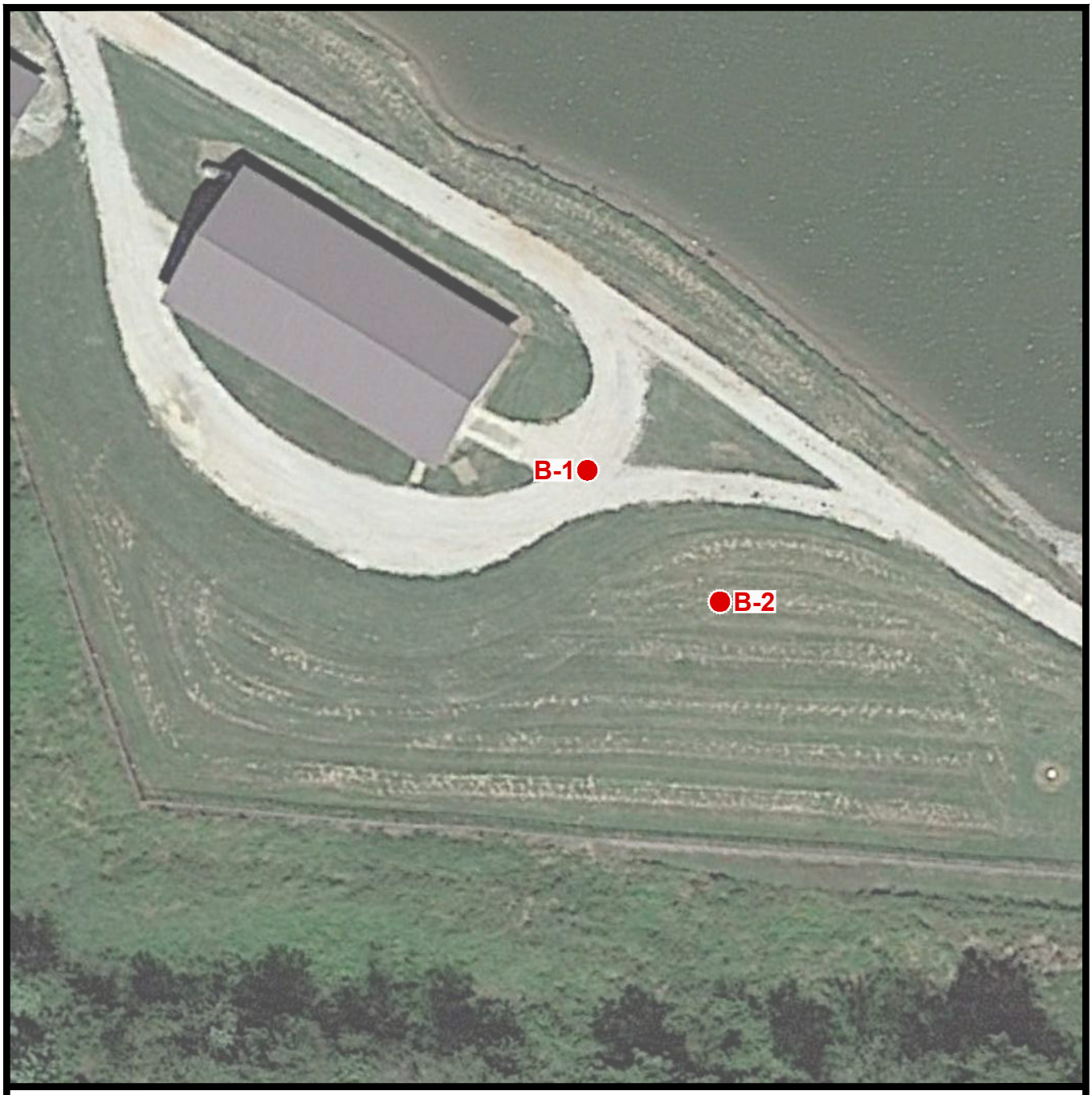
Bentonville, Arkansas

AERIAL PHOTOGRAPH OF SITE AND BORING LOCATIONS

Project Number J043428.01

FIGURE 2



NOTES

1. Plan adapted from a September 7, 2021 aerial photograph courtesy of Google Earth.
2. Borings were located in the field with reference to site features and are shown approximate only.
3. See Figure 2 for location of Detail Area.

LEGEND

● Boring Location

0 20 40 80

SCALE IN FEET

N

Drawn By: WAH	Ck'd By: EJH	App'vd By: DBA
Date: 7-21-23	Date: 8-24-23	Date: 8-24-23

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Bentonville, Arkansas

DETAIL AREA 1 AND BORING LOCATIONS

Project Number J043428.01	FIGURE 3

NOTES

1. Plan adapted from a September 7, 2021 aerial photograph courtesy of Google Earth.
2. Borings were located in the field with reference to site features and are shown approximate only.
3. See Figure 2 for location of Detail Area.

LEGEND

● Boring Location

0 20 40 80

SCALE IN FEET

N

Drawn By: WAH	Ck'd By: EJH	App'vd By: DBA
Date: 7-21-23	Date: 8-24-23	Date: 8-24-23

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Bentonville, Arkansas

DETAIL AREA 2 AND BORING LOCATIONS

Project Number J043428.01	FIGURE 4

NOTES

1. Plan adapted from a September 7, 2021 aerial photograph courtesy of Google Earth.
2. Borings were located in the field with reference to site features and are shown approximate only.
3. See Figure 2 for location of Detail Area.

LEGEND

● Boring Location

0 20 40 80

SCALE IN FEET

N

Drawn By: WAH	Ck'd By: EJH	App'vd By: DBA
Date: 7-21-23	Date: 8-24-23	Date: 8-24-23

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Bentonville, Arkansas

DETAIL AREA 3 AND BORING LOCATIONS

Project Number J043428.01	FIGURE 5

NOTES

1. Plan adapted from a September 7, 2021 aerial photograph courtesy of Google Earth.
2. Borings were located in the field with reference to site features and are shown approximate only.
3. See Figure 2 for location of Detail Area.

LEGEND

Boring Location

LEGEND

Boring Location

0 100 200

SCALE IN FEET

N

Drawn By: WAH	Ck'd By: EJH	App'vd By: DBA
Date: 8-23-23	Date: 8-24-23	Date: 8-24-23

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Bentonville, Arkansas

DETAIL AREA 4 AND BORING LOCATIONS

Project Number J043428.01

FIGURE 6

APPENDIX C – BORING INFORMATION

Boring Logs

Boring Log Terms and Symbols

Surface Elevation: N/A

Datum N/A

Completion Date: 7/18/23

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Topsoil: ~ 6 inches			
	FILL: gray clay, silt and gravel		7-6-3	SS1
	Soft, gray, LEAN CLAY with sand - CL			
	88.6% passing the No. 200 sieve.		0-2-2	SS2
5				
	Hard to stiff, brown and orange, sandy, LEAN CLAY with chert fragments - CL ▽		9-17-16	SS3
			15-11-9	SS4
10				
			7-8-7	SS5
15	Boring terminated at 15 feet.			

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 7 FEET ▽

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

CJ DRILLER DA LOGGER

Diedrich D-50 DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 93 %

REMARKS:

Drawn by: EJH	Checked by: EJH	App'vd. by: DBA
Date: 7/19/23	Date: 8/10/23	Date: 8/10/23

GEOTECHNOLOGY
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AGFC Charlie Craig Hatchery Improvement
Bentonville, Arkansas

LOG OF BORING: B-1

Project No. J043428.01

LOG OF BORING 2020.JDM J043428.1.GPJ GTINC 0638301.GPJ 8/24/23

Surface Elevation: N/A

Datum N/A

Completion Date: 7/18/23

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Topsoil: ~ 6 inches		
	Soft to very soft, brown, LEAN CLAY - (CL)	2-2-2	SS1
	with grass and rootlets		
		1-0-0	SS2
5		1-2-1	SS3
		7-13-20	SS4
	Dense to loose, brown and gray, CLAYEY SAND with chert fragments - SC		
	40.3% passing the No. 200 sieve.	16-20-25	SS5
10			
		3-5-1	SS6
15	Boring terminated at 15 feet.		

GRAPHIC LOG

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 13 FEET ▽

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

CJ DRILLER DA LOGGER

Diedrich D-50 DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 93 %

REMARKS: Boring offset 10' northeast due to utilities.

Drawn by: EJH	Checked by: EJH	App'vd. by: DBA
Date: 7/19/23	Date: 8/10/23	Date: 8/10/23

GEOTECHNOLOGY
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AGFC Charlie Craig Hatchery Improvement
Bentonville, Arkansas

LOG OF BORING: B-2

Project No. J043428.01

LOG OF BORING 2020.JDM J043428.1.GPJ GTINC 0638301.GPJ 8/24/23

Surface Elevation: N/A

Datum N/A

Completion Date: 7/19/23

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Topsoil: ~ 6 inches			
	Soft, brown, LEAN CLAY - CL		1-2-2	SS1
	with grass and rootlets			
	Stiff, brown, sandy, LEAN CLAY - CL		6-6-5	SS2
	some chert fragments			
	Stiff to hard, brown and orange, CLAYEY SAND with chert fragments - SC		6-14-17	SS3
5			13-7-6	SS4
	29.4% passing the No. 200 sieve.		5-7-17	SS5
10			50/2"	SS6
15	Boring terminated at 15 feet.			

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

S-2"

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

CJ DRILLER DA LOGGER

Diedrich D-50 DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 93 %

REMARKS:

Drawn by: EJH	Checked by: EJH	App'vd. by: DBA
Date: 7/19/23	Date: 8/10/23	Date: 8/10/23

GEOTECHNOLOGY
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Bentonville, Arkansas

LOG OF BORING: P-1

Project No. J043428.01

LOG OF BORING 2020.JDM J043428.1.GPJ GTINC.0638301.GPJ 8/24/23

Surface Elevation: N/A

Datum N/A

Completion Date: 7/19/23

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Topsoil: ~ 6 inches			
	Medium stiff, brown, LEAN CLAY - (CL)		1-2-3	SS1
	sandy		3-4-3	SS2
5	Hard to very stiff, brown and orange, sandy, LEAN CLAY with chert fragments - CL		15-14-12	SS3
	chert cobble/layer			SS4
10			7-16-14	SS5
			7-15-6	SS6
15				

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

CJ DRILLER DA LOGGER

Diedrich D-50 DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 93 %

REMARKS:

Drawn by: EJH	Checked by: EJH	App'vd. by: DBA
Date: 7/19/23	Date: 8/10/23	Date: 8/10/23

GEOTECHNOLOGY
A UES Company

AGFC Charlie Craig Hatchery Improvement
Bentonville, Arkansas

LOG OF BORING: P-2

Project No. J043428.01

LOG OF BORING 2020.JDM J043428.1.GPJ GTINC.0638301.GPJ 8/24/23

Surface Elevation: N/A

Datum N/A

Completion Date: 7/19/23

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Topsoil: ~ 6 inches			
	FILL: brown clay, silt and gravel		3-4-7	SS1
	Very stiff to hard, brown, tan and orange, sandy, LEAN CLAY with chert fragments - (CL)		7-11-10	SS2
5			8-17-12	SS3
	Dense to medium dense, tan and orange, CLAYEY SAND - SC 37.4% passing the No. 200 sieve.		0-8-28	SS4
			4-7-14	SS5
10				
			6-18-13	SS6
15	Boring terminated at 15 feet.			

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

CJ DRILLER DA LOGGER

Diedrich D-50 DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 93 %

REMARKS:

Drawn by: EJH	Checked by: EJH	App'vd. by: DBA
Date: 7/19/23	Date: 8/10/23	Date: 8/10/23

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Bentonville, Arkansas

LOG OF BORING: P-3

Project No. J043428.01

LOG OF BORING 2020.JDM J043428.1.GPJ GTINC.0638301.GPJ 8/24/23

Surface Elevation: N/A

Datum N/A

Completion Date: 7/19/23

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Topsoil: ~ 6 inches			
	Medium stiff, brown, silty, LEAN CLAY - CL		3-2-4	SS1
	Stiff to very stiff, brown and orange, FAT CLAY - CH		4-5-7	SS2
5	some sand		6-10-10	SS3
			7-10-9	SS4
	Hard, brown and orange, sandy, LEAN CLAY with chert fragments - CL		6-13-22	SS5
10			24-32-22	SS6
15	Boring terminated at 15 feet.			

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

CJ DRILLER DA LOGGER

Diedrich D-50 DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 93 %

REMARKS:

Drawn by: DBA	Checked by: EJH	App'vd. by: DBA
Date: 7/27/23	Date: 8/10/23	Date: 8/10/23

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Bentonville, Arkansas

LOG OF BORING: P-4

Project No. J043428.01

LOG OF BORING 2020.JDM J043428.1.GPJ GTINC.0638301.GPJ 8/24/23

Surface Elevation: N/A

Datum N/A

Completion Date: 7/19/23

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Topsoil: ~ 6 inches			
	Very stiff to medium stiff, brown and gray, LEAN CLAY - (CL)		2-2-1	SS1
			3-8-10	SS2
5			4-7-6	SS3
			4-5-8	SS4
			3-2-4	SS5
10				
	Very stiff, brown and orange, sandy, LEAN CLAY with chert fragments - CL		13-16-13	SS6
15	Boring terminated at 15 feet.			

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

CJ DRILLER DA LOGGER

Diedrich D-50 DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 93 %

REMARKS:

Drawn by: DBA	Checked by: EJH	App'vd. by: DBA
Date: 7/27/23	Date: 8/10/23	Date: 8/10/23

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LOG OF BORING: P-5

Project No. J043428.01

LOG OF BORING 2020.JDM J043428.1.GPJ GTINC.0638301.GPJ 8/24/23

Surface Elevation: N/A

Datum N/A

Completion Date: 7/18/23

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Gravel: ~12 inches		22-20-7	SS1
	Medium stiff, gray and brown, FAT CLAY - CH			
			3-4-3	SS2
5			2-2-3	SS3
			2-3-3	SS4
	Hard, brown, tan and orange, sandy, LEAN CLAY with chert fragments - CL			
10			13-28-22	SS5
			17-28-50	SS6
15	Boring terminated at 15 feet.			

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

78

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 8 FEET ▽

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

CJ DRILLER DA LOGGER

Diedrich D-50 DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 93 %

REMARKS:

Drawn by: EJH	Checked by: EJH	App'vd. by: DBA
Date: 7/19/23	Date: 8/10/23	Date: 8/10/23

GEOTECHNOLOGY
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AGFC Charlie Craig Hatchery Improvement
Bentonville, Arkansas

LOG OF BORING: SB-1

Project No. J043428.01

LOG OF BORING 2020.JDM J043428.1.GPJ GTINC 0638301.GPJ 8/24/23

Surface Elevation: N/A

Datum N/A

Completion Date: 7/18/23

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Gravel: ~12 inches		12-5-4	SS1
	Brown and gray, medium stiff to soft, LEAN CLAY - CL		2-4-3	SS2
5			0-1-1	SS3
			2-3-7	SS4
	Medium dense to very dense, brown and orange, CLAYEY SAND with chert fragments - SC 29.3% passing the No. 200 sieve.		13-14-9	SS5
10				
			50/2"	SS6
15	Boring terminated at 15 feet.			

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

S-2"

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 6 FEET ▽

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

CJ DRILLER DA LOGGER

Diedrich D-50 DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 93 %

REMARKS:

Drawn by: EJH	Checked by: EJH	App'vd. by: DBA
Date: 7/19/23	Date: 8/10/23	Date: 8/10/23

GEOTECHNOLOGY
A UES Company

AGFC Charlie Craig Hatchery Improvement
Bentonville, Arkansas

LOG OF BORING: SB-2

Project No. J043428.01

LOG OF BORING 2020.JDM J043428.1.GPJ GTINC 0638301.GPJ 8/24/23

Surface Elevation: N/A

Datum N/A

Completion Date: 7/18/23

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Gravel: ~12 inches		6-4-6	SS1
	Stiff to very stiff, brown, LEAN CLAY, some chert fragments - CL		5-6-12	SS2
5	Medium dense to dense, brown and red, CLAYEY SAND with chert fragments - SC		24-25-13	SS3
			34-17-14	SS4
10			34-24-17	SS5
			10-7-14	SS6
15	Boring terminated at 15 feet.			

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

CJ DRILLER DA LOGGER

Diedrich D-50 DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 93 %

REMARKS:

Drawn by: EJH	Checked by: EJH	App'vd. by: DBA
Date: 7/19/23	Date: 8/10/23	Date: 8/10/23

GEOTECHNOLOGY
A UES Company

AGFC Charlie Craig Hatchery Improvement
Bentonville, Arkansas

LOG OF BORING: SB-3

Project No. J043428.01

LOG OF BORING 2020.JDM J043428.1.GPJ GTINC 0638301.GPJ 8/24/23

Surface Elevation: N/A

Datum N/A

Completion Date: 7/18/23

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Gravel: ~ 4 inches			
	Stiff, brown, LEAN CLAY - CL		5-6-7	SS1
	some chert fragments			
	Hard to stiff, brown and orange, sandy, FAT CLAY with chert fragments - (CH)		26-16-15	SS2
5			19-12-14	SS3
			15-23-24	SS4
			7-17-16	SS5
10				
			7-6-11	SS6
15	Boring terminated at 15 feet.			

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL ● LL

10 20 30 40 50

74 >>

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

CJ DRILLER DA LOGGER

Diedrich D-50 DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 93 %

REMARKS:

Drawn by: EJH	Checked by: EJH	App'vd. by: DBA
Date: 7/19/23	Date: 8/10/23	Date: 8/10/23

GEOTECHNOLOGY
A UES Company

AGFC Charlie Craig Hatchery Improvement
Bentonville, Arkansas

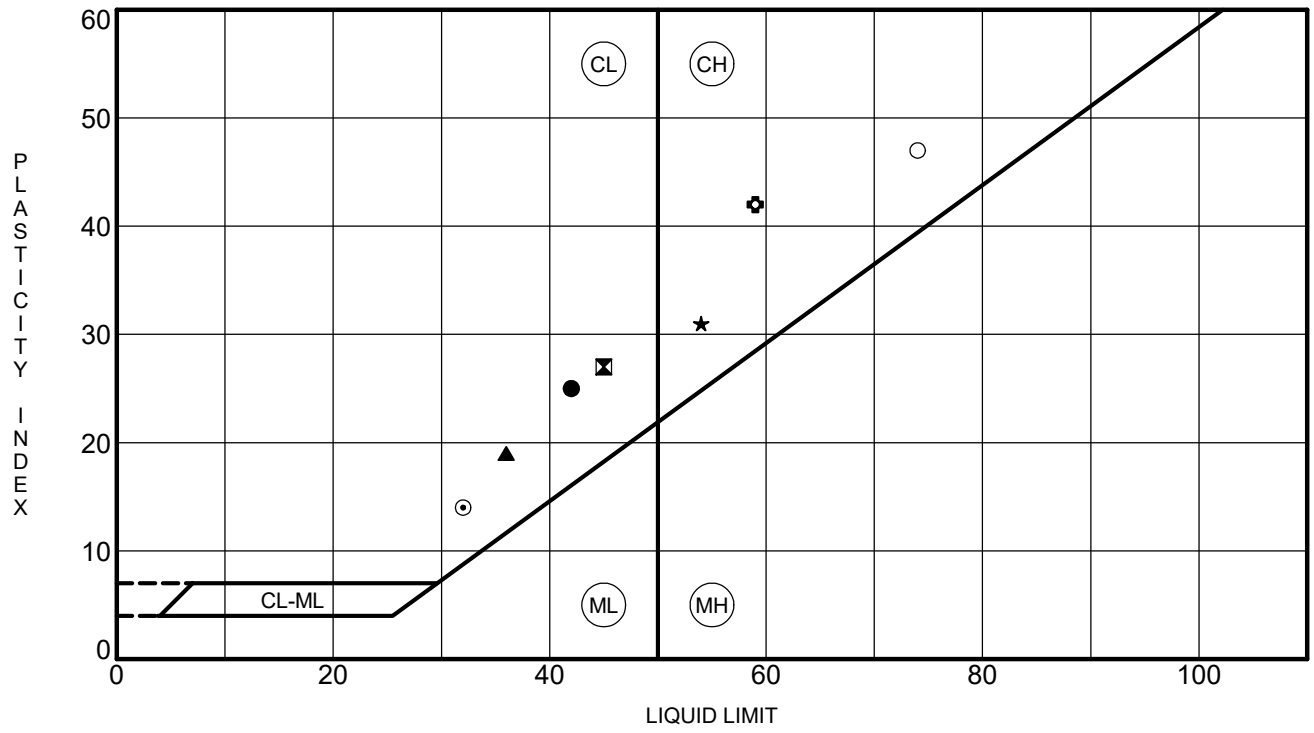
LOG OF BORING: SB-4

Project No. J043428.01

LOG OF BORING 2020.JDM J043428.1.GPJ GTINC.0638301.GPJ 8/24/23

APPENDIX D – LABORATORY TEST DATA

Atterberg Limits



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**B-2**	**2.0**	**42**	**17**	**25**		**LEAN CLAY(CL)**
⊠	**P-2**	**2.0**	**45**	**18**	**27**		**LEAN CLAY(CL)**
▲	**P-3**	**2.0**	**36**	**17**	**19**		**LEAN CLAY(CL)**
★	**P-4**	**4.0**	**54**	**23**	**31**		**FAT CLAY(CH)**
⊙	**P-5**	**2.0**	**32**	**18**	**14**		**LEAN CLAY(CL)**
✿	**SB-1**	**4.0**	**59**	**17**	**42**		**FAT CLAY(CH)**
○	**SB-4**	**2.0**	**74**	**27**	**47**		**FAT CLAY(CH)**

GEOTECHNOLOGY
A UES Company

ATTERBERG LIMITS RESULTS

AGFC Charlie Craig Hatchery Improvement
Bentonville, Arkansas
J043428.01

SECTION 02 20 0

PREPARATORY AND RESTORATION WORK

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. In accordance with the requirements as hereinafter stated, the Contractor shall (1) clear and grub all designated areas, (2) remove all structures and obstructions interfering with the work or designated to be removed, (3) dispose of all unsuitable and excess materials, debris and vegetation, and (4) slope, grade and restore all areas disturbed during the performance of the work, and (5) coordinate with all proper utility owners the adjustment of any existing above ground or below ground utility.

B. The Contractor shall also remove and restore all permanent type pavements, sidewalks, driveways, curbs, gutters, landscape vegetation, fences, poles and other property and surface structures conflicting with the installation of scheduled improvements.

1.02 RELATED WORK

A. Section 31 20 00: Site Grading and Filling

B. Section 31 23 23: Trenching, Backfilling and Compacting

C. Section 33 30 00: Sewerage Systems

1.03 PRECAUTIONS

A. Protection of Property: The Contractor shall be responsible for the preservation from injury and damage and protection of all public and private property within the limits of or adjacent to the Work.

B. Use every precaution to prevent the damage or destruction of buildings, poles, trees, shrubs, and lawns; also all overhead lines, wires, cables and all other structures which are to remain in place.

C. Protect and carefully preserve all official survey monuments, property

corners and elevation benchmarks, especially those that are intended for use in the horizontal and vertical control for this work. If any of these monuments, property corners or benchmarks are disbursed during construction, the Contractor shall be responsible for their replacement at no additional cost to the Owner or Owner's Representative.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.01 CLEARING AND GRUBBING

3.01.1 SCOPE

Clearing and grubbing shall consist of the removal and disposal of all trees and stumps (except those designated to remain in place outside of the construction limits), roots, vegetation, rubbish of any other waste material and debris within the limits of rights-of-way, easements and borrow pit areas. When not covered by specific Bid Items in the Proposal, this item shall also include the complete removal and disposal of all structures and obstructions and old installations (above or below the surface of the ground) which interfere with the proposed construction, obstruct clear vision or is otherwise considered objectionable. All clearing and grubbing operations shall be in accordance with these Specifications and shall be for the areas indicated on the Plans or as required by the Owner's Representative.

The Work shall also include the preservation from injury or defacement of all vegetation, objects or material(s) designated to be salvaged or to remain and shall include removal and proper disposal of obstructions and salvageable material encountered, when such removal and disposal is not otherwise provided in the Contract. The requirements for such removal and disposal shall be in accordance with the provisions and requirements of this Section.

3.01.2 CONSTRUCTION REQUIREMENTS

A. Clearing: The term "clearing" shall mean the felling, cutting up and

disposal of trees, stumps, down timber, snags, brush and other vegetation within the construction limits of the Contract.

The trees to be cleared shall be cut off as close as practicable to ground elevation on the high side. Trees located in creek channels or sloughs may be cut off at a higher elevation if, in the Engineer's opinion, the remaining stumps would not be objectionable.

Branches of trees extending over traffic lanes should be trimmed to give a clear height of eighteen feet (18') above the street. Limbs shall be cut closely to trunk with sharp saws in accordance with good tree surgery practice. The saw cuts and scars on trees caused by the Contractor's operations shall be shaped to facilitate healing and thoroughly painted with a bituminous base tree paint.

B. Grubbing: All tree stumps and roots within the construction limits shall be grubbed out, hauled and disposed of. Stumps which will be buried three feet (3') or more by a fill or roadway embankment may be allowed to remain. Old decayed stumps, logs and snags shall be grubbed out and removed regardless of fill cover. Holes left from grubbing stumps in embankment areas shall be backfilled and compacted prior to beginning grading operations.

C. Disposal of Material and Debris: Unless otherwise stipulated on the Plans and in the Specifications, the residue material resulting from the clearing and grubbing operations shall be hauled off the site of the work and disposed of by burning (as may be allowed by local ordinances) and/or burying in the disposal areas furnished by the Contractor.

In no case will burning or burying of refuse material be permitted "on site" when the work is located on established streets or in built-up areas. In specific instances where the work is on new location in isolated areas remote from any development or improvements, the Owner’s Representative may allow burning of debris for the particular Contract. Disposal by burning or burial shall be in accordance with the requirements set forth below.

D. Burning: Perishable materials shall be hauled off and may be burned or buried but only at locations approved by the Owner’s Representative and through the use of methods and procedures that will prevent damage to existing structures and adjacent properties.

When burning is permitted under the circumstances outlined above and with permission of the local fire marshal, the Contractor shall take every reasonable safeguard to prevent any damage to public or private property. The Contractor shall notify the local fire fighting unit in advance of starting burn operations and shall furnish and maintain adequate fire fighting equipment and personnel at the site for compliance with all State and Federal laws and regulations relative to the building of fires.

E. Burying: Under the foregoing conditions, when offsite burying is permitted by the Owner's Representative, the materials buried shall consist only of inert materials such as old concrete, stone, rubble and other materials which can not be burned. In burying inert materials, a hole shall be excavated in the ground, the material placed in the hole and covered with a level backfill of not less than three feet (3') of compacted earth. In no case shall materials be buried in a natural drain or by piling the material and covering it with an earth mound. In addition, no materials shall be buried within the limits of a permanent sanitary, storm or other utility easement.

3.02 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

3.02.1 SCOPE

Removal of structures and obstructions shall consist of the removal and satisfactory disposal of all buildings, fences, structures, old pavements, abandoned pipe lines and any other obstructions which are not designated or permitted to remain, except for the obstructions to be removed and disposed of under other items in the Contract as directed. It shall also include the salvaging of designated materials and backfilling the resulting trenches, holes and pits. When the Proposal does not include Pay Items for removal of structures and obstructions as set forth in this Section, the cost of such work shall be included in prices bid on other construction items.

3.02.2 CONSTRUCTION REQUIREMENTS

A. Removal of Pipe: Pipe removed may be any size or type. All pipe lines shall be carefully removed and every reasonable precaution taken to avoid breaking or damaging any pipe. Pipes designated to be relaid shall be removed, handled and stored when necessary so that there will be no loss or damage before relaying; the Contractor shall replace,

without extra compensation, such sections lost from storage or damaged by negligence or improper methods to the extent its reuse is deemed by the Owner's Representative to be unsatisfactory.

3.03 REMOVAL AND RESTORATION OF IMPROVED SURFACES

3.03.1 SCOPE

The requirements set forth in the Section govern the removal and restoration of all permanent type pavements, sidewalks, driveways, curbs, gutters, landscape vegetation, fences, poles and other property and surface structures conflicting with the installation of scheduled improvements under this Contract.

All improved surface disturbed during or as a result of construction operations shall be restored to a condition which is equal in appearance and quality to the condition that existed before the work begun.

The surface of all improvements shall be constructed of the same material and match in appearance the surface of the improvement which is removed.

When select material is used to backfill trenches or other excavations, the restoration shall be made as soon as possible after compaction of the backfill has been completed.

3.03.2 CONSTRUCTION REQUIREMENTS

A. Removal of Permanent Surfaces: Whenever a gravity flow or pressure flow pipeline is to be located along or across an improved surface, the width of the trench shall be held as nearly as possible to the maximum specified for the applicable condition as specified in Section 02221. Where brick or concrete pavement, or curbing is cut, the width of the cut shall exceed the actual width of the top of the trench by twelve inches (12") on each side or a total of two feet (2'). Exposed surfaces of Portland cement or asphaltic concrete shall be cut with a pavement saw before breaking. Care shall be taken in cutting to ensure that a straight joint is sawed. Whenever a gravity flow or pressure flow pipeline is to be located along or across brick or concrete driveways or sidewalks, the width of cut shall be to the nearest existing expansion or construction joint of the permanent surface affected.

B. Removal of Landscape Vegetation: Developed areas, yards, lawns,

shrubbery and other decorative plantings that must be removed shall be stored and growth maintained by watering and fertilizing. The work shall be accomplished in accordance with prevailing local nursery practices with consideration given to seasonal limitations.

C. Temporary Surfacing Over Trenches: Whenever a pipeline is installed under traveled roadways, driveways, sidewalks or other traveled surface, temporary surface shall be placed over the top of the trench as soon as possible after placement and compaction of the backfill has been satisfactorily completed. The temporary surface shall consist of a minimum of six inches (6") of crushed limestone (CR 610). The top of the temporary surface shall be smooth and meet the grade of the adjacent undisturbed surface. The temporary surface shall be maintained at the Contractor's expense until final restoration of the street surface is completed as specified. No permanent restoration of street surface shall be initiated until authorized by the Engineer. The temporary surfacing shall be required over the entire width of the trench. The placement and removal of this temporary surface prior to the reconstruction of the permanent base and surface treatment will be considered incidental to the construction and no separate payment will be made.

D. Replacement of Pavements

Bituminous Concrete Pavement Surface - Rigid Base: Where the existing pavement surface is bituminous concrete and the base consists of a rigid material such as bituminous base course, brick, Portland cement concrete, soil cement, natural cement or a combination of these materials, the base replacement shall consist of ten inches (10") Portland cement concrete base course placed over a suitably prepared backfill in accordance with Section 02221. The Portland cement concrete base shall conform with the applicable provisions of these Specifications and shall have a compressive strength of three thousand pounds per square inch (3,000 psi) at twenty-eight (28) days. The surface replacement shall consist of a bituminous prime coat and a two inch (2") minimum thickness bituminous surface course.

Bituminous Plant Mix Pavement or Bituminous Treated Surface - Flexible Base: Where the existing pavement is bituminous plant mix material or bituminous surface treatment and the base consists of a flexible material such as gravel or crushed stone, the base replacement shall consist of compacted crushed limestone (CR 610) placed over the

suitably prepared pipe and bedding.

NOTE: For Bituminous Plant Mix or Bituminous Treated Surfaces placed over a trench backfilled with flowable concrete fill, only a two inch (2") compacted thickness shall be used.

The surface replacement shall consist of a bituminous prime coat, 2-inch thick asphalt base followed by a one inch surface mix.

Optional Bituminous Surface Course: If specified in these documents or as shown on the Plans, the Contractor shall fill the upper trench cavity with ten inches (10") of Portland cement concrete or bituminous cement base to meet the grade of the undisturbed surface. A bituminous surface plant mix with bituminous prime coat shall then be placed to the compacted thickness and width specified on the Plans. The material and construction requirements of the surface course shall also be in compliance with the applicable provisions of these Specifications.

Replacement of Concrete Walks, Driveways and Curbs: Where necessary to remove and replace concrete sidewalks, driveways, curbs and curb and gutters, replacements shall be made as follows:

Concrete sidewalks, driveways, curbs and curb and gutters shall be replaced with concrete meeting the applicable provisions of these Specifications. They shall have a compressive strength of not less than four thousand pounds per square inch (4,000 psi) at twenty-eight (28) days. Minimum thickness shall be four inches (4") for sidewalks and six inches (6") for driveways. All concrete driveways and sidewalks shall be reinforced with 6:6 x 10:10 WWM.

In the replacement of concrete sidewalks and driveways, the Contractor shall replace those portions damaged or disturbed during construction up to the nearest existing expansion or construction joint.

Curb or curb and gutter dimensions and cross-sections shall conform (as nearly as practicable) with the existing installations. One-half inch (1/2") preformed expansion joints shall be placed at intervals not exceeding thirty feet (30') and at the junctions with existing work. Sidewalks shall be finished to match existing adjacent sidewalks surfaces, unless otherwise specified or directed by the Owner's Representative.

E. Restoration of Landscaped Areas: All sod, shrubbery, decorative plantings and other landscape items shall be replanted, replaced or restored in the manner removed.

Should new construction be required to replace damaged or unsalvageable items, the Contractor shall furnish all labor, materials, equipment, tools and incidentals set forth in the applicable Sections of these Specifications governing such items of work.

END OF SECTION

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SECTION 03 10 00

CONCRETE FORMWORK

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 20 00: Concrete Reinforcement

B. Section 03 30 00: Cast-In-Place Concrete

1.02 QUALITY ASSURANCE

A. Design, construct and erect formwork per ACI 347, Recommended Practice for Concrete Formwork.

1.03 ALLOWABLE TOLERANCES

A. In accordance with ACI 301; Tolerances for Formed Surfaces.

1.04 REFERENCES

A. The following references shall be obtained by the Contractor and maintained at the job site in a readable condition:

1. ACI 347, Recommended Practice for Concrete Formwork.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concealed concrete: No. 2 Common Southern Pine, 545

B. Exposed concrete: B-B Plyform, Class I or II, EXT-APA, Metal or fiberglass forms may be used.

C. Construction joint forms: Key-type steel formers, Vulcan Screed Joints, Burke Keyed Kold Joint Form or equal.

D. Form coating: Non-staining mineral oil.

E. Form ties: Snap-off type which will break off at least 1/2" below surface of concrete. For sanitary structures, the form times shall be of the "snap tie type", which can be removed to at least 1" below the surface leaving an opening no larger than the tie diameter, with or without cones. Wall ties for structures containing liquid shall have integral water stops.

G. Expansion joint filler: Asphalt impregnated, pre-molded fiberboard by full thickness of slab or joint. ASTM D 994.

2.02 EARTH FORMS

A. Where soil is firm enough to permit cutting to true size, concrete may be placed without forms.

PART 3 - EXECUTION

3.01 ERECTING

A. Erect forms to obtain shapes, designs and dimensions indicated. Make forms sufficiently tight to prevent leakage. Brace, shore and tie forms together to maintain position without sagging or bulging.

B. Provide 3/4" chamfering at exposed corners.

C. Prepare insides of forms so that concrete will have a smooth, uniform finish, free from fins, stone pockets, voids and other surface defects.

D. Provide construction joint forms where concrete placement terminates at the end of a day or because of other reasons.

E. Provide bulkheads, with reinforcing steel penetrating bulkheads, where concrete placement stops at end of day or for other reasons.

F. Where soil conditions are such that concrete cannot be placed without forms, and where other conditions cause trenches to be opened wider than footing or slab widths, erect forms for footing or slabs.

G. Install items furnished by others for installation in concrete. Use templates to locate anchor bolts and other critical items.

3.02 PREPARING

A. Prepare insides of forms so that concrete will have a smooth, uniform finish free of surface defects.

B. Coat forms before reinforcement steel is placed. Where mill-oiled forming material is used, follow manufacturer's instructions for recoating. Where forming material is not mill-oiled, coat forms before each use.

C. Before reusing forms, thoroughly clean them and remove projecting nails or similar devices.

3.03 FORM REMOVAL

A. Remove forms in such manner and such time as to insure safety of structure and to avoid chipping and spalling of concrete. In no case shall forms be removed before limits set forth in the Commentary to ACI 318.

END OF SECTION

SECTION 03 15 00

EXPANSION, CONSTRUCTION, AND CONTROL JOINTS

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

1. Section 03 10 00: Concrete Formwork

2. Section 03 30 00: Cast-In-Place Concrete

1.02 SUBMITTALS

1. Submit warranty from supplier stating that materials meet requirements referenced herein.

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

1. Deliver materials to project site marked for easy identification.

2. Handle and store materials to prevent contamination.

PART 2 - PRODUCTS

2.01 BOND BREAKERS

A. Tape for Expansion Joints: Adhesive-backed glazed butyl or polyethylene tape, same width as the joint, that will adhere to the premolded joint material or concrete surface.

B. Use either bond breaker tape or a bond prevention material, nonstaining type, as specified in Section 03300, CAST-IN-PLACE CONCRETE, except where a tape is specifically called for.

2.02 PREMOLDED JOINT FILLER

A. Sponge Rubber: Neoprene, closed-cell, expanded; ASTM D1056-91, Type 2C5, with a compression deflection, 25 percent deflection (limits), 119 to 168 kPa (17 to 24 psi) minimum; Rubatex Corp., R451N.

2.03 ACCESSORIES

A. Non-Shrink Grout: Firmix (metallic) or Euco NS (non-metallic) and Masterflow 713 (non-metallic) by Mater Builders. The grout shall conform to CRD-C-621-80, "Corps of Engineers Specifications for Non-Shrink Grout."

B. Reinforcing Steel: As specified in Section 03200, REINFORCING STEEL.

C. Masking Tape: As required to temporarily adhere to concrete at each side of joint to receive filler.

D. Waterstops

1. Waterstops at joints shall be Greenstreak Plastic Products, Division of Wester Textile Products Company, P. O. Box 7139, St. Louis, Missouri 63177, #784 or Vinylex Corporation, 2636 Bylington-Solway Road, Knoxville, Tennessee 37921, #RB6-12, or equal. Waterstops shall be at least 2" thick at their center and 6" or 9" wide as noted on the plans. Contractor shall follow manufacturer's direction for installation.

2. Between new and old construction waterstops shall be combination of 2" and Vinylex Bluestop by Vinylex, Knoxville, Tennessee.

PART 3 - EXECUTION

3.01 GENERAL

A. Locate joints as shown.

B. Construct straight joints; make vertical or horizontal, except where walls intersect sloping floors.

C. Commence concrete placement after the joint preparation is complete.

3.02 SURFACE PREPARATION

A. Construction Joints: Prior to placement of abutting concrete, clean contact surface:

1. Remove laitance and spillage from reinforcing steel and dowels.
2. Roughen surface to a minimum of 3" amplitude:
    a. Sandblast after the concrete has fully cured.
    b. Water blast after the concrete has partially cured.
    c. Green cut fresh concrete with high pressure water and hand tools.

3.03 INSTALLATION

A. Secure premolded joint filler to form and/or adjacent concrete with galvanized nails and/or construction adhesive.

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. ACI 301 - Specifications for Structural Concrete; 2016.

B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018).

C. ACI SP-66 - ACI Detailing Manual; 2004.

D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2020.

E. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement; 2016.

F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2018a.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.

C. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
   1. Deformed billet-steel bars.
   2. Unfinished.

B. Reinforcing Steel: Deformed bars, ASTM A996/A996M Grade 40 (280), Type A.

C. Steel Welded Wire Reinforcement (WWR): Plain type; ASTM A1064/A1064M.
   1. Form: Flat Sheets.
   2. WWR Style: As indicated on drawings.

D. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
   3. Provide stainless steel components for placement within 1-1/2 inches of weathering surfaces.

2.02 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

B. Welding of reinforcement is not permitted.

PART 3 EXECUTION

3.01 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Do not displace or damage vapor barrier.

C. Accommodate placement of formed openings.

D. Comply with applicable code for concrete cover over reinforcement.

3.02 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 01 40 00 - Quality Requirements, will inspect installed reinforcement for compliance with contract documents before concrete placement.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete formwork.

B. Floors and slabs on grade.

C. Concrete foundations and anchor bolts for pre-engineered building.

D. Joint devices associated with concrete work.

E. Concrete curing.

1.02 RELATED REQUIREMENTS

A. Section 03 20 00 - Concrete Reinforcing.

B. Section 03 35 11 - Concrete Floor Finishes: Densifiers, hardeners, applied coatings, and polishing.

C. Section 07 92 00 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

1.03 REFERENCE STANDARDS

A. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).

C. ACI 301 - Specifications for Structural Concrete; 2016.

D. ACI 302.1R - Guide to Concrete Floor and Slab Construction; 2015.

E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).

F. ACI 308R - Guide to External Curing of Concrete; 2016.

G. ACI 347R - Guide to Formwork for Concrete; 2014, with Errata (2017).

H. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.

I. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2021.

J. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2020b.

K. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2016.

L. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2016.

M. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

N. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019.

O. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2019.

P. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2021.

Q. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2017.

R. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.

S. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting; 2015.

T. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2018a.

U. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017.

V. NSF 61 - Drinking Water System Components - Health Effects; 2020.

W. NSF 372 - Drinking Water System Components - Lead Content; 2020.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

C. Mix Design: Submit proposed concrete mix design.

D. Test Reports: Submit report for each test or series of tests specified.

PART 2 PRODUCTS

2.01 FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.

B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
   1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
   2. Earth Cuts: Do not use earth cuts as forms for vertical surfaces. Natural rock formations that maintain a stable vertical edge may be used as side forms.
   3. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
   4. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.

2.02 REINFORCEMENT MATERIALS

A. Comply with requirements of Section 03 20 00.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
   1. Acquire cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C33/C33M.
   1. Acquire aggregates for entire project from same source.

C. Fly Ash: ASTM C618, Class C or F.

D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C260/C260M.

C. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.

D. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

E. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.

F. Water Reducing Admixture: ASTM C494/C494M Type A.

2.05 ACCESSORY MATERIALS

A. Underslab Vapor Retarder:
   1. Sheet Material: ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single ply polyethylene is prohibited. 15 mil thickness.
   2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.

B. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. Grout: Comply with ASTM C1107/C1107M.
   2. Minimum Compressive Strength at 28 Days, ASTM C109/C109M: 7,000 pounds per square inch.

2.06 BONDING AND JOINTING PRODUCTS

A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.

B. Waterstops: Bentonite and butyl rubber, complying with NSF 61 and NSF 372.
   1. Configuration: As indicated on drawings.
   2. Size: As indicated on drawings or standard size.

C. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.

2.07 CURING MATERIALS

A. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.

B. Curing Agent, Water-Cure Equivalent Type: Clear, water-based, non-film-forming, liquid-water cure replacement agent.
   1. Compressive Strength of Treated Concrete: Equal to or greater than strength after 28-day water cure when tested according to ASTM C39/C39M.

C. Moisture-Retaining Sheet: ASTM C171.
   1. Curing paper, regular.
   2. Polyethylene film, white opaque, minimum nominal thickness of 4 mil, 0.004 inch.
   3. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard.

D. Polyethylene Film: ASTM D2103, 4 mil, 0.004 inch thick, clear.

E. Water: Potable, not detrimental to concrete.

2.08 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

B. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

C. Normal Weight Concrete:
   1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3500 pounds per square inch.

2. Fly Ash Content: Maximum 20 percent of cementitious materials by weight.
3. Cement Content: Minimum ___ pounds per cubic yard.
4. Water-Cement Ratio: Maximum 46 percent by weight.
5. Total Air Content: 5 percent, determined in accordance with ASTM C173/C173M.
6. Maximum Slump: 5 inches.
7. Maximum Aggregate Size: ___ inch.

2.09 MIXING

A. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 PREPARATION

A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.

B. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

C. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
   1. Use latex bonding agent only for non-load-bearing applications.

D. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.02 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Place concrete for floor slabs in accordance with ACI 302.1R.

C. Notify Architect not less than 24 hours prior to commencement of placement operations.

D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

E. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

F. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.03 SLAB JOINTING

A. Locate joints as indicated on drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

3.04 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Maximum Variation of Surface Flatness:
   1. Exposed Concrete Floors: 1/4 inch in 10 feet.

2. Under Seamless Resilient Flooring: 1/4 inch in 10 feet.
3. Under Carpeting: 1/4 inch in 10 feet.

B. Correct the slab surface if tolerances are less than specified.

C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.05 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:

C. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
1. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

3.06 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Surfaces Not in Contact with Forms:
1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
2. Final Curing: Begin after initial curing but before surface is dry.

3.07 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

3.08 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

END OF SECTION

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SECTION 03 35 11
CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface treatments for concrete floors and slabs.

B. Clear coatings.

C. Clear penetrating sealers.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with concrete floor placement and concrete floor curing.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.

C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

D. Warranty Documentation: Manufacturer warranty; ensure that forms have been completed in Owner's name and registered with manufacturer.

E. Manufacturer's Installation Instructions.

1.05 QUALITY ASSURANCE

A. Installer with a minimum of 5 years experience in performing work of this Section who has specialized in insallation of work similar to that required for this project.

B. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.

C. Preinstallation Meetings: Conduct a preinstallation meeting to verify project requirements, manufacturer’s installation instructions and manufacturer’s warranty requirements. Review the following:
   1. Environmental requirements.
   2. Scheduling and phasing of work.
   3. Coordinating with other work and personnel. Remind all trades that they are working on a surface that is to become a finished surface.
   4. Protection of adjacent surfaces.
   5. Surface preparation.
   6. Repair of defects and defective work prior to installation.
   7. Cleaning.
   8. Installation of polished floor finishes.
   9. Application of liquid hardener, densifier.
   10. Protection of finished surfaces after installation.
   11. Do not place any materials on the concrete surface that may cause staining, etching or scratching.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

B. Protect Concrete Slab:
   1. Protect from petroleum stains during construction.

2. Diaper hydraulic power equipment.
3. Restrict vehicular parking.
4. Restrict use of pipe cutting machinery.
5. Restrict placement of reinforcing steel and storage of other ferrous metals on concrete surfaces.
6. Restrict use of acids or acidic detergents on concrete surfaces.
7. Restrict painting activities over concrete surfaces.

1.07 FIELD CONDITIONS

A. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.

B. Do not finish floors until interior heating system is operational.

C. Maintain ambient temperature of 50 degrees F minimum.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a two-year period commencing on the Date of Substantial Completion.

C. Finish Warranty: Provide five-year manufacturer warranty against excessive degradation of finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 CONCRETE FLOOR FINISH APPLICATIONS

A. Unless otherwise indicated, all concrete floors are to be finished using liquid densifier/hardener.

B. Penetrating Clear Sealer:
1. Use at following locations: throughout.

2.02 SURFACE TREATMENTS

A. Surface cutting aids, concrete repair materials, and pre-densifier concrete cleaners as recommended by floor finish manufacturer. Comply with national, state and district VOC regulations and regulations of these specifications.

2.03 DENSIFIERS AND HARDENERS

A. Liquid Densifier and Hardener: Penetrating chemical compound that reacts with concrete, filling the pores and dustproofing; for application to concrete after set.
1. Composition: Lithium silicate.
2. Products:
   a. ARDEX Engineered Cements; ARDEX PC-50: www.ardexamericas.com/#sle.
   b. Kaufman Products Inc; SureHard LS: www.kaufmanproducts.net/#sle.
   c. PROSOCO, Inc; Consolideck LS/CS: www.prosoco.com/consolideck/#sle.
   d. PROSOCO, Inc; Consolideck LS: www.prosoco.com/consolideck/#sle.
   e. PROSOCO, Inc; ColorHard used with Consolideck LS or LS/CS: www.prosoco.com/consolideck/#sle.
   f. SpecChem, LLC; LithSeal SC: www.specchemllc.com/#sle.
   g. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 COATINGS

A. High Gloss Clear Coating: Transparent, non-yellowing, water- or solvent-based coating.
1. Coating must be compatible with Densifier / Hardener.
2. Composition: Acrylic polymer-based.
3. Nonvolatile Content: 15 percent, minimum, when measured by volume.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this section.

B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

C. Do not begin installation until unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.02 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

3.03 COATING APPLICATION AND PREPARATION

A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.

B. Clean dirt, dust, oil, grease and other contaminants that interfere with penetration or performance of specified product from surfaces. Use appropriate concrete cleaners approved by the concrete surface treatment manufacturer where necessary. Rinse thoroughly using pressure water spray to remove cleaner residues. Allow surfaces to dry completely before application of product.

C. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.

D. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material. If product is accidentally misapplied to adjacent surfaces, flush with water immediately before material dries.

E. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

F. Repair, patch and fill cracks, voids, defects and damaged areas in surface as approved by the Architect. Allow repair materials to cure completely before application of product.

G. Variations in substrate texture and color will affect final appearance and should be corrected prior to application of sealer/hardener system and the polishing steps.

H. Avoid contact in areas not to be treated. Avoid contact with metal, glass and painted surfaces.

I. Seal open joints in accordance with Section 07 90 00.

J. Apply specified sealants and caulking and allow complete curing before application of penetrating concrete hardener/densifier.

K. Do not proceed until unsatisfactory conditions have been corrected.

END OF SECTION

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SECTION 03 40 00

PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 10 00: Concrete Formwork

B. Section 03 20 00: Concrete Reinforcement

C. Section 03 30 00: Cast-In-Place Concrete

1.02 SCOPE OF WORK

A. This specification section and the related sections shall cover the Precast Concrete Aerator and Walkway Support Bents. The intent of this specification is to allow for casting all bents at a precast plant facility and transporting to the site for erection and installation by the Contractor. The Contractor has the option of precasting the bents onsite for transport to their final location, erection, and installation. In either case, the casting, transport, erection, and installation of the structural precast shall not interfere with the ongoing and daily operation of the wastewater treatment plant.

B. If the Contractor elects to utilize a precast plant facility, the fabrication plant shall be certified by the National Precast Concrete Association (NPCA). As an alternative to NPCA Plant Certification, the precaster may satisfy this requirement by demonstrating certification under the Precast/Prestressed Concrete Institute (PCI) for Group B1 or Group C1. Regardless of the certifying entity, the plant must be certified prior to submitting of a bid for this project and shall remain certified for the entire duration of the precast structure fabrication, delivery, erection, installation, and commissioning. The Contractor shall furnish evidence of such certification with the precast submittal. A precast concrete plant fabricator not meeting these requirements will NOT be allowed to furnish precast concrete components to this project.

1.02 QUALITY ASSURANCE

A. Quality Control and Quality Assurance for Precast shall be in accordance with the Quality Control Manual for the certified Precast Manufacturer. The Quality Manual shall be submitted along with the precast shop drawings and calculations submittal a minimum of 30 days prior to casting. The cost for meeting all of the requirements for precast quality control and assurance shall be the Contractor's responsibility.

B. If the Contractor elects to precast the units on site, the Contractor must meet, at a minimum, the requirements set forth in the 16th edition of the NPCA Quality Control Manual for Precast Plants. The Contractor must submit their quality control and testing plan for all site precasting operations to the Engineer for review and approval 30 days prior to precasting is set to begin.

C. Additional tests may be required if evidence of faulty workmanship, failure of laboratory tests, or questionable concrete exists. These tests shall be paid for by Contractor.

1.03 EVALUATION AND ACCEPTANCE OF CONCRETE

A. See Spec. Section 03 30 00

1.04 CONCRETE QUALITY DESIGN

A. See Spec. Section 03 30 00

1.05 SUBMITTALS

A. See Spec. Section 03 30 00

B. The Precast Bents are designed for in-service stresses. The Contractor shall submit to the Engineer for review and approval, design calculations and shop and erection drawings for all precast concrete structures. The design calculations shall account for all stresses that result from casting, curing, stripping, handling, transport, erection, and installation. The calculations and drawings shall be prepared, signed, and sealed by a Registered Professional Engineer duly licensed in State of Arkansas.

C. The Contractor's precast submittal shall include all design, details, materials, hardware, handling procedures and related information needed for the Engineer to evaluate the proposed precast structures for their intended purpose. The submittal shall show a layout plan for all piece marks and shall account for joints and tolerances. Field verified dimensions shall be utilized to prepare precast shop drawings to insure proper fit during installation, this shall be the Contractor's responsibility.

D. Product Data - For precast segments the Contractor shall submit product data showing the dimensions, location/size of steel reinforcement, embedments and certify that the structures and all accessories meet or exceed the applicable requirements listed in this specification. The manufacturer shall certify that such products and all accessories meet the required specifications.

E. Shop Drawings Precast Concrete - The Contractor shall submit shop drawings for precast concrete segments for review and approval by the Engineer prior to fabrication of the units. These drawings shall show design information including appropriate ASTM references, dimensions, steel reinforcement size/placement, lifting inserts installation elevations as well as supporting engineering design calculations.

F. The Contractor shall not be entitled to any additional compensation for labor or materials incorporated into precast units.

1.06 ENVIRONMENTAL REQUIREMENTS

A. See Spec. Section 03 30 00

PART 2 - PRODUCTS

2.01 See Spec Section 03 30 00

PART 3 - EXECUTION

3.01 See Spec Section 03 30 00

END OF SECTION

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SECTION 04 20 01
MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.

B. Clay facing brick.

C. Mortar and grout.

D. Reinforcement and anchorage.

E. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Steel stud backup for masonry veneer.

B. Section 07 92 00 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2020.

B. ASTM C91/C91M - Standard Specification for Masonry Cement; 2018.

C. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2017.

D. ASTM C150/C150M - Standard Specification for Portland Cement; 2020.

E. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.

F. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019.

G. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2018.

H. ASTM C476 - Standard Specification for Grout for Masonry; 2020.

I. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar.

C. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.

D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.08 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
   2. Non-Loadbearing Units: ASTM C129.
      a. Hollow block, as indicated.
      b. Lightweight.

2.02 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91/C91M Type N.
   1. Colored Mortar: Premixed cement as required to match Architect's color sample.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

C. Hydrated Lime: ASTM C207, Type S - Structural.

D. Hydrated Lime: ASTM C207, Type N - Structural.

E. Grout Aggregate: ASTM C404.

F. Water: Clean and potable.

G. Moisture-Resistant Admixture: Water repellent compound designed to reduce capillarity.

2.03 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) yield strength, deformed billet bars; uncoated.

B. Joint Reinforcement Type: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

C. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws; corrosion resistant finish or hot dip galvanized to ASTM A153/A153M.

2.04 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.

B. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.05 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, Proportion Specification.
   1. Masonry below grade and in contact with earth; Type S.
   2. Exterior, non-loadbearing masonry; Type N.

B. Grout: ASTM C476; consistency as required to fill volumes completely for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.
   3. Mortar Joints: Concave.

3.03 PLACING AND BONDING

A. Lay hollow masonry units with face shell bedding on head and bed joints.

B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

C. Remove excess mortar as work progresses.

D. Interlock intersections and external corners.

E. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

F. Isolate top joint of masonry veneer from horizontal structural framing members or support angles with compressible joint filler.

3.04 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.05 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Install horizontal joint reinforcement 16 inches on center.

B. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 16 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.06 CONTROL AND EXPANSION JOINTS

A. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

B. Size control joints as indicated on drawings; if not indicated, 3/4 inch wide and deep.

C. Form expansion joint as detailed on drawings.

3.07 TOLERANCES

A. Install masonry within the site tolerances found in TMS 402/602.

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

3.08 CUTTING AND FITTING

A. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.09 CLEANING

A. Remove excess mortar and mortar smears as work progresses.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.10 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 05 10 00

STRUCTURAL STEEL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing members with required bracing, welds, and fasteners.

B. Base plates.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Shop Drawings, Product Data, and Samples.

B. Section 01 45 23 - Testing Laboratory Services.

C. Section 03 30 00 - Cast-in-Place Concrete.

D. Section 04 20 00 – Basic Masonry.

E. Section 05 50 00 - Metal Fabrications.

1.03 REFERENCES

A. ASTM A6 - General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use

B. ASTM A36 – Carbon Structural Steel

C. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

D. ASTM A123 – Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip

E. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners

F. ASTM A325 - High-Strength Bolts, Nuts, & Hardened Washers for Structural Steel Joints

G. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

H. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

I. ASTM A992 – Steel for Structural Shapes for Use in Building Framing

J. AWS D1.1 - Structural Welding Code

K. AISC - Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings

L. Anchor Bolts: ASTM A36& ASTM A316 Stainless Steel as noted on the drawings.

1.04 SUBMITTALS

A. Provide submittals in accordance with Section 01340.

B. Shop Drawings:

1. Prepare shop drawings in conformance with Contract Documents, AISC Specifications, and with necessary information for complete fabrication and erection of structural steel.

2. 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.

3. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by others.

4. Prepare shop drawings under supervision of Registered Professional Engineer licensed in State of Project.

5. Reproduction of any portion of design drawings for use as shop drawings will not be permitted.

1.05 QUALITY ASSURANCE

A. Quality Standards: Fabrication and erection of structural steel shall conform to recommendations of AISC Steel Construction Manual except where modified by this Section.

B. Fabricator/Erector Qualifications:

1. Company having not less than 5 years' experience and successfully completed at least one project of the size of this project or larger with similar structural system. Provide list with submittal package.

2. Approved by Owner; any of the following reasons will be cause for rejection:

    a. Warranty work not properly performed.
    b. Lack of financial capability.
    c. Record of inferior or substandard practices.
    d. Lack of proper facilities or equipment.
    e. Lack of experienced, properly trained, and qualified personnel.
    f. Other causes indicating unsuitability for performing work specified.

C. Qualification for Welding Work:

1. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

2. Provide certification that welders to be employed in this work have satisfactorily passed AWS qualification tests. If recertification of welders is required, retesting is Contractor's responsibility.

3. Each welder shall mark or stamp his identification symbol at each full penetration shop and field welds.

D. Qualification for Bolted Work:

1. Assign each bolting crew an identification symbol or mark. Each crew shall appropriately mark their bolted connections.

2. Maintain appropriate records of daily on-site calibration of pneumatic powered impact wrenches used for erection.

3. Definition: Calibration shall consist of tightening, in a hydraulic tension-measuring device 3 bolts of same size with hardened washer under bolt head or nut, whichever is turned in tightening. Calibration procedure shall comply with Specification for Structural Joints using A325 or A490 bolts.

4. Provide manual torque-indicator wrench for use by testing

laboratory to determine torque-tension relationship for each combination of impact wrench and bolt size used.

1.06 DELIVERY, STORAGE & HANDLING

A. Deliver materials to site at such intervals to ensure uninterrupted progress of this work.

B. Deliver anchors bolts and anchor devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to avoid delay of work.

C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, skids, or other supports. Protect steel members and packaged materials from damage.

D. Store materials on structure so as not to cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Wide Flange Shapes: ASTM A992.

B. Channels, Angles, and Plates: ASTM A36, typical; Type 304 Stainless Steel where noted on the drawings.

C. Structural Tubing: ASTM A500, Grade B, typical; Type 304 Stainless Steel where noted on the drawings.

D. Pipe: ASTM A53, Grade B or ASTM A501, typical; Type 304 Stainless Steel where noted on the drawings.

E. Bolts, Nuts, and Washers: ASTM A325, typical; Type 304 Stainless Steel where noted on the drawings.

F. Anchor Bolts: ASTM A36, typical; Type 304 Stainless Steel where noted on the drawings.

G. Shear Connectors: Headed stud type, ASTM A108, Grade 1015 or Grade 1020 unfinished forged steel; with dimensions complying with AISC Specifications. Provide Type 304 Stainless Steel studs where noted on the drawings.

H. Welding Materials: Filler metal conforming to AWS D1.1 for E70 electrodes, for structural steel. Stainless steel filler material to be used for stainless steel.

I. Grout: Refer to Section 03300 for grouting at base plates.

J. Shop and Touch-Up Primer: See Protective Coatings Section 09910.

K. Stainless Steel; Type 304, typical, unless noted otherwise.

2.02 FABRICATION

A. Fabricate structural steel in accordance with Contract Drawings and AISC specifications. Fabricate and assemble structural assemblies in shop to maximum extent practicable.

B. Shop Connections: Utilizing welding or bearing type bolts; install by "modified turn-of-the-nut method" unless otherwise indicated. Do not use one-sided or eccentric connections except where specifically approved.

C. For fabrication of items which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finish.

D. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.

E. Where 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.

F. Field Connections: Field welded connections allowed only where noted on the drawings. For field bolted connections (typical), install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints Using ASTM A325 or A490 Bolts". Assume bearing-type bolts unless indicated otherwise.

G. Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.

H. Assemble and weld built-up sections by methods that will achieve true alignment of axes without warp.

I. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

J. Make bolt holes 1/16" larger than nominal bolt diameter; exclude bolt threads from shear plane.

K. Make fillet welds 3/16" minimum. Make groove and butt welds full penetration.

L. Inspect and test shop-welded connections in accordance with AWS D1.1. Perform visual inspection of all shop welds. Test 50% of all complete and partial penetration shop-welds by ultrasonic or radiographic method.

M. Splice members only where indicated unless otherwise approved in writing by Engineer.

2.03 SHOP PRIMING AND GALVANIZING

A. Shop prime structural steel, except those members or portions of members to be embedded in concrete or mortar. For embedded steel that is partially exposed, prime exposed portions and initial 2" of embedded areas only.

B. Do not prime surfaces that are to be welded or high-strength bolted with friction-type connections.

C. Do not prime surfaces that are scheduled to receive sprayed-on fireproofing.

D. Do not prime steel surfaces to be galvanized.

E. Surface Preparation: Per Section 09910, Protective Coatings.

F. Painting per Section 09910, Protective Coatings: Immediately after surface preparation, apply the specified structural steel primer paint in accordance with manufacturer's instructions and at rate specified to provide dry film thickness specified. Use painting methods that result in full coverage of joints, corners, edges and exposed surfaces.

G. Galvanizing: Galvanize beams in accordance with ASTM A123 where

indicated. Do not chromate quench after galvanizing.

H. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds and repair painting galvanized steel, with wet film containing minimum 93 percent zinc dust by weight and conforming to DOD-P-21035A or SSPC-Paint 20.

PART 3 - EXECUTION

3.01 PREPARATION

A. Make necessary field measurements to ensure that structural steel is fabricated in accordance with Drawings and AISC specifications.

B. Comply with requirements of Section 01050, Field Engineering prior to beginning erection.

C. Check elevations of concrete and masonry bearing surfaces and locations of anchor bolts and similar devices, before erection proceeds, and report discrepancies to Engineer.

D. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been accepted by Engineer.

3.02 ERECTION

A. Erect structural steel framing plumb, level and properly aligned to building lines and elevations on Drawings and in accordance with reference standards.

B. Field connections; use one of the following:

1. Bolted connections using A307 bolts brought up to and beyond snug tight after faying surfaces are in contact. Use A307 bolts only on miscellaneous members.

2. ASTM A325 high strength steel bolts.

a. Install using pneumatic powered impact wrenches with sufficient capacity and adequate supply of compressed air.
b. Install in accordance with "turn-of-the-nut" method; AISC "Specification for Structural Joints using ASTM A325 or A490 Bolts", except use hardened washer under bolt head or nut, whichever is turned in tightening (modified

turn-of-the-nut).

c. Provide hot dip galvanized hardware (nuts, bolts, & washers) with all galvanized framing.

d. Provide stainless steel hardware (nuts, washers, & bolts) with all stainless steel framing.

3. Welding: Perform field welding in accordance with requirements under fabrication except requirements that apply solely to shop conditions.

C. Temporary Shoring and Bracing:

1. Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads.

2. Remove temporary members and connections when permanent members are in place and final connections are made.

3. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

D. Temporary Scaffolding: Provide temporary scaffolding, planking, and working platforms to effectively complete work.

E. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.

F. Furnish templates and other devices for presetting bolts and other anchors to accurate locations.

G. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.

H. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.

I. Column base plates and large bearing plates shall be supported on double nuts or steel shims until supported members have been plumbed.

J. 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.

K. 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.

L. Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening.

M. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

N. Level and plumb individual members of structure within specified AISC tolerances.

O. Splice members only where indicated on Drawings. Field cutting and modification of structural framing will not be allowed unless specifically approved by Engineer.

P. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.

Q. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

R. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

S. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting is permitted only on secondary members which are not under stress, and when approved by Engineer. Finish gas-cut sections, when permitted, equal to sheared appearance.

T. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Use primer compatible with shop coat. Where exposed, leave surfaces clean and suitable to receive finish as scheduled in Section 09910, Protective Coatings.

U. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and apply galvanizing repair paint per ASTM A780.

V. Cut members neat and square; erect true and flush, without twists and open joints. Light drifting to draw holes together is permitted; drifting to match unfair holes is not permitted.

W. Adjust miscellaneous structural steel support members for glazing system to within 1/8" plus or minus in any direction. Make adjustments prior to installation of glazing components or masonry materials.

X. Fabricate beams with shop camber up.

3.03 FIELD QUALITY CONTROL

A. Field inspection and testing of high-strength bolted connections and welded connections shall be performed by an independent testing and inspection agency according to provisions of Section 01400.

1. Testing agency shall conduct and interpret tests, state in each report whether test specimens comply with requirements, and specifically state any deviations there from.

2. Correct deficiencies in structural steel work that inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests at Contractor's expense, as necessary to reconfirm any noncompliance or original work and to show compliance of corrected work.

B. Field-bolted Connections:

1. Inspect and test field-bolted connections in accordance with AISC specifications.

2. Observe the installation and tightening of bolts to determine that the selected bolt tightening procedures are properly followed.

C. Field-welded Connections:

1. Inspect and test field-welded connections in accordance with AWS D1.1.

2. Perform visual inspection of all field-welds.

3. Test all complete and partial penetration field-welds by

ultrasonic or radiographic method.

3.04 CLEANING

A. After erection, prime welds, abrasions and areas where shop coating has been damaged. Use primer compatible with shop coat.

B. Where exposed, leave surfaces clean and suitable for finish as scheduled in Section 09910, Protective Coatings.

END OF SECTION

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SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud exterior wall and interior wall framing.

1.02 RELATED REQUIREMENTS

A. Section 04 20 01 - Masonry: Veneer masonry supported by wall stud metal framing.

B. Section 09 21 16 - Gypsum Board Assemblies: Lightweight, non-load bearing metal stud framing.

C. Section 09 21 16 - Gypsum Board Assemblies: Gypsum-based sheathing.

D. Section 09 51 00 - Acoustical Ceilings: Ceiling suspension system.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

C. ASTM C955 - Standard Specification for Cold-Formed Steel Structural Framing Members; 2018, with Editorial Revision.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.

C. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.

PART 2 PRODUCTS

2.01 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

2.02 FRAMING MATERIALS

A. Studs and Track: ASTM C955; studs formed to channel, C- or Sigma-shaped with punched web; U-shaped track in matching nominal width and compatible height.
   1. Gauge and Depth: As indicated on drawings.
   2. Galvanized in accordance with ASTM A653/A653M, G90/Z275 coating.

B. Framing Connectors: Factory-made, formed steel sheet.
   1. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.
   2. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

2.03 FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.

B. Anchorage Devices: Powder actuated.

C. Welding: Comply with AWS D1.1/D1.1M.

2.04 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

PART 3 EXECUTION

3.01 INSTALLATION OF STUDS

A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.

B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 16 inches on center. Coordinate installation of sealant with floor and ceiling tracks.

C. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

D. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.

E. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

F. Touch-up field welds and damaged galvanized surfaces with primer.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Bollards.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

E. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

G. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

H. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

I. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

J. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

K. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M Grade B cold-formed or hot rolled, ASTM A501/A501M ; seamless structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Cold-Rolled Carbon Steel Sheets: ASTM A653/A653M . Provide "Commercial" galvanizing, for exterior use.

F. Stainless Steel, General: ASTM A666, Type 304.

G. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.

H. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

J. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

K. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

A. Bollards: 8 inch steel bollard, concrete filled, crowned cap, as detailed; plastic bollard sleeve cover.

B. Plates Not Attached to Structural Framing: For support of metal decking; prime paint finish.

C. Lintels: As detailed; galvanized finish.

D. Door Frames for Overhead Door Openings: Channel sections; prime paint finish.

2.04 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
   2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Perform field welding in accordance with AWS D1.1/D1.1M.

D. Obtain approval prior to site cutting or making adjustments not scheduled.

E. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

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SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonstructural dimension lumber framing.

B. Preservative treated wood materials.

C. Fire retardant treated wood materials.

D. Concealed wood blocking, nailers, and supports.

E. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

A. Section 09 21 16 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.

B. AWPA U1 - Use Category System: User Specification for Treated Wood; 2018.

C. PS 20 - American Softwood Lumber Standard; 2020.

D. SPIB (GR) - Grading Rules; 2014.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials.

C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a two-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: S-dry or MC19.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.04 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

B. Fire Retardant Treatment:
   1. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Treat rough carpentry items as indicated .
      c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

C. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

D. Provide the following specific nonstructural framing and blocking:

1. Cabinets and shelf supports.
2. Wall brackets.
3. Handrails.
4. Grab bars.
5. Towel and bath accessories.
6. Wall-mounted door stops.
7. Chalkboards and marker boards.
8. Wall paneling and trim.
9. Joints of rigid wall coverings that occur between studs.

3.04 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.05 CLEANING

A. Waste Disposal: See Section 01 74 19 - Construction Waste Management and Disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

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SECTION 07 19 00
WATER REPELLENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water repellents applied to interior, masonry surfaces.

B. Pressure washing.

1.02 REFERENCE STANDARDS

A. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2020a.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.

1.04 FIELD CONDITIONS

A. Protect liquid materials from freezing.

B. Do not apply water repellent when ambient temperature is lower than 50 degrees F or higher than 100 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Silane, Siloxane, Silane-Siloxane Blend, and Siliconate Water Repellents:
   1. BASF Construction Chemicals: www.buildingsystems.basf.com/#sle.
   2. PROSOCO, Inc: www.prosoco.com/#sle.
   3. Tnemec Company, Inc: www.tnemec.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Water Repellent: Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.
   1. Applications: Vertical surfaces and non-traffic horizontal surfaces.
   2. Number of Coats: Two.
   3. Moisture Absorption When Applied to Masonry: Five percent, maximum, when tested in accordance with ASTM C140/C140M using masonry sample completely coated with water repellent.
   4. Maintains dry appearance when wetted.
   5. Silane, siloxane, silane-siloxane blend, or siliconate that reacts chemically with concrete and masonry.
      a. Manufacturers:
         1) BASF Construction Chemicals; Enviroseal 20: www.buildingsystems.basf.com/#sle.
         2) PROSOCO, Inc; Consolideck SL100 Water Repellent, with VOC of 400 g/L or less: www.prosoco.com/#sle.
         3) Tnemec Inc; Prime-A-Pell Plus V662, with VOC of 400 g/L or less: www.tnemec.com/#sle.
         4) Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify joint sealants are installed and cured.

C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.02 PREPARATION

A. Protection of Adjacent Work:
   1. Protect adjacent landscaping, property, and vehicles from drips and overspray.
   2. Protect adjacent surfaces not intended to receive water repellent.

B. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.

C. Do not start work until masonry mortar substrate is cured a minimum of 60 days.

D. Remove loose particles and foreign matter.

E. Remove oil and foreign substances with a chemical solvent that will not affect water repellent.

F. Pressure wash surfaces to be coated.

G. Allow surfaces to dry completely to degree recommended by water repellent manufacturer before starting coating work.

3.03 APPLICATION

A. Apply water repellent in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.

B. Apply at rate recommended by manufacturer, continuously over entire surface.

C. Apply two coats, minimum.

D. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Batt insulation in exterior and interior wall construction.

B. Batt insulation for filling perimeter window and door shim spaces.

1.02 REFERENCE STANDARDS

A. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.

C. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C; 2019a.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.04 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 BATT INSULATION MATERIALS

A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
   1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
   4. R-Value: R-19.
   5. Formaldehyde Content: Zero.
   6. Products:
      a. CertainTeed Corporation; CertaPRO Universal Blanket Unfaced: www.certainteed.com/#sle.
      b. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

A. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide.

B. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.

C. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.

D. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in exterior wall spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Staple or nail facing flanges in place at maximum 6 inches on center.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

3.04 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.

B. Section 07 84 00 - Firestopping: Firestopping sealants.

C. Section 08 71 00 - Door Hardware: Setting exterior door thresholds in sealant.

D. Section 08 80 00 - Glazing: Glazing sealants and accessories.

E. Section 09 21 16 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

F. Section 09 30 00 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.03 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015.

B. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants; 2018.

C. ASTM C834 - Standard Specification for Latex Sealants; 2017.

D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2018.

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

F. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2016.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

H. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2018.

I. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2014.

J. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2020).

K. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2020.

L. SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).

M. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.

1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
2. List of backing materials approved for use with the specific product.

3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
4. Substrates the product should not be used on.
5. Substrates for which use of primer is required.
6. Substrates for which laboratory adhesion and/or compatibility testing is required.
7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
8. Sample product warranty.
9. Certification by manufacturer indicating that product complies with specification requirements.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

F. Sustainable Design Documentation: For sealants and primers, submit VOC content and emissions documentation as specified in Section 01 61 16.

G. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

H. Installation Plan: Submit at least four weeks prior to start of installation.

I. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.

J. Field Quality Control Plan: Submit at least two weeks prior to start of installation.

K. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.

L. Installation Log: Submit filled out log for each length or instance of sealant installed.

M. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

N. Manufacturer's Qualification Statement.

O. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each referenced document covering installation requirements on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

E. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
1. Adhesion Testing: In accordance with ASTM C794.
2. Compatibility Testing: In accordance with ASTM C1087.
3. Allow sufficient time for testing to avoid delaying the work.

4. Deliver to manufacturer sufficient samples for testing.
5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
6. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

F. Installation Plan: Include schedule of sealed joints, including the following.
1. Method to be used to protect adjacent surfaces from sealant droppings and smears, with acknowledgement that some surfaces cannot be cleaned to like-new condition and therefore prevention is imperative.
2. Approximate date of installation, for evaluation of thermal movement influence.
3. Installation Log Form: Include the following data fields, with known information filled out.
   a. Unique identification of each length or instance of sealant installed.
   b. Location on project.
   c. Substrates.
   d. Sealant used.
   e. Stated movement capability of sealant.
   f. Primer to be used, or indicate as "No primer" used.
   g. Size and actual backing material used.
   h. Date of installation.
   i. Name of installer.
   j. Actual joint width; provide space to indicate maximum and minimum width.
   k. Actual joint depth to face of backing material at centerline of joint.
   l. Air temperature.

G. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
1. Identification of testing agency.
2. Name(s) of sealant manufacturers' field representatives who will be observing
3. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
   a. Test date.
   b. Location on project.
   c. Sealant used.
   d. Date of installation of field sample to be tested.
   e. Date of test.
   f. Copy of test method documents.
   g. Age of sealant upon date of testing.
   h. Test results, modeled after the sample form in the test method document.
   i. Indicate use of photographic record of test.

H. Field Quality Control Plan:
1. Visual inspection of entire length of sealant joints.
2. Field testing agency's qualifications.
3. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.

I. Field Adhesion Test Procedures:
1. Allow sealants to fully cure as recommended by manufacturer before testing.
2. Have a copy of the test method document available during tests.

3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
4. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

J. Field Adhesion Tests of Joints: Test for adhesion using most appropriate method in accordance with ASTM C1521, or other applicable method as recommended by manufacturer.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 JOINT SEALANT APPLICATIONS

A. Scope:
1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
   a. Wall expansion and control joints.
   b. Joints between door, window, and other frames and adjacent construction.
   c. Joints between different exposed materials.
   d. Openings below ledge angles in masonry.
   e. Other joints indicated below.
2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
   a. Joints between door, window, and other frames and adjacent construction.
   b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
      1) Exception: Such gaps and openings in gypsum board finished stud walls and suspended ceilings.
      2) Exception: Through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
   c. Other joints indicated below.
3. Do not seal the following types of joints.
   a. Intentional weepholes in masonry.
   b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
   c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
   d. Joints where installation of sealant is specified in another section.
   e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
2. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.

C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.

2. Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
3. Floor Joints in Wet Areas: Non-sag polyurethane "non-traffic-grade" sealant suitable for continuous liquid immersion.
4. Wall, Ceiling, and Floor Joints Where Tamper-Resistance is Required: Non-sag tamper-resistant silyl-terminated polyurethane sealant.
5. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
6. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
7. Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.
8. Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.

D. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

E. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

F. Areas Where Tamper-Resistance is Required: As indicated on drawings.

2.02 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

B. Colors: As indicated on drawings.

2.03 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
4. Color: Match adjacent finished surfaces.
5. Cure Type: Single-component, neutral moisture curing.
6. Service Temperature Range: Minus 20 to 180 degrees F.

B. Type Bathtub/Tile - Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
1. Color: White.

C. Type General Purpose Exterior - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 35 percent, minimum.
2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
3. Color: Match adjacent finished surfaces.
4. Service Temperature Range: Minus 40 to 180 degrees F.

D. Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface.
1. Movement Capability: Plus and minus 35 percent, minimum.
2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
3. Color: Match adjacent finished surfaces.
4. Service Temperature Range: Minus 40 to 180 degrees F.

E. Type General Purpose Interior Sealant - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
   1. Color: Standard colors matching finished surfaces.
   2. Grade: ASTM C834; Grade Minus 18 Degrees C (0 Degrees F).

F. Acrylic Latex Sealant: ASTM C834; for use as acoustical sealant and in firestopping systems for expansion joints and through penetrations.
   1. Color: Standard colors matching finished surfaces.
   2. Fire Rated System: Complies with UL 263 and ASTM E119 with UL fire resistance classifications.

G. Non-Curing Butyl Sealant: Solvent-based, single component, non-sag, non-skinning, non-hardening, non-bleeding; non-vapor-permeable; intended for fully concealed applications.

2.04 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
   1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
   2. Notify Architect of date and time that tests will be performed, at least seven days in advance.
   3. Arrange for sealant manufacturer's technical representative to be present during tests.
   4. Record each test on Preinstallation Adhesion Test Log as indicated.
   5. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect.
   6. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 FIELD QUALITY CONTROL

A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

B. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

END OF SECTION

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SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Thermally insulated hollow metal doors with frames.

D. Hollow metal borrowed lites glazing frames.

E. Accessories, including glazing, louvers, and matching panels.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware.

B. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.

1.03 ABBREVIATIONS AND ACRONYMS

A. ANSI: American National Standards Institute.

B. ASCE: American Society of Civil Engineers.

C. HMMA: Hollow Metal Manufacturers Association.

D. NAAMM: National Association of Architectural Metal Manufacturers.

E. NFPA: National Fire Protection Association.

F. SCIF: Sensitive Compartmented Information Facility.

G. SDI: Steel Door Institute.

H. UL: Underwriters Laboratories.

1.04 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames; 2007 (Reaffirmed 2011).

C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021.

H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.

I. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.

J. ASTM C476 - Standard Specification for Grout for Masonry; 2020.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.

L. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2016.

M. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

N. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

O. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

P. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2007.

Q. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

R. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.

S. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Samples: Submit two samples of metal, 2 by 2 inches in size, showing factory finishes, colors, and surface texture.

E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

F. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   3. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.

4. Steelcraft, an Allegion brand: www.allegion.com/#sle.
5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
2. Accessibility: Comply with ICC A117.1 and ADA Standards.
3. Door Top Closures: Flush end closure channel, with top and door faces aligned.
4. Door Edge Profile: Beveled, both sides.
5. Typical Door Face Sheets: Flush.
6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Door Finish: Factory finished.

B. Exterior Doors: Thermally insulated.
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 3 - Extra Heavy-duty.
b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 2 - Seamless.
d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.
2. Door Core Material: Polyurethane, 1.8 lbs/cu ft minimum density.
a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
3. Door Thermal Resistance: R-Value of 8.7, minimum, for installed thickness of polyurethane.
4. Door Thickness: 1-3/4 inches, nominal.
5. Weatherstripping: Refer to Section 08 71 00.

C. Hardened Area Door:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 4 - Maximum-duty.
b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 1 - Full Flush.
d. Door Face Metal Thickness: 14 gauge, 0.067 inch, minimum.
e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").

3. Temperature-Rise Rating (TRR) Across Door Thickness: In accordance with local building code and authorities having jurisdiction.
4. Provide units listed and labeled by UL (DIR) or ITS (DIR).
   a. Attach fire rating label to each fire rated unit.
5. Door Core Material: Manufacturer's recommended interior reinforcing for hardened rooms.
6. Door Thickness: 1-3/4 inches, nominal.
7. Door Face Sheets: Flush.
8. Door Finish: Factory finished.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Same as hollow metal door.

C. **Exterior Frames**: Face welded type.
   1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
   2. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.
   3. Weatherstripping: Separate, see Section 08 71 00.

D. **Frames for Wood Doors**: Comply with frame requirements in accordance with corresponding door.

E. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Factory Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.
   1. Color: As selected by Architect from manufacturer's standard range.

C. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.06 ACCESSORIES

A. Glazing: As specified in Section 08 80 00, factory installed.

B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

C. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

D. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

E. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install prefinished frames after painting and wall finishes are complete.

C. Coordinate frame anchor placement with wall construction.

D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

E. Install door hardware as specified in Section 08 71 00.

F. Comply with glazing installation requirements of Section 08 80 00.

G. Coordinate installation of electrical connections to electrical hardware items.

H. Touch up damaged factory finishes.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION

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SECTION 08 36 13
SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Overhead insulated sectional doors, electrically operated.

B. Operating hardware and supports.

C. Electrical controls.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Steel channel opening frame.

B. Section 06 10 00 - Rough Carpentry: Rough wood framing for door opening.

C. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

D. Section 08 71 00 - Door Hardware: Lock cylinders.

E. Section 09 90 00 - Painting and Coating: Finish painting.

F. Section 26 05 83 - Wiring Connections.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

B. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

C. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

D. DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors; 2011.

E. ITS (DIR) - Directory of Listed Products; current edition.

F. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2000, with Errata (2008).

G. NEMA MG 1 - Motors and Generators; 2018.

H. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL (DIR) - Online Certifications Directory; Current Edition.

K. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 PERFORMANCE REQUIREMENTS

A. Wind Loads: Design and size components to withstand loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with applicable code.

B. Wiring Connections: Requirements for electrical characteristics.
   1. 115 volts, single phase, 60 Hz.

C. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.

C. Product Data: Show component construction, anchorage method, and hardware.

D. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

G. Operation Data: Include normal operation, troubleshooting, and adjusting.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience.

C. Comply with applicable code for motor and motor control requirements.

D. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction, as suitable for purpose specified.

1.07 PROJECT COORDINATION

A. Convene a preinstallation conference just prior to commencement of field operations, to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for electric motor and transmission.

D. Provide five year manufacturer warranty for electric operating equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Products: Specific brand names used in drawings and specifications are used to establish design and quality standards, performance criteria, technical characteristics, or other salient requirements. It is not intended to restrict products that are equal to these characteristics. Products that clearly and demonstrably meet the requirements may also be acceptable.

B. Basis of Design: Insulated Steel Sectional Overhead Doors: 422 Series Insulated Steel Doors manufactured by Overhead Door Corporation.

C. Other Acceptable Manufacturers - Sectional Doors; provided they meet requirements in this section:

1. Amarr: www.amarr.com/commercial/#sle.
2. Alpine Doors: www.alpinedoors.com.
3. C.H.I. Overhead Doors: www.chiohd.com/#sle.
4. Raynor Garage Doors: www.raynor.com/#sle.
5. Wayne-Dalton, a Division of Overhead Door Corporation: www.wayne-dalton.com/#sle.
6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 STEEL DOORS

A. Steel Doors: Flush steel, insulated; standard lift operating style with track and hardware; complying with DASMA 102, Commercial application.
   1. Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330/E330M, using 10 second duration of maximum load.
   2. Door Nominal Thickness: 2 inches thick.
   3. Exterior Surface: Ribbed.
   4. Exterior Steel: 20- gauge, hot-dip galvanized.
   5. Back Cover: 26 ga. steel - white.
   6. Center and End Stiles: 26 ga. steel.
   7. Springs: 10,000 cycles.
   8. Thermal Transmittance: U-factor of 0.136 Btu/hr sq ft degrees F, maximum, in accordance with DASMA 102.
   9. Air Leakage Rate: Less than 0.40 cfm/sf when tested in accordance with ASTM E283 at test pressure difference of 1.57 psf.
   10. Exterior Finish: Factory finished with acrylic baked enamel; color as selected by Architect.
   11. Interior Finish: Factory finished with acrylic baked enamel; color as selected from manufacturers standard line.
   12. Electric Operation: Electric control station.

2.03 COMPONENTS

A. Track: Rolled galvanized steel, 0.090 inch minimum thickness; 2 inch wide, continuous one piece per side; galvanized steel mounting brackets 1/4 inch thick.

B. Lift Mechanism: Torsion spring on cross head shaft, with braided galvanized steel lifting cables.

C. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.

D. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.

E. Head Weatherstripping: EPDM rubber seal, one piece full length.

F. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.

G. Lock: Inside side mounted, adjustable keeper, spring activated latch bar with feature to retain in locked or retracted position; interior handle.
   1. Interlock switch for automatic opener

2.04 MATERIALS

A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating, plain surface.

B. Insulation: Expanded polystyrene (EPS), bonded to facing.
   1. R-value of 7.35.

C. Metal Primer Paint: Zinc molybdate type.

2.05 ELECTRIC OPERATION

A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
   1. Provide interlock switches on motor operated units.
   2. Provide tamperproof operation cycle counter.

B. Electric Operators:

1. Mounting: Side mounted on cross head shaft.
2. Motor Enclosure:
   a. Exterior Doors: NEMA MG 1, Type 4; open drip proof.
3. Motor Rating: 3/4 hp; continuous duty; or as recommended by manufacturer for specific door requirements.
4. Motor Voltage: 120 volts, single phase, 60 Hz.
5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
6. Controller Enclosure: NEMA 250, Type 1.
7. Opening Speed: 12 inches per second.
8. Brake: Adjustable friction clutch type, activated by motor controller.
9. Manual override in case of power failure.
10. Refer to Section 26 05 83 for electrical connections.

C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated; enclose terminal lugs in terminal box sized to comply with NFPA 70.

D. Control Station: Provide standard three button (Open-Close-Stop) momentary-contact control device for each operator complying with UL 325.
   1. 24 volt circuit.
   2. Surface mounted, at interior door jamb.
   3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
      a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.
      b. Secondary Device: Provide electric sensing edge with wireless edge kit or non-monitored safety edge as an option along with continuous-constant control device.

E. Safety Edge: Located at bottom of sectional door panel, full width; pneumatic sensitized type, wired to stop and reverse door direction upon striking object; hollow neoprene covered to provide weatherstrip seal.

F. Provide interconnection to security system.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

B. Verify that electric power is available and of the correct characteristics.

3.02 PREPARATION

A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.

B. Apply primer to wood frame.

3.03 INSTALLATION

A. Install door unit assembly in accordance with manufacturer's instructions.

B. Anchor assembly to wall construction and building framing without distortion or stress.

C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.

D. Fit and align door assembly including hardware.

E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

3.04 TOLERANCES

A. Maximum Variation from Plumb: 1/16 inch.

B. Maximum Variation from Level: 1/16 inch.

C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.

D. Maintain dimensional tolerances and alignment with adjacent work.

3.05 ADJUSTING

A. Adjust door assembly for smooth operation and full contact with weatherstripping.

B. Have manufacturer's field representative present to confirm proper operation and identify adjustments to door assembly for specified operation.

3.06 CLEANING

A. Clean doors and frames and glazing.

B. Remove temporary labels and visible markings.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION

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SECTION 08710
DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY:

A. Section Includes: Finish Hardware for door openings, except as otherwise specified herein.
   1. Door hardware for steel (hollow metal) doors.
   2. Door hardware for aluminum doors.
   3. Door hardware for wood doors.
   4. Door hardware for other doors indicated.
   5. Keyed cylinders as indicated.
   6. Access Control Components as indicated - FURNISHED AND INSTALLED UNDER THIS SECTION.

B. Related Sections:
   1. Division 6: Rough Carpentry.
   2. Division 8: Aluminum Doors and Frames
   3. Division 8: Hollow Metal Doors and Frames.
   4. Division 8: Wood Doors.
   5. Division 16 Electrical
   6. Division 16: Electronic Security

C. References: Comply with applicable requirements of the following standards. Where these standards conflict with other specific requirements, the most restrictive shall govern.
   1. Builders Hardware Manufacturing Association (BHMA)
   2. NFPA 101 Life Safety Code
   3. NFPA 80 - Fire Doors and Windows
   4. ANSI-A156.xx- Various Performance Standards for Finish Hardware
   5. UL10C - Positive Pressure Fire Test of Door Assemblies
   6. ANSI-A117.1 - Accessible and Usable Buildings and Facilities
   7. DHI /ANSI A115.IG - Installation Guide for Doors and Hardware

D. Requirement of Intent of Hardware Groups
   1. Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
   2. Where items of hardware aren't definitely or correctly specified, are required for completion of the Work, a written statement of such omission, error, or other discrepancy to Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.

1.02 SUBSTITUTIONS:

A. Comply with Division 1.

1.03 SUBMITTALS:

A. Comply with Division 1.

B. Special Submittal Requirements: Combine submittals of this Section with Sections listed below to ensure the "design intent" of the system/assembly is understood and can be reviewed together.`

C. Product Data: Manufacturer's specifications and technical data including the following:
   1. Detailed specification of construction and fabrication.
   2. Manufacturer's installation instructions.

3. Wiring diagrams for each electric product specified. Coordinate voltage with electrical before submitting.
4. Submit 6 copies of catalog cuts with hardware schedule.
5. Provide 9001-Quality Management and 14001-Environmental Management for products listed in Materials Section 2.2

D. Shop Drawings - Hardware Schedule: Submit 6 complete reproducible copies of detailed hardware schedule in a vertical format.
1. List groups and suffixes in proper sequence.
2. Completely describe door and list architectural door number.
3. Manufacturer, product name, and catalog number.
4. Function, type, and style.
5. Size and finish of each item.
6. Mounting heights.
7. Explanation of abbreviations and symbols used within schedule.
8. Detailed wiring diagrams, specially developed for each opening, indicating all electric hardware, security equipment and access control equipment, and door and frame rough-ins required for specific opening.

E. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.
1. Templates, wiring diagrams and "reviewed Hardware Schedule" of electrical terms to electrical for coordination and verification of voltages and locations.

F. Samples: (If requested by the Architect)
1. 1 sample of Lever and Rose/Escutcheon design, (pair).
2. 3 samples of metal finishes

G. Contract Closeout Submittals: Comply with Division 1 including specific requirements indicated.
1. Operating and maintenance manuals: Submit 3 sets containing the following.
a. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
b. Catalog pages for each product.
c. Name, address, and phone number of local representative for each manufacturer.
d. Parts list for each product.
1) Copy of final hardware schedule, edited to reflect, "As installed".
2) Copy of final keying schedule
3) As installed “Wiring Diagrams” for each piece of hardware connected to power, both low voltage and 110 volts.
4) One set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.04 QUALITY ASSURANCE

A. Comply with Division 1.
1. Statement of qualification for distributor and installers.
2. Statement of compliance with regulatory requirements and single source responsibility.
3. Distributor's Qualifications: Firm with 3 years experience in the distribution of commercial hardware.
4. Installer's Qualifications: Firm with 3 years experienced in installation of similar hardware to that required for this Project, including specific requirements indicated.
5. Regulatory Label Requirements: Provide testing agency label or stamp on hardware for labeled openings.
a. Provide UL listed hardware for labeled and 20 minute openings in conformance with requirements for class of opening scheduled.

b. Underwriters Laboratories requirements have precedence over this specification where conflict exists.
1) Single Source Responsibility: Except where specified in hardware schedule, furnish products of only one manufacturer for each type of hardware.

B. Review Project for extent of finish hardware required to complete the Work. Where there is a conflict between these Specifications and the existing hardware, notify the Architect in writing and furnish hardware in compliance with the Specification unless otherwise directed in writing by the Architect.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Comply with Division 1.
1. Deliver products in original unopened packaging with legible manufacturer's identification.
2. Package hardware to prevent damage during transit and storage.
3. Mark hardware to correspond with "reviewed hardware schedule".
4. Deliver hardware to door and frame manufacturer upon request.

B. Storage and Protection: Comply with manufacturer's recommendations.

1.06 PROJECT CONDITIONS:

A. Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.

B. Review Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

1.07 WARRANTY:

A. Refer to Conditions of the Contract

B. Manufacturer's Warranty:
1. Closers: Ten years
2. Exit Devices: Three Years
3. Locksets & Cylinders: Three years
4. All other Hardware: Two years.

1.08 OWNER'S INSTRUCTION:

A. Instruct Owner's personnel in operation and maintenance of hardware units.

1.09 MAINTENANCE:

A. Extra Service Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals Section.
1. Special Tools: Provide special wrenches and tools applicable to each different or special hardware component.
2. Maintenance Tools: Provide maintenance tools and accessories supplied by hardware component manufacturer.
3. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra service materials.

B. Maintenance Service: Submit for Owner's consideration maintenance service agreement for electronic products installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. The following manufacturers are approved subject to compliance with requirements of the Contract Documents. Approval of manufacturers other than those listed shall be in accordance with Division 1.

	Item:	Manufacturer:	Approved:
2.	Hinges	Hager	McKinney
3.	Continuous Hinges	Hager	McKinney
4.	Locksets	Yale	Sargent
5.	Cylinders	Yale	Sargent
6.	Exit Devices	Yale	Sargent
7.	Closers	Norton	
8.	Push/Pull Plates	Hager	Trimco, Rockwood
9.	Push/Pull Bars	Hager	Trimco, Rockwood
10.	Protection Plates	Hager	Trimco, Rockwood
11.	Door Stops	Hager	Trimco, Rockwood
12.	Flush Bolts	Hager	Trimco, Rockwood
13.	Threshold & Gasketing	Hager	Pemko, Hager

2.02 MATERIALS:

A. Hinges:
   1. Certified by BHMA for all applicable ANSI Standards for type, size, function and finish
   2. Template screw hole locations
   3. Minimum of 2 permanently lubricated non-detachable bearings
   4. Equip with easily seated, non-rising pins
   5. Sufficient size to allow 180-degree swing of door
   6. Furnish hinges with three knuckles and concealed bearings
   7. Provide hinge type as listed in schedule.
   8. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
   9. UL10C listed for Fire

B. Geared Continuous Hinges:
   1. Certified by BHMA for ANSI A156.26 Grade 1
   2. Anti-spinning through fastener
   3. UL10C listed for 3 hour Fire rating
   4. Non-handed
   5. Lifetime warranty
   6. Provide Fire Pins for 3-hour fire ratings, if required
   7. Sufficient size to permit door to swing 180 degrees

C. Cylindrical Type Locks and Latchsets:
   1. Certified by BHMA for ANSI A156.2, Series 4000, Operational Grade 1, Extra-Heavy Duty, and be UL10C listed.
   2. Provide 9001-Quality Management and 14001-Environmental Management.
   3. Fit modified ANSI A115.2 door preparation.
   4. Locksets and cores to be of the same manufacturer to maintain complete lockset warranty
   5. Locksets to have anti-rotational studs that are thru-bolted
   6. Keyed lever shall not have exposed “keeper” hole
   7. Each lever to have independent spring mechanism controlling it
   8. 2-3/4 inch (70 mm) backset

9. 9/16 inch (14 mm) throw latchbolt
10. Outside lever sleeve to be seamless, of one-piece construction made of a hardened steel alloy
11. Keyed lever to be removable only after core is removed, by authorized control key
12. Provide locksets with 7-pin removable and interchangeable core cylinders
13. Hub, side plate, shrouded rose, locking pin to be a one-piece casting with a shrouded locking lug.
14. Locksets outside locked lever must withstand minimum 1400 inch pounds of torque. In excess of that, a replaceable part will shear. Key from outside and inside lever will still operate lockset.
15. Core face must be the same finish as the lockset.
16. Functions and design as indicated in the hardware groups

E. Cylinders:
1. Provide the necessary cylinder housings, collars, rings & springs as recommended by the manufacturer for proper installation.
2. Provide the proper cylinder cams or tail piece as required to operate all locksets and other keyed hardware items listed in the hardware sets.
3. Coordinate and provide as required for related sections.

F. Door Closers shall:
1. Certified by BHMA for ANSI 156.4, Grade 1, cast iron.
2. UL10C certified
3. Provide 9001-Quality Management and 14001-Environmental Management.
4. Closer shall have extra-duty arms and knuckles
5. Conform to ANSI 117.1
6. Maximum 2 7/16 inch case projection with non-ferrous cover
7. Separate adjusting valves for closing and latching speed, and backcheck
8. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions
9. Full rack and pinion type closer with 1½“ minimum bore
10. Mount closers on non-public side of door, unless otherwise noted in specification
11. Closers shall be non-handed, non-sized and multi-sized.

H. Door Stops: Provide a dome floor or wall stop for every opening as listed in the hardware sets.
1. Wall stop and floor stop shall be wrought bronze, brass or stainless steel.
2. Provide fastener suitable for wall construction.
3. Coordinate reinforcement of walls where wall stop is specified.
4. Provide dome stops where wall stops are not practical. Provide spacers or carpet riser for floor conditions encountered

I. Over Head Stops: Provide a Surface mounted or concealed overhead when a floor or wall stop cannot be used or when listed in the hardware set.
1. Surface overhead stops shall be heavy duty bronze or stainless steel.

J. Kickplates: Provide with four beveled edges ANSI J102, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.

K. Door Bolts: Flush bolts for wood or metal doors.
1. Provide a set of Automatic bolts, Certified ANSI/BHMA 156.3 Type 25 for hollow metal label doors.

2. Provide a set of Automatic bolts, Certified ANSI/BHMA 156.3 Type 27 at wood label doors.
3. Manual flush bolts, Certified ANSI/BHMA 156.16 at openings where allowed local authority.
4. Provide Dust Proof Strike, Certified ANSI/BHMA 156.16 at doors with flush bolts without thresholds.

2.03 FINISH:

A. Designations used in Schedule of Finish Hardware - 3.5, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products

B. Powder coat door closer finish to be compatible with other hardware, unless otherwise noted.

C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

2.04 KEYS AND KEYING:

A. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.

B. Cylinders, **Sargent Restricted keyway to match City Keyway**. **No Substitutions**

C. Permanent keys and cores: Stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."

D. Transmit Grand Masterkeys, Masterkeys and other Security keys to Owner by Registered Mail, return receipt requested.

E. Furnish keys in the following quantities:
1. 1 each Grand Masterkeys
2. 4 each Masterkeys
3. 2 each Change keys each keyed core
4. 5 each Construction masterkeys
5. 3 each Construction Control keys

F. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.

G. Keying Schedule: Arrange for a keying meeting, with Architect Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying complies with project requirements. Furnish 3 typed copies of keying schedule to Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion.
1. Do not proceed until unsatisfactory conditions have been corrected.

3.02 HARDWARE LOCATIONS:

A. Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.
   1. Recommended Locations for Builder's Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).
   2. Recommended locations for Architectural Hardware for flush wood doors (DHI).
   3. WDMA Industry Standard I.S.-1A-04, Industry Standard for Architectural wood flush doors.

3.03 INSTALLATION:

A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

B. Conform to local governing agency security ordinance.

C. Install Conforming to ICC/ANSI A117.1 Accessible and Usable Building and Facilities.
   1. Adjust door closer sweep periods so that from the open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the landing side of the door.

D. Installed hardware using the manufacturers fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use “Riv-Nuts” or similar products.

3.04 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

A. Contractor/Installers, Field Services: After installation is complete, contractor shall inspect the completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.
   1. Check and adjust closers to ensure proper operation.
   2. Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.
      a. Verify levers are free from binding.
      b. Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.
   3. Report findings, in writing, to architect indicating that all hardware is installed and functioning properly. Include recommendations outlining corrective actions for improperly functioning hardware if required

3.05 SCHEDULE OF FINISH HARDWARE:

A. The following is a general listing of hardware requirements and is not intended to be a final hardware schedule. Any items of hardware required by good practice or to meet state and local codes shall be furnished whether or not specifically called out in the below listed groups.

3.06 SCHEDULE OF FINISH HARDWARE:

MATERIALS

Manufacturer's Index:

HA ..... HAGER
NO..... NORTON
PE ..... PEMKO
RO..... ROCKWOOD
YA ..... YALE SECURITY

Abbreviations:
Alum = Clear / Mill Aluminum
DW = Door Width
DH = Door Height
DOW = Door Opening Width
DOH = Door Opening Height
TBD = To Be Determined

HARDWARE SCHEDULE

SET 1		Door #: E2, E4	
Each To Have:			
HA	3 ea	Hinge	BB1279 4 ½" x 4 ½" NRP US26D
YA	1 ea	Exit Device	2100 x DW x 630
YA	1 ea	Exit Device Trim	AU446 x 626
NO	1 ea	Door Closer	8501 x 689
HA	1 ea	Kickplate	10" x 2" less DW x US32D
HA	1 ea	Weatherstrip	891SV x AL
HA	1 ea	Threshold	412S x AL
HA	1 ea	Door Sweep	756S x AL
HA	1 ea	Floor Stop	267F x US32D

SET 2		Door #: 106,	
Each To Have:			
HA	3 ea	Hinge	BB1279 4 ½" x 4 ½" US26D
YA	1 ea	Privacy Lockset	AU5302LN x US26D
HA	1 ea	Wall Stop	232W x US32D
HA	3 ea	Silencers	307D

SET 3		Door #: 104, 105,	
Each To Have:			
HA	3 ea	Hinge	BB1279 4 ½" x 4 ½" US26D
YA	1 ea	Lockset - Storeroom	AU5305LN x US26D
NO	1 ea	Door Closer	8501 x 689
HA	1 ea	Wall Stop	232W x US32D
HA	3 ea	Silencers	307D

SET 4		Door #: 103,	
Each To Have:			

HA	3 ea	Hinge	BB1279 4 ½" x 4 ½" US26D
YA	1 ea	Lockset	AU5307LN x US26D
HA	1 ea	Wall Stop	232W x US32D
HA	3 ea	Silencers	307D

SET 5		Door #: 102, 107	
Each To Have:			
HA	3 ea	Hinge	BB1279 4 ½" x 4 ½" US26D
YA	1 ea	Lockset – Classroom	AU5308LN x US26D
NO	1 ea	Door Closer	8501 x 689
HA	1 ea	Wall Stop	232W x US32D
HA	3 ea	Silencers	307D

SET 6		Door #: E3	
Each To Have:			
HA	6 ea	Hinge	BB1279 4 ½" x 4 ½" NRP US26D
YA	2 ea	Exit Device	2100 x DW x 630
YA	1 ea	Exit Device Trim	AU446 x 626
NO	1 ea	Door Closer	8501 x 689
YA	1 ea	Removable Mull	M200
HA	1 ea	Weatherstrip	891SV x AL
HA	1 ea	Threshold	412S x AL
HA	1 ea	Door Sweep	756S x AL
HA	1 ea	Floor Stop	267F x US32D

END OF SECTION

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SECTION 08 80 00
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

B. Section 08 43 13 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015.

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

F. ASTM C1036 - Standard Specification for Flat Glass; 2021.

G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

H. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.

I. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

J. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021.

K. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.

L. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.

M. GANA (GM) - GANA Glazing Manual; 2008.

N. GANA (SM) - GANA Sealant Manual; 2008.

O. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2017.

P. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014, with Errata (2017).

Q. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2017.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Submit two samples 6 by 6 inch in size of glass units.

E. Samples: Submit 6 inch long bead of glazing sealant, color as selected.

F. Certificate: Certify that products of this section meet or exceed specified requirements.

G. Manufacturer's qualification statement.

H. Installer's qualification statement.

I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Insulating Glass Units: One of each glass size and each glass type.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM) for glazing installation methods. Maintain one copy on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.07 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Products: Specific brand names used in drawings and specifications are used to establish design and quality standards, performance criteria, technical characteristics, or other salient requirements. It is not intended to restrict products that are equal to these characteristics. Products that clearly and demonstrably meet the requirements may also be acceptable.

B. Float Glass Manufacturers:
   1. AGC Glass North America, Inc: www.agcglass.com/#sle.
   2. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
   3. Guardian Glass, LLC: www.guardianglass.com/#sle.
   4. Pilkington North America Inc: www.pilkington.com/na/#sle.
   5. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.

6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Design Pressure: Calculated in accordance with ASCE 7.
   2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   3. Seismic Loads: Design and size glazing components to withstand seismic loads and sway displacement in accordance with the requirements of ASCE 7
   4. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   5. Glass thicknesses listed are minimum.

B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
   1. In conjunction with vapor retarder and joint sealer materials described in other sections.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
   2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
   3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
   4. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality - Q3, with color and performance characteristics as indicated.
   5. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category II impact test requirements.
   2. Polyvinyl Butyral (PVB) Interlayer: 0.030 inch thick, minimum.
   3. Where fully tempered is specified or required, provide glass that has been tempered by the tong-less horizontal method.
   4. Provide this type of glazing in the locations required by code.

C. Low E Glass: Float type, heat strengthened, clear.
   1. Coating on inner surface.
   2. Comply with ASTM C 1036, Type I, transparent flat, Quality Q3 (glazing select).
   3. Comply with ASTM C 1048.
   4. 6 mm minimum thick.

2.04 INSULATING GLASS UNITS

A. Manufacturers:
   1. Any of the manufacturers specified for float glass.

B. Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
   3. Metal Edge Spacers: Aluminum, bent and soldered corners.
   4. Spacer Color: Black.
   5. Edge Seal:
      a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
      b. Color: Black.
   6. Purge interpane space with dry air, hermetically sealed.

C. Insulating Glass Units: Vision glass, double glazed with Low-E coating.
   1. Basis of Design: Solar Ban 60 or equal.
   2. Applications: Exterior glazing unless otherwise indicated.
   3. Space between lites filled with air.
   4. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
      a. Tint: Clear.
   5. Inboard Lite: Annealed float glass, 1/4 inch thick, minimum.
      a. Tint: Clear.
   6. Total Thickness: 1 inch.

2.05 GLAZING COMPOUNDS

A. Glazing Putty: Polymer modified latex recommended by manufacturer for outdoor use, knife grade consistency; gray color.

B. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.06 ACCESSORIES

A. Setting Blocks: Neoprene, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
   1. Width: As required for application.
   2. Thickness: As required for application.
   3. Spacer Rod Diameter: As required for application.

D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that the minimum required face and edge clearances are being provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Verify that sealing between joints of glass framing members has been completed effectively.

E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - WET GLAZING METHOD (COMPOUND AND COMPOUND)

A. Application - Interior Glazed: Set glazing infills from the interior of the building.

B. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 24 inch centers, kept 1/4 inch below sight line.

C. Locate and secure glazing pane using glazers' clips.

D. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

3.06 FIELD QUALITY CONTROL

A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

B. Monitor and report installation procedures and unacceptable conditions.

3.07 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove non-permanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.08 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 09 05 61
COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
   1. Fluid-Applied Flooring.

B. Preparation of new concrete floor slabs for installation of floor coverings.

C. Testing of concrete floor slabs for moisture and alkalinity (pH).

D. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
   1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

E. Patching compound.

F. Remedial floor coatings.

1.02 RELATED REQUIREMENTS

A. Section 01 22 00 - Unit Prices: Bid pricing for remediation treatments if required.

B. Section 01 40 00 - Quality Requirements: Additional requirements relating to testing agencies and testing.

C. Section 03 30 00 - Cast-in-Place Concrete: Limitations on curing requirements for new concrete floor slabs.

1.03 PRICE AND PAYMENT PROCEDURES

A. Alternate for Alternate Flooring Adhesive: Do not include the cost of the alternate adhesive in the base bid; state on the bid form the total additional cost for the alternate adhesive, installed, in the event such remediation is required.

B. Alternate for Remedial Floor Coating or Sheet Membrane: Do not include the cost of floor coating or underlayment in the base bid; state on the bid form the total additional cost for the floor coating, installed, in the event such remediation is required.

1.04 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2020b.

B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete; 2020.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2019, with Editorial Revision (2020).

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.

E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

F. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2011.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.06 SUBMITTALS

A. Visual Observation Report: For existing floor coverings to be removed.

B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and alkalinity (pH) limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.

C. Testing Agency's Report:
   1. Description of areas tested; include floor plans and photographs if helpful.
   2. Summary of conditions encountered.
   3. Moisture and alkalinity (pH) test reports.
   4. Copies of specified test methods.
   5. Recommendations for remediation of unsatisfactory surfaces.
   6. Include certification of accuracy by authorized official of testing agency.
   7. Submit report to Architect.
   8. Submit report not more than two business days after conclusion of testing.

D. Adhesive Bond and Compatibility Test Report.

E. Copy of RFCI (RWP).

1.07 QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.

B. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.

C. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
   1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.

D. Contractor's Responsibility Relating to Independent Agency Testing:
   1. Provide access for and cooperate with testing agency.
   2. Confirm date of start of testing at least 10 days prior to actual start.
   3. Allow at least 4 business days on site for testing agency activities.
   4. Achieve and maintain specified ambient conditions.
   5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

E. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer’s instructions and recommendations.

B. Deliver materials in manufacturer’s packaging; include installation instructions.

C. Keep materials from freezing.

1.09 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
   1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
   2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
   3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.

B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.

C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
   1. Thickness: As required for application and in accordance with manufacturer's installation instructions.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:
   1. Preliminary cleaning.
   2. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
   3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
   4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
   5. Specified remediation, if required.
   6. Patching, smoothing, and leveling, as required.
   7. Other preparation specified.
   8. Adhesive bond and compatibility test.
   9. Protection.

B. Remediations:
   1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
   2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
   3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the

level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

3.03 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F1869 and as follows.

D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.

F. Report: Report the information required by the test method.

3.04 INTERNAL RELATIVE HUMIDITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F2170 Procedure A and as follows.

D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.

F. Report: Report the information required by the test method.

3.05 ALKALINITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.

1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
3. Use of a digital pH meter with probe is acceptable; follow meter manufacturer's instructions.

C. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.06 PREPARATION

A. See individual floor covering section(s) for additional requirements.

B. Comply with requirements and recommendations of floor covering manufacturer.

C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

D. Do not fill expansion joints, isolation joints, or other moving joints.

3.07 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.08 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

3.09 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

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SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Metal channel ceiling framing.

D. Gypsum sheathing.

E. Cementitious backing board.

F. Gypsum wallboard.

G. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 05 40 00 - Cold-Formed Metal Framing: Structural steel stud framing.

C. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

D. Section 07 21 00 - Thermal Insulation: Acoustic insulation.

E. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2018.

B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2016).

C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017.

D. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board; 2004 (Reapproved 2020).

E. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2018.

F. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

G. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2020.

H. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2020.

I. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2019.

J. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2019.

K. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

L. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.

M. GA-216 - Application and Finishing of Gypsum Panel Products; 2018.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

E. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

F. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing.

PART 2 PRODUCTS

2.01 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. ClarkDietrich: www.clarkdietrich.com/#sle.
   2. Marino: www.marinoware.com/#sle.
   3. Phillips Manufacturing Co: www.phillipsmfg.com/#sle.
   4. Steel Construction Systems: www.steelconsystems.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Non-structural Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
   1. Studs: C-shaped with flat or formed webs with knurled faces.
   2. Runners: U shaped, sized to match studs.
   3. Ceiling Channels: C-shaped.

C. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.

D. Non-structural Framing Accessories:
   1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

2.02 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum Company: www.americangypsum.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/#sle.
   3. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
   4. National Gypsum Company: www.nationalgypsum.com/#sle.
   5. USG Corporation: www.usg.com/#sle.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.

3. Thickness:
    a. Vertical Surfaces: 5/8 inch.
    b. Ceilings: 5/8 inch.
4. Special Fire Resistant Type: "Type C" meeting and exceeding requirements of Type X; UL or WH rated.
    a. Application: Where indicated.
    b. Thickness: 1/2 inch; 5/8 inch; and 1-inch, as indicated.
    c. Edges Tapered.
5. Paper-Faced Products:
    a. CertainTeed Corporation; Type X Drywall: www.certainteed.com/#sle.
    b. Georgia-Pacific Gypsum; ToughRock Fireguard X: www.gpgypsum.com/#sle.
    c. National Gypsum Company; Gold Bond BRAND Fire-Shield Gypsum Board: www.nationalgypsum.com/#sle.
    d. USG Corporation; USG Sheetrock Brand Firecode X Panels: www.usg.com/#sle.
    e. Substitutions: See Section 01 60 00 - Product Requirements.

C. Backing Board For Wet Areas: One of the following products:
1. Application: Surfaces behind tile in wet areas including tub and shower surrounds, shower ceilings, and as recommended behind epoxy coated walls.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
    a. Thickness: 1/2 inch.
    b. Products:
        1) Custom Building Products: www.custombuildingproducts.com/#sle.
        2) National Gypsum Company; PermaBase Cement Board: www.nationalgypsum.com/#sle.
        3) USG Corporation: www.usg.com/#sle.
        4) Substitutions: See Section 01 60 00 - Product Requirements.

D. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
1. Application: Vertical surfaces behind thinset tile, except in wet areas.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Type X Thickness: 5/8 inch.
4. Edges: Tapered.
5. Products:
    a. American Gypsum Company; M-Bloc Type X: www.americangypsum.com/#sle.
    b. Georgia-Pacific Gypsum; DensArmor Plus: www.gpgypsum.com/#sle.
    c. National Gypsum Company; Gold Bond XP Gypsum Board: www.nationalgypsum.com/#sle.
    d. Substitutions: See Section 01 60 00 - Product Requirements.

E. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
2. Thickness: 5/8 inch.
3. Edges: Tapered.
4. Products:
    a. Georgia-Pacific Gypsum; ToughRock Span 24 Ceiling Board: www.gpgypsum.com/#sle.
    b. USG Corporation; 1/2 Inch Sheetrock Brand UltraLight Panels: www.usg.com/#sle.

c. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 GYPSUM WALLBOARD ACCESSORIES

A. Acoustic Insulation: As specified in Section 07 21 00.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
   1. Types: As detailed or required for finished appearance.
   2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.

D. Joint Accessories: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
   1. Expansion Control Joints:
      a. Type: V-shaped PVC with tear away fins.

E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
   2. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
   3. Joint Compound: Drying type, vinyl-based, ready-mixed.
   4. Joint Compound: Setting type, field-mixed.

F. Finishing Compound: Surface coat and primer, takes the place of skim coating.

G. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

H. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

I. Nails for Attachment to Wood Members: ASTM C514.

J. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
   1. Level ceiling system to a tolerance of 1/1200.
   2. Laterally brace entire suspension system.
   3. Install bracing as required at exterior locations to resist wind uplift.

C. Studs: Space studs at 16 inches on center.
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   3. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Blocking: Install wood blocking for support of:
   1. Framed openings.
   2. Wall-mounted cabinets.
   3. Plumbing fixtures.
   4. Toilet partitions.
   5. Toilet accessories.
   6. Wall-mounted door hardware.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.04 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

D. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

E. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

F. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For nonrated assemblies, install as follows:
   1. Single-Layer Applications: Screw attachment.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
   2. At exterior soffits, not more than 30 feet apart in both directions.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 3: Walls to receive textured wall finish.
   3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
   4. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.
   2. Taping, filling, and sanding are not required at base layer of double-layer applications.

E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.07 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 67 00
FLUID-APPLIED FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid-applied seamless monolithic aggregate polymer flooring, including waterproof membrane and base.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available; and installation details.

C. Samples: Submit two samples, 4 by 4 inch in size illustrating color and pattern for each floor material for each color specified.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and application rate for each coat.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Top Coat Materials: 2 gallons.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section.
   1. Minimum 5 years of documented experience.
   2. Approved by manufacturer.

C. Supervisor Qualifications: Trained by product manufacturer , under direct full time supervision of manufacturer's own foreman.

1.05 MOCK-UP

A. Construct mock-up(s) of fluid applied flooring to serve as basis for evaluation of texture and workmanship.
   1. Number of Mock-Ups to be Prepared: One.
   2. Use same materials and methods for use in the work.
   3. Locate where directed.
   4. Minimum Size: 48 inches by 48 inches.

B. Obtain approval of mock-up by Architect before proceeding with work.

C. Approved mock-up may remain as part of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store resin materials in a dry, secure area.

B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.07 FIELD CONDITIONS

A. Maintain minimum temperature in storage area of 55 degrees F.

B. Store materials in area of installation for minimum period of 24 hours prior to installation.

C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fluid-Applied Flooring:
   1. Tnemec; www.tnemec.com.
   2. Desco Coatings; www.descocoatings.com.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FLUID-APPLIED FLOORING SYSTEMS

A. Basis of Design Products: Specific brand names used in drawings and specifications are used to establish design and quality standards, performance criteria, technical characteristics, or other salient requirements. It is not intended to restrict products that are equal to these characteristics. Products that clearly and demonstrably meet the requirements may also be acceptable.

B. Polyurethane Modified Concrete (EP-1)
   1. Base Coat
      a. Basis of Design: Tnemec Ultra-Tread S Series 242: www.tnemec.com.
      b. Slurry applied floor topping broadcast with colored quartz.
      c. Color to be selected from manufacturer's standard color line.
      d. Installed at 3/8 inch mininum thickness.
   2. Top Coat
      a. Basis of Design: Tnemec SatinGlaze Series 285: www.tnemec.com.
      b. Modified Polyamine Epoxy.
      c. Clear finish.
      d. Orange Peel Finish.
      e. Installed at 6.0 mils thick.

C. Minimum Performance Characteristics:
   1. Cure Time at 75 degrees F.: 24 Hours.

2.03 ACCESSORIES

A. Divider Strips: Zinc, 1/8 inch thick, height to match flooring thickness, with anchoring features; color as selected.

B. Control Joint Strips: Match divider strips; 1/16 inch nominal width, 1/8 inch wide neoprene filler strip between side strips, with anchoring features, strip height to suit flooring thickness.

C. Base Caps, and Separator Strips: Match divider strips, with projecting base of 1/8 inch.

D. Cant Strips: Molded of flooring resin material.

E. Subfloor Filler: Epoxy; type recommended by flooring material manufacturer.

F. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.

G. Transition to other floors - 1/8" zinc strips to be used to transition to other floor systems such as carpet or sealed concrete.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive flooring.

C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.

D. Verify that wood subfloors have 12 percent maximum moisture content.

3.02 PREPARATION

A. Perform preparation and cleaning procedures in compliance with flooring system manufacturer's instructions and for substrate conditions involved. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Prepare concrete floors as recommended by the manufacturer.

C. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.

D. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.

E. Vacuum clean substrate.

F. Prime Coat: Apply primer over properly prepared substrate as recommended by manufacturer spreading rate with timing of application coordinated with subsequent application of topping mix to insure optimum adhesion between flooring materials and substrate.

G. Apply primer to surfaces required by flooring manufacturer.

3.03 INSTALLATION - ACCESSORIES

A. Accurately saw cut substrate to install divider strips.

B. Install strips straight and level.

C. Install cant strips at base of walls where flooring is to be extended up wall as base.

D. Install base divider strips to match floor pattern. Install terminating cap strip at top of base; attach securely to wall substrate.

3.04 MATERIALS PREPARATION

A. Carefully mix and prepare materials used in resinous flooring system in compliance with manufacturer's instructions.

3.05 INSTALLATION - FLOORING

A. Apply in accordance with manufacturer's instructions.

B. Apply each coat to minimum thickness required by manufacturer.

C. Finish to smooth level surface.

D. Hand-Trowled Application

1. Apply hand-troweled resinous flooring system in compliance with manufacturer's directions to produce a minimum 1/8 inch thick, dense, uniform, non-slip, monolithic wearing surface, uninterrupted, except at divider strips and joints indicated or required.
2. Trowel apply base coat mix including quarts aggregates over freshly applied primer in number of coats and at spreading rates required to product minimum thickness indicated. Check thickness at frequent and regular intervals by method recommended by manufacturer. Perform finish troweling as work proceeds. Finished surface to be uniform

and free of trowel marks.

3. Provide additional thickness as required to provide positive slope to drains.
4. Texture as approved from submittal sample.

E. Cove Base: Apply floor system to wall surfaces at locations indicated to form base with cove of 3/4 inch radius and a height of 4 inches, unless otherwise indicated. Round all interior and external corners. Provide thinset type divider strips parallel to wall.

F. Sealer: After base coat has cured sufficiently, apply sealer of type required in number of coats and at spreading rates recommended by manufacturer.

G. Joints: Where substrate is interrupted by expansion or control joints, provide joint in epoxy flooring to comply with recommendations of flooring system manufacturer.

3.06 PROTECTION

A. Cure flooring system materials in compliance with manufacturer's directions, taking care to prevent their contamination during stages of application and prior to completion of curing process.

B. Protect epoxy flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose comply with manufacturer's recommendations for protective materials and the method of their application. Remove temporary covering just prior to cleaning for final inspections.

C. Clean flooring system just prior to final inspections. Use materials and procedures recommended by flooring manufacturer.

D. Prohibit traffic on floor finish for 48 hours after installation.

E. Barricade area to protect flooring until fully cured.

END OF SECTION

SECTION 09 77 00
FIBERGLASS REINFORCED WALL PANELS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Prefinished polyester glass reinforced plastic sheets and adhered to unfinished gypsum wallboard.
   1. PVC trim.

B. Products Not Furnished or Installed under This Section:
   1. Gypsum Cementitious substrate board.
   2. Resilient Base.

1.02 RELATED SECTIONS

A. Section 09 21 16 – Gypsum Board Assemblies - substrate board.

B. Section 05 40 00 – Cold-Formed Metal Framing.

C. Section 09 90 00 – Painting and Coatings.

1.03 REFERENCES

A. American Society for Testing and Materials: Standard Specifications (ASTM)
   1. Izod Impact Strengths (ft #/in)
   2. Water Absorption (%)
   3. Tensile Strengths (psi) & Tensile Modulus (psi)
   4. Flexural Strengths (psi) & Flexural Modulus (psi)
   5. ASTM D 2583- Barcol Hardness
   6. ASTM D 5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
   7. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. Product Data: Submit sufficient manufacturer's data to indicate compliance with these specifications, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

B. Shop Drawings: Submit elevations of each wall showing location of paneling and trim members with respect to all discontinuities in the wall elevation.

C. Selection Samples: Submit manufacturer’s standard color pattern selection samples representing manufacturer's full range of available colors and patterns.

D. Samples for Verification: Submit appropriate section of panel for each finish selected indicating the color, texture, and pattern required.
   1. Submit complete with specified applied finish.
   2. For selected patterns show complete pattern repeat.
   3. Exposed Molding and Trim: Provide samples of each type, finish, and color.

E. Manufacturers Material Safety Data Sheets (MSDS) for adhesives, sealants and other pertinent materials prior to their delivery to the site.

1.05 QUALITY ASSURANCE

A. Conform to building code requirements for interior finish for smoke and flame spread requirements as tested in accordance with:

1. ASTM E 84 (Method of test for surface burning characteristics of building Materials)
    a. Wall Required Rating – Class C.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials factory packaged on strong pallets.

B. Store panels and trim lying flat, under cover and protected from the elements. Allow panels to acclimate to room temperature (range of 60 to 75°F) for 48 hours prior to installation.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Building are to be fully enclosed prior to installation with sufficient heat (70°) and ventilation consistent with good working conditions for finish work

B. During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.
    1. Provide ventilation to disperse fumes during application of adhesive as recommended by the adhesive manufacturer.

1.08 WARRANTY

A. Furnish one-year guarantee against defects in material and workmanship.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN MANUFACTURER

A. Marlite; 1 Marlite Drive, Dover, OH 44622. 800-377-1221 FAX (330) 343-4668 Email: info@marlite.com www.marlite.com.

B. Other acceptable manufacturers:
    1. Panolam FRP; Panolam Industries International, Inc.
    2. Crane Composites

C. Substitutions: Section 01 60 00 – Product Requirements

D. Product:
    1. Standard FRP

2.02 PANELS

A. Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D 5319.
    1. Dimensions:
        a. Thickness – 0.090 “ (2.29mm) nominal
        b. Width - 4'-0” (1.22m) nominal
        c. Length – 10’-0” (3.0m) nominal
    2. Tolerance:
        a. Length and Width: +/-1/8 “ (3.175mm)
        b. Square - Not to exceed 1/8 “ for 8 foot panels or 5/32 “ (3.96mm) for 10 foot panels

B. Properties: Resistant to rot, corrosion, staining, denting, peeling, and splintering.
    1. Flexural Strength - 1.7 x 104 psi per ASTM D 790.
    2. Flexural Modulus – 6.0 x 105 psi per ASTM D 790.
    3. Tensile Strength – 8.0 x 103 psi per ASTM D 638.
    4. Tensile Modulus – 9.43 x 105 psi per ASTM D 638.
    5. Water Absorption - 0.17% per ASTM D 570.
    6. Barcol Hardness (scratch resistance) of 30 as per ASTM D 2583.
    7. Izod Impact Strength of 7.0 feet lbs./in ASTM D 256

C. Back Surface: Smooth. Imperfections which do not affect functional properties are not cause for rejection.

D. Front:
   1. Finish: Pebbled.
   2. Color: To Be Selected
   3. Fire Rating: Class C

E. Size:
   1. 48” x 120”

2.03 MOLDINGS

A. PVC Trim: Thin-wall semi-rigid extruded PVC.
   1. M 350 Inside Corner, 10’ length
   2. M 360 Outside Corner, 10’ length
   3. M 365 Division, 10’ length
   4. M 370 Edge, 10’ length
   5. V 177 135° Inside Corner White only
   6. V 179 135° Outside Corner White only
   7. Color: To Be Selected

B. Outside Corner Guard:
   1. M 961 PVC Outside Corner Guard
      a. Color: To Be Selected, 10’ length

2.04 ACCESSORIES

A. Fasteners: Non-staining nylon drive rivets.
   1. Match panel colors.
   2. Length to suit project conditions.

B. Adhesive: Either of the following construction adhesives complying with ASTM C 557.
   1. Marlite C-551 FRP Adhesive - Water- resistant, non-flammable adhesive.
   2. Marlite C-915 Construction Adhesive - Flexible, water-resistant, solvent based adhesive, formulated for fast, easy application.
   3. Titebond Advanced Polymer Panel Adhesive – VOC compliant, non-flammable, environmentally safe adhesive.

C. Sealant:
   1. Marlite Brand MS-250 Clear Silicone Sealant.
   2. Marlite Brand MS-251 White Silicone Sealant.
   3. Marlite Brand - Color Match Sealant.

PART 3 EXECUTION

3.01 PREPARATION

A. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.
   1. Verify that stud spacing does not exceed 24” (61cm) on-center.

B. Repair defects prior to installation.
   1. Level wall surfaces to panel manufacturer’s requirements. Remove protrusions and fill indentations.

3.02 INSTALLATION

A. Comply with manufacturer's recommended procedures and installation sequence.

B. Cut sheets to meet supports allowing 1/8” (0.12 inch) clearance for every 8 foot of panel.
   1. Cut and drill with carbide tipped saw blades or drill bits, or cut with shears.
   2. Pre-drill fastener holes 1/8” (3mm) oversize with high speed drill bit.

a. Space at 8” (200mm) maximum on center at perimeter, approximately 1” from panel edge.
b. Space at in field in rows 16’ (40.64cm) on center, with fasteners spaced at 12” (1 feet) maximum on center.

C. Apply panels to board substrate, above base, vertically oriented with seams plumb and pattern aligned with adjoining panels.
1. Install panels with manufacturer's recommended gap for panel field and corner joints.
a. Adhesive trowel and application method to conform to adhesive manufacturer’s recommendations.
b. Drive fasteners for snug fit. Do not over-tighten.

D. Apply panel moldings to all panel edges using silicone sealant providing for required clearances.
1. All moldings must provide for a minimum 1/8 “(3mm) of panel expansion at joints and edges, to insure proper installation.
2. Apply sealant to all moldings, channels and joints between the system and different materials to assure watertight installation.

3.03 CLEANING

A. Remove excess sealant from panels and moldings. Wipe panel down using a damp cloth and mild soap solution or cleaner.

B. Refer to manufacturer's specific cleaning recommendations Do not use abrasive cleaners.

END OF SECTION

SECTION 09 90 00
PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Interior painting and coating systems.

C. Exterior painting and coating systems.

D. Scope:

1. Finish surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
    a. Exterior:
        1) Masonry: Concrete masonry units or concrete brick.
        2) Metal: Aluminum, galvanized.
        3) Metal, Miscellaneous: Iron, ornamental iron, structural iron and steel, and other ferrous metal.
        4) Wood: Siding, trim, shutters, sashes, and hardboard-bare/primed.
        5) Drywall: Gypsum board and exterior drywall.
    b. Interior:
        1) Concrete Masonry Units: Concrete, split face, scored, smooth, high density, low density, and fluted.
        2) Metal: Aluminum and galvanized.
        3) Metal, Galvanized: Ceilings and ductwork.
        4) Metal: Structural steel columns, joists, trusses, beams, miscellaneous and ornamental iron, structural iron, and other ferrous metal.
        5) Wood: Walls, ceilings, doors, and trim.
        6) Drywall: Walls, ceilings, gypsum board, and similar items.
2. Do not paint or finish the following:
    a. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
    b. Items indicated to receive other finishes.
    c. Items indicated to remain unfinished.
    d. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
    e. Non-metallic roofing and flashing.
    f. Stainless steel, anodized aluminum, bronze, terne, and lead items.
    g. Marble, granite, slate, and other natural stones.
    h. Floors, unless specifically so indicated.
    i. Ceramic and other tiles.
    j. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
    k. Exterior insulation and finish system (EIFS).
    l. Glass.
    m. Concrete masonry in utility, mechanical, and electrical spaces.
    n. Acoustical materials, unless specifically so indicated.
    o. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 05 50 00 - Metal Fabrications: Shop-primed items.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Product characteristics: Provide a list of required coating materials. Cross-reference each product to paint system, and locations of applications areas. Identify each material by manufacturer's catalog number. Use the same designations indicated on drawings and in schedules.
   2. Surface preparation instructions and recommendations.
   3. Primer requirements and finish specification.
   4. Storage and handling requirements and recommendations.
   5. Application methods.
   6. Clean-up information.

C. Samples: Submit four paper draw down samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified and sheen of topcoat.

D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

E. Applicator's qualification statement.

F. Maintenance Data: Submit coating maintenance manual including finish schedule showing where each product/color/finish was used, product technical data sheets, safety data sheets (SDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
   3. Label each container with color in addition to manufacturer's label.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience and approved by manufacturer.

B. Paint Coordination: Use block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

C. Regulatory Requirements: Comply with applicable codes and regulations of governmental agencies having jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this specification, comply with the more stringent provisions.
   1. Regulatory changes may affect the formulation, availability or use of specified coatings. Confirm availability of coatings to be used.

1.06 SHEENS AND GLOSSES

A. Paints are available in a wide range of sheens or glosses, as measured by a gloss meter from a 60 and/or 85 degree angle from vertical, as a percentage of the amount of light that is reflected. The following terms are used to describe the gloss of our products. The list below is provided for general guidance; refer to the technical data sheet for the actual gloss/sheen level for each product.
   1. Flat - Less than 5 Percent.

2. Eggshell - 5 - 20 Percent.
3. Satin - 20 - 35 Percent.
4. Semi-Gloss - 30 - 65 Percent.
5. Gloss - Over 65 Percent.

1.07 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for general requirements for mock-ups.

B. Provide one accent wall as directed by Architect to demonstrate color and finish.

C. Locate where directed by Architect.

D. Mock-up may remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, product name, product code, color designation, VOC content, batch date, environmental handling, surface preparation, application, and use instructions.

C. Paint Materials: Store at a minimum of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

D. Handling: Maintain a clean, dry storage area to prevent contamination or damage to materials.

E. Disposal:
1. Never pour leftover coating down any sink or drain. Use up material on the job or seal can and store safely for future use.
2. Do not incinerate closed containers.
3. For specific disposal or recycle guidelines, contact the local waste management agency or district. Recycle whenever possible.

1.09 FIELD CONDITIONS

A. Do not apply materials when environmental conditions are outside the ranges required by manufacturer.

B. Follow manufacturer's recommended procedures for producing the best results, including testing substrates, moisture in substrates, and humidity and temperature limitations.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
1. Farrell-Calhoun Paint, 221 E. Carolina Avenue, Memphis, TN 38126.
2. Benjamin Moore and Co: 101 Paragon Dr ; Montvale, NJ 07645; Toll Free Tel: 866-708-9181; Email: info@benjaminmoore.com; Web:www.benjaminmoore.com.
3. Sherwin Williams www.sherwin-williams.com/#sle.

2.02 PAINTINGS AND COATINGS

A. Material Quality: Provide manufacturer's best quality material of the coating types specified. Provide paints and coatings capable of being readily and uniformly dispersed to complete homogeneous mixture. Provide paints that exhibit good flow and brushing properties and are capable of drying or curing free of streaks and sags.
1. Provide factory-mixed coatings unless otherwise indicated.
2. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application.
3. Do not reduce, thin, or dilute coatings or add materials to coatings unless specifically indicated in manufacturer's instructions.

B. Volatile Organic Compound (VOC) Content:
   1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
      b. Architectural coatings VOC limits of State in which the project is located.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site, or other method acceptable to authorities having jurisdiction.

C. Compatibility: Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

D. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

E. Colors: Provide color samples provided by manufacturer of paint system approved for use. Match approved samples for color, texture and coverage.

2.03 PAINT SYSTEMS - EXTERIOR

A. Masonry: Concrete masonry units (CMU), cinder or concrete block.
   1. Latex Systems:
      a. Flat Finish: Sherwin Williams:
         1) Prime Coat: SW PrepRite Block Filler, B25W25: www.sherwin-williams.com/#sle.
         2) 2nd and 3rd Coat: SW A-100 Exterior Latex Flat, A6 Series: www.sherwin-williams.com/#sle.
      b. Flat Finish: Farrell-Calhoun
         1) Prime Coat: FC Interior/Exterior Latex Masonry Block Filler 470 or 470A.
         2) 2nd and 3rd Coat: FC 100% Acrylic Exterior Flat Latex 200 Line.
      c. Flat Finish: Benjamin Moore
         1) Prime Coat: Coronado Super Kote 5000 Production Block Filler 958-11 (35 g/L), MPI # 4, X-Green 4, LEED V4, CHPS Certified.
         2) 2nd and 3rd Coat: Coronado Cryli Cote 100% Acrylic Flat House & Trim Paint 10 (44 g/L), MPI # 10.

B. Metal: Aluminum, Galvanized.
   1. Latex Systems:
      a. Semi-Gloss Finish: Sherwin Williams
         1) Prime Coat:
         2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Acrylic Semi-Gloss, B66-650 Series: www.sherwin-williams.com/#sle.
      b. Gloss Finish: Farrell Calhoun
         1) Prime Coat: Primer, latex, interior/exterior: FC 100% Acrylic All Purpose DTM Primer 5-56.
         2) 2nd and 3rd Coat: Latex, exterior, gloss: FC 100% Acrylic Exterior Gloss Enamel 2400 Line
      c. Semi-Gloss Finish: Benjamin Moore
         1) Prime Coat: Ultra Spec HP Acrylic DTM Semi-Gloss Enamel HP29 (147 g/L), MPI # 141, X-Green 141, 153, X-Green 153, LEED 2009.
         2) 2nd and 3rd Coat: Ultra Spec HP Acrylic DTM Semi-Gloss Enamel HP29 (147 g/L), MPI # 141, X-Green 141, 153, X-Green 153, LEED 2009.
   2. Alkyd Systems, Water-Based:

a. Semi-Gloss Finish: Sherwin Williams
    1) Prime Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series: www.sherwin-williams.com/#sle.
    2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Water Based Alkyd Urethane Enamel Semi-Gloss, B53-1150 Series: www.sherwin-williams.com/#sle.
b. Gloss Finish: Farrell Calhoun
    1) Prime Coat: Primer, latex, interior/exterior - FC 100% Acrylic All Purpose DTM Primer 5-56.
    2) 2nd and 3rd Coat: Alkyd, interior/exterior, gloss - FC Tuff-Boy Industrial Gloss Enamel 800 Line.

C. Metal, Miscellaneous: Iron, ornamental iron, structural iron and steel, ferrous metal.
1. Latex Systems:
    a. Semi-Gloss Finish: Sherwin Williams
        1) Prime Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series: www.sherwin-williams.com/#sle.
        2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Acrylic Semi-Gloss, B66-650 Series: www.sherwin-williams.com/#sle.
    b. Semi-Gloss Finish: Farrell Calhoun
        1) Prime Coat: Primer, latex, interior/exterior - FC 100% Acrylic All Purpose DTM Primer 5-56.
        2) 2nd and 3rd Coat: Latex, exterior, gloss: FC 100% Acrylic Exterior Gloss Enamel 2400 Line.
    c. Semi-Gloss Finish: Benjamin Moore
        1) Prime Coat: Corotech Acrylic Metal Primer V110 (199 g/L), LEED Credit.
        2) 2nd and 3rd Coat: Benjamin Moore Ultra Spec HP D.T.M. Acrylic Semi-Gloss Enamel, HP29 (147 g/L), MPI # 141, X-Green 141, 153, X-Green 153, LEED 2009, LEED V4.

D. Wood: Siding, trim, shutters, sashes, and hardboard-bare/primed.
1. Latex Systems:
    a. Semi-Gloss Finish: Sherwin Williams
        1) Prime Coat: Sherwin-Williams Latex Wood Primer, B42W8041: www.sherwin-williams.com/#sle.
        2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Acrylic Semi-Gloss, B66-650 Series: www.sherwin-williams.com/#sle.
    b. Gloss Finish: Farrell Calhoun
        1) Prime Coat: Primer, latex, interior/exterior - FC 100% Acrylic Latex Undercoater 235.
        2) 2nd and 3rd Coat: Latex, exterior, gloss - FC 100% Acrylic Exterior Gloss Enamel 2400 Line.
    c. Semi-Gloss Finish: Benjamin Moore
        1) 1st Coat: Benjamin Moore Fresh Start High-Hiding All Purpose Primer 046 (44 g/L), MPI # 6, 17, X-Green 17, 39, 50, X-Green 50, 137, X-Green 137, LEED Credit, CHPS Certified.
        2) 2nd Coat: Benjamin Moore Ultra Spec HP D.T.M. Acrylic Semi-Gloss Enamel, HP29 (147 g/L), MPI # 141, X-Green 141, 153, X-Green 153, LEED 2009, LEED V4.

E. Drywall: Gypsum board - Exterior Drywall.
1. Latex Systems:
    a. Satin Finish: Sherwin Williams
        1) Prime Coat: Sherwin-Williams Latex Wood Primer, B42W8041: www.sherwin-williams.com/#sle.

2) 2nd and 3rd Coat: Sherwin-Williams A-100 Exterior Latex Satin, A82 Series: www.sherwin-williams.com/#sle.

b. Satin Finish: Farrell Calhoun
   1) Prime Coat: Primer, latex, interior/exterior - FC 100% Acrylic Latex Undercoater 235.
   2) 2nd and 3rd Coat: Latex, exterior, satin - FC Durashield 100% Acrylic Exterior Satin Enamel 3200 Line.

c. Satin Finish: Benjamin Moore
   1) Prime Coat: Benjamin Moore Fresh Start High-Hiding All Purpose Primer 046 (44 g/L), MPI # 6, 17, X-Green 17, 39, 50, X-Green 50, 137, X-Green 137, LEED Credit, CHPS Certified.
   2) 2nd and 3rd Coat: Benjamin Moore ben Exterior Low Luster 542 (45 g/l), MPI # 15.

2.04 PAINT SYSTEMS - INTERIOR

A. Masonry CMU: Concrete, split face, scored, smooth, high density, low density, and fluted.
   1. Epoxy Systems, Water-Based:
      a. Semi-Gloss Finish - Sherwin Williams:
         1) Prime Coat: Sherwin-Williams Loxon Block Surfacer, LX01W200: www.sherwin-williams.com/#sle.
         2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, K46 Series: www.sherwin-williams.com/#sle.
      b. Semi-Gloss Finish - Farrell Calhoun
         1) Prime Coat: Block filler, latex, interior/exterior - FC Interior/Exterior Latex Masonry Block Filler 470.
         2) 2nd and 3rd Coat: Latex, interior, semi-gloss - FC 100% Acrylic Semi-Gloss Latex Enamel 600 Line
      c. Eg-Shel/Low Luster Finish - Sherwin Williams:
         1) Prime Coat: Sherwin-Williams Loxon Block Surfacer, LX01W200: www.sherwin-williams.com/#sle.
         2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45 Series: www.sherwin-williams.com/#sle.
      d. Eg-Shel/Low Luster Finish - Farrell Calhoun
         1) Prime Coat: Block filler, latex, interior/exterior - FC Interior/Exterior Latex Masonry Block Filler 470.
         2) 2nd and 3rd Coat: FC Premium Latex Eggshell Enamel 370 Line.

B. Metal: Aluminum and galvanized.
   1. Latex Systems:
      a. Semi-Gloss Finish: Sherwin Williams
         1) Prime Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series: www.sherwin-williams.com/#sle.
         2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Acrylic Semi-Gloss, B66-650 Series: www.sherwin-williams.com/#sle.
      b. Semi-Gloss Finish: Farrell Calhoun
         1) Prime Coat: Primer, latex, interior/exterior - FC 100% Acrylic All Purpose DTM Primer 5-56.
         2) 2nd and 3rd Coat: FC 100% Acrylic Semi-Gloss Latex Enamel 600 Line.
      c. Semi-Gloss Finish: Benjamin Moore
         1) 1st Coat: Corotech Acrylic Block Filler V114 (43 g/L), LEED 2009.
         2) 2nd Coat: Corotech Pre-Catalyzed Waterborne Epoxy Semi-Gloss V341 (71 g/L), LEED 2009.

C. Metal, Galvanized: Ceilings and ductwork.
   1. Dryfall Waterborne Topcoats:
      a. Flat Finish: Sherwin Williams
         1) Prime Coat:
         2) 2nd and 3rd Coats: : Sherwin-Williams Pro Industrial Waterborne Acrylic Dryfall, B42-181 Series: www.sherwin-williams.com/#sle.
      b. Flat Finish: Farrell Calhoun
         1) Prime Coat: Primer, latex, interior/exterior - FC 100% Acrylic All Purpose DTM Primer 5-56.
         2) 2nd and 3rd Coats: FC Tuff-Boy Waterborne Flat Dry Fall 999 Line.
      c. Flat Finish: Benjamin Moore
         1) 1st Coat: Coronado Super Kote 5000 Dry Fall Latex Flat N110 (46 g/L), MPI # 118.
         2) 2nd and 3rd Coats: Coronado Super Kote 5000 Dry Fall Latex Flat N110 (46 g/L), MPI # 118.

D. Metal: Structural steel columns, joists, trusses, beams, miscellaneous and ornamental iron, structural iron, and ferrous metal.
   1. Latex Systems:
      a. Semi-Gloss Finish: Sherwin Williams
         1) Prime Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series: www.sherwin-williams.com/#sle.
         2) 2nd and 3rd Coats: Sherwin-Williams Pro Industrial Acrylic Semi-Gloss, B66-650 Series: www.sherwin-williams.com/#sle.
      b. Semi-Gloss Finish: Farrell Calhoun
         1) Prime Coat: Prime Coat: Primer, latex, interior/exterior - FC 100% Acrylic All Purpose DTM Primer 5-56.
         2) 2nd and 3rd Coats: FC 100% Acrylic Semi-Gloss Latex Enamel 600 Line.
      c. Semi-Gloss Finish: Benjamin Moore
         1) Prime Coat: Corotech Acrylic Metal Primer V110 (199 g/L), LEED Credit.
         2) 2nd and 3rd Coats: Corotech Pre-Catalyzed Waterborne Epoxy Semi-Gloss V341 (71 g/L), LEED 2009.
   2. Dryfall Waterborne Topcoat:
      a. Flat Finish: Sherwin Williams
         1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series: www.sherwin-williams.com/#sle.
         2) 2nd and 3rd Coats: Sherwin-Williams Pro Industrial Waterborne Acrylic Dryfall, B42-181 Series: www.sherwin-williams.com/#sle.
      b. Flat Finish: Farrell Calhoun
         1) Prime Coat: Primer, latex, interior/exterior - FC 100% Acrylic All Purpose DTM Primer 5-56.
         2) 2nd and 3rd Coats: Dry Fall, latex, interior, flat - FC Tuff-Boy Waterborne Flat Dry Fall 999 Line.
      c. Flat Finish: Benjamin Moore
         1) Prime Coat: Corotech Acrylic Metal Primer V110 (199 g/L), LEED Credit.
         2) 2nd and 3rd Coats: Coronado Super Kote 5000 Dry Fall Latex Flat N110 (46 g/L), MPI # 118.

E. Wood: Walls, ceilings, doors, and trim.
   1. Latex Systems:
      a. Semi-Gloss Finish: Sherwin Williams
         1) Prime Coat: Sherwin-Williams Multi-Purpose Int/Ext. Primer/Sealer, B51-450.

2) 2nd and 3rd Coats: Sherwin-Williams ProClassic Waterborne Acrylic Semi-Gloss, B31 Series: www.sherwin-williams.com/#sle.

b. Semi-Gloss Finish: Farrell Calhoun
1) Prime Coat: FC Waterborne 100% Acrylic Enamel Undercoater 699.
2) 2nd and 3rd Coats: Latex, interior, semi-gloss - FC 100% Acrylic Semi-Gloss Latex Enamel 600 Line.

c. Semi-Gloss Finish: Benjamin Moore
1) Prime Coat: Benjamin Moore Fresh Start Multi-Purpose Primer N023 (44 g/L), MPI # 6, 17, X-Green 17, 39, 137, X-Green 137, LEED Credit, CHPS Certified.
2) 2nd and 3rd Coats: Coronado Rust Scat Waterborne Acrylic Semi-Gloss 90 (134 g/L), MPI # 153, LEED Credit.

2. Alkyd Systems, Water-Based:
a. Semi-Gloss Finish: Sherwin Williams
1) Prime Coat: Sherwin-Williams Multi-Purpose Int/Ext. Primer/Sealer, B51-450.
2) 2nd and 3rd Coats: Sherwin-Williams Pro Industrial Water Based Alkyd Urethane Enamel Semi-Gloss, B53-1150 Series: www.sherwin-williams.com/#sle.

b. Semi-Gloss Finish: Farrell Calhoun
1) Prime Coat: Primer, alkyd, interior - FC Alkyd Enamel Undercoater 599.
2) 2nd and 3rd Coats: Alkyd , interior, semi-gloss - FC Alkyd Semi-Gloss Enamel 500 Line.

c. Semi-Gloss Finish: Benjamin Moore
1) Prime Coat: Benjamin Moore Fresh Start Multi-Purpose Primer N023 (44 g/L), MPI # 6, 17, X-Green 17, 39, 137, X-Green 137, LEED Credit, CHPS Certified.
2) 2nd and 3rd Coats: Benjamin Moore Advance Waterborne Interior Alkyd Semi-Gloss 793 (48g/L), LEED 2009, LEED V4, CHPS Certified.

3. Stain and Varnish System:
a. Satin Finish: Sherwin Williams
1) 1st Coat: Sherwin-Williams Minwax Performance Series Tintable Wood Stain 250 VOC: www.sherwin-williams.com/#sle.
2) 2nd and 3rd Coats: Sherwin-Williams Minwax Waterbased Oil-Modified Polyurethane: www.sherwin-williams.com/#sle.

b. Satin Finish: Farrell Calhoun
1) Stain Coat: Stain, waterborne, interior/exterior - FC Wood Kraft Waterborne Penetrating Wiping Stain 1500.
2) 2nd and 3rd Coats: Waterborne varnish, interior, satin - FC Wood Kraft WB Acrylic Polyurethane Varnish 1192.

c. Satin Finish: Benjamin Moore
1) 1st Coat: Lenmar Waterborne Interior Wiping Stain 1WB.1300 (240 g/L), MPI # 186 LEED Credit.
2) 2nd Coat: Lenmar Waterborne Aqua-Plastic Urethane Satin, 1WB.1427 (335 g/L), MPI # 121, 128.

F. Drywall: Walls, ceilings, gypsum board, and similar items.
1. Latex Systems:
a. Eg-Shel Finish: Sherwin Williams
1) 1st Coat: Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28W2600: www.sherwin-williams.com/#sle.
2) 2nd and 3rd Coat: Sherwin-Williams ProMar 200 Zero VOC Eg-Shel, B20-2600 Series: www.sherwin-williams.com/#sle.

b. Eg-Shel Finish: - Farrell Calhoun

1) Prime Coat: Primer, latex, interior - FC Perfik-Seal Latex Wall Primer/Sealer 380.
2) 2nd and 3rd Coat: FC Premium Latex Eggshell Enamel 370 Line

c. Eg-Shel Finish: - Benjamin Moore
1) Prime Coat: Benjamin Moore Ultra Spec 500 Interior Latex Primer N534 (0 g/L), MPI # 50, X-Green 50, 149, X-Green 149, LEED 2009, LEED V4, CHPS Certified.
2) 2nd and 3rd Coat: Benjamin Moore Ultra Spec 500 Latex Eggshell N538 (0 g/L), MPI # 52, X-Green 52, 145, X-Green 145, 139, X-Green 139, LEED 2009 LEED V4, CHPS Certified.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Do not begin application of coatings until substrates have been properly prepared and are ready to receive work as instructed by the product manufacturer.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Ensure that moisture-retaining substrates to receive coatings have moisture content within tolerances allowed by coating manufacturer, using moisture measurement techniques recommended by coating manufacturer. The maximum moisture content of substrates, when measured with an electronic moisture meter, are as follows:
1. Concrete: 12 %
2. Masonry (Clay and CMU): 12%
3. Wood: 15%
4. Gypsum Board: 12%
5. Plaster: 12%

3.02 PREPARATION

A. Comply with manufacturer's written instructions and recommendations.

B. Clean surfaces thoroughly and correct defects prior to application.

C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

D. Remove mildew from impervious surfaces by scrubbing with solution of water and bleach. Rinse with clean water and allow surface to dry.

E. Concrete:
1. Remove release agents, curing compounds, efflorescence, and chalk.
2. Fill bug holes, air pockets, and other voids with cement patching compound.

F. Masonry: Remove efflorescence and chalk.

G. Gypsum Board: Fill minor defects with filler compound; sand smooth and remove dust prior to painting.

H. Aluminum: Remove surface contamination and oil; wash with solvent according to SSPC-SP 1.

I. Galvanized Surfaces:
1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
2. Prepare surface according to SSPC-SP 2.

J. Ferrous Metal:
1. Solvent clean according to SSPC-SP 1.

2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Prime bare steel surfaces.
3. Remove rust, loose mill scale, and other foreign substances using methods recommended by paint manufacturer and blast cleaning according to SSPC-SP 6. Protect from corrosion until coated.

K. Wood: Remove dust, grit, and foreign matter. Scrape, sand, and spot prime knots and pitch streaks. Fill nail holes and imperfections with wood filler and sand smooth.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions.

C. Apply coatings at spread rate required to achieve manufacturer's recommended dry film thickness.

D. Regardless of number of coats specified, apply additional coats until complete hide is achieved.

3.04 PRIMING

A. Apply primer to all surfaces unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

B. Primers specified in painting schedules may be omitted on items factory primed or factory finished items if acceptable to top coat manufacturers.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

A. Protect finished coatings from damage until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 97 13.24

PROTECTIVE COATINGS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provision and application of coatings or finishes to the following structures and surfaces:
   1. All exterior above grade metal piping including valves, pumps, hand wheels, and stands.
   2. All interior masonry wall surfaces and floors.
   3. Metal doors and jams.
   4. Exterior below grade concrete walls of clear well.

1.02 QUALITY OF WORKMANSHIP

A. Employ only competent workmen who are skilled in this work.

B. Installer shall be trained and approved by material manufacturer to install this work.

1.03 SUBMITTALS

A. Submit specifications and color selections chips for selection and approval by Owner and Engineer prior to ordering.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original unopened containers bearing the name of the manufacturer.

B. Use care in handling materials to avoid damage.

C. Store only in areas where there is no danger of damage to the materials.

1.05 COORDINATION

A. Coordinate this work with work of other trades for timely installation and to preclude delays and interferences.

PART 2 - PRODUCTS

2.01 PROTECTIVE COATING SYSTEMS

A. The paint system in these specifications is manufactured by the Tnemec Company, Inc., Kansas City, Missouri.

B. The concrete water proofing system in this specification is manufactured by T.C. MiraDri a subsidiary of Royal Ten Cate (USA), Inc.

C. These products are specified to establish standards of quality and are approved for use on this project. Equivalent materials of other manufacturers are acceptable, providing they meet or exceed all performance criteria of the specified materials. No products shall be considered that would decrease the film thickness or offer a change in generic type of coating specified,

All materials shall be brought to the jobsite in the original sealed and labeled containers of the manufacturer. Field painting and waterproofing shall not be done during inclement weather or when the temperature is outside the range recommended by the manufacturer.

The Contractor shall submit to the Engineer/Owner immediately upon completion of the job, certification from the manufacturer indicating that the quantity of each coating purchased was sufficient to properly coat all surfaces.

2.02 PAINTING SURFACE PREPARATION

A. General Surface Preparation:

1. Dislodge dirt, rust, plaster nibs, mortar spatter and other dry material by scraping or brushing. Remove dust and loose material by brushing, sweeping, vacuuming or blowing with high pressureair.
2. Remove oil, wax and grease by scraping off heavy deposits and cleaning with mineral spirits or a hot trisodium phosphate solution followed by a water rinse.
3. Verify that surfaces to be coated are dry, clean and free of dust, dirt, oil, wax, grease or other contaminants.

B. Specific Surface Preparation:

1. Dense Concrete and Concrete Masonry Units:
   a. Allow new concrete and masonry to cure 28 days.

b. Scrape and grind fins and protrusions flush with surface.
c. Patch holes and cracks flush with surface.
d. Rake mortar joints clean.

2. Ferrous Metal:

a. For surfaces that have been factory primed or finished: Lightly sand and Hand or Power Tool Clean (SSPC-SP2 or SP3) failed, rusted and abraded areas.
b. All uncoated steel pipe and structural steel that is exposed shall be cleaned by Commercial Blast Cleaning (SSPC- SP6).

2.03 APPLICATION

A. General: Mixed, thin and apply materials according to manufacturer's instructions.

1. First coat for porous masonry surfaces, concrete and dense masonry shall be applied by suitable method to completely fill voids and surface irregularities.
2. Allow each coat to dry thoroughly before recoating. Follow manufacturer's recommended recoat times.
3. Cut edges clean and sharp where work joins other materials or colors.
4. Make finish coats smooth, uniform in color, and free of brush marks, laps, runs, dry spray, overspray and skipped or missed areas.

B. Application Requirements:

1. Request acceptance of surface preparation prior to applying the first coat.
2. Request acceptance of each coat before applying next coat.
3. Correct work that is not acceptable, and request reinspection.

2.04 PAINTING SCHEDULE

A. Paint Concrete and Masonry as follows:

1. Concrete Floor:

Surface Preparation: Shot blast or acid etch all laitance, surface contaminants and provide an anchor profile.
Primer: 1 coat TNEMEC Series 66-Color HI-Build Epoxoline at 200 sq. ft. per gallon (thinned 10 to 15%).

Intermediate Coat: 1 coat TNEMEC Series 66-Color HI-Build Epoxoline at 150 sq. Ft. per gallon.

Finish: 1 coat TNEMEC Series 291-Color CRU Polyurethane at 300 sq. Ft. per gallon.

2. Masonry Interior:

Surface Preparation: Level protrusions and mortar splatter, clean and dry, free from oil.

Primer: 1 coat TNEMEC Series 130-Color Envirofill at 80 sq. ft. per gallon.

Intermediate Coat: 1 coat TNEMEC Series 66-Color Hi-Build epoxoline at 150 sq. ft. per gallon.

Finish: 1 coat TNEMEC Series 66-Color Hi-Build epoxoline at 150 sq. ft. per gallon.

B. Paint Metal surfaces as follows:

1. Uncoated Steel Pipe, Equipment, and Exposed Structural Steel:

. Surface Preparation: Commercial Blast Cleaning (SSPC-SP6) all loose scale, rust, loose paint and other loose detrimental foreign matter.

Shop or Field Primer: 1 coat TNEMEC Series 66 HI-Build Epoxoline at 3.0 to 5.0 mils DFT.

. Finish: 1 coat TNEMEC Series 73-Color Endura-Shield at 3.0 to 5.0mil minimum DFT per coat.

2. Factory Primed or Finish Painted Fixtures:

Surface Preparation: Lightly sand factory finish. Hand or power Tool Clean (SSPC-SP2 or SP3) failed, rusted or abraded areas.

Spot Primer: 1 coat TNEMEC Series N27-Color F.C. TYPOXY at 2.0 to 3.0 mils DFT per coat.

Finish: 2 coats TNEMEC Series 66-Color Hi-Build Epoxoline 4.0 to 6.0 mils DFT per coat.

3. Metal Doors, Frames, Trim and Miscellaneous Equipment:

Surface Preparation: Lightly sand factory finish. Hand or power Tool Clean (SSPC-SP2 or SP3) failed, rusted or abraded areas.

Spot Primer: 1 coat TNEMEC Series N27-Color F.C. TYPOXY at 2.0 to 3.0 mils DFT per coat.

Finish: 2 coats TNEMEC Series 73-Color Endura-Shield at 4.0 to 6.0 mils DFT per coat.

4. Interior Exposed Ductile Iron Pipe

Surface Preparation (Precleaning): All surfaces shall be precleaned by scrubbing of the surface with stiff bristle brushes soaked in solvent to remove grease, oil and other soluble contaminants. Prior to evaporation remove solvent by wiping with clean, lint-free cloth rags. Remove rag residue, if any, with dry, oil free compressed air.

Surface Preparation (Final Cleaning): Remove all loose annealing oxides, loose rust, dirt and other foreign matter by compressed air nozzle abrasive blast cleaning. Any dust or other contaminants remaining after blasting shall be removed with dry oil compressed air or by vacuum cleaning. A profile thickness of at least 1.5 milsis required.

Primer Coating: Tnemec Series 66-1255 Beige Primer Hi-Build Epoxoline at 4.0 to 6.0 mils DFT.

Finish Coating: Tnemec Series 66-Color Hi-Build Epoxoline at 4.0 to 6.0 mils DFT.

2.05 WATERPROOFING

A. A waterproofing system shall be applied to the vertical exterior walls of the below ground concrete reservoir.

B. System manufacturer: TC MiraDRI, Norcross, Georgia, or approved manufacturer.

C. The waterproofing system shall be a two component system consisting of an application of MiraDRI 860 or approved equivalent followed by a protection course of MiraDRI 200V or approved equivalent.

PART 3 - EXECUTION

3.01 PAINT

A. Application:

1. Apply paints in strict accordance with manufacturer's instructions to obtain the specified film thicknesses.
2. No paint shall be applied when the surrounding air temperatures, as measured in the shade, is less than 40 degrees F., or when the surrounding air temperature is expected to fall below 35 degrees F. within 24 hours.
3. No paint shall be applied when the relative humidity exceeds 85 percent or is expected to exceed 85 percent within 24 hours.

B. Inspection

1. Painting work, including surface preparation and paint application, will be inspected by the Engineer or his representative.
2. Any deficiencies in the work noted by the Engineer or his representative shall be corrected at the Contractor's expense.

C. Owner's representative (Engineer) is to receive color chips of all paints and coatings. Selection of color shall be responsibility of owner's representative.

3.02 WATERPOOFING

A. Prepare surface and apply in strict accordance with manufacturer’s recommendations.

END OF SECTION

SECTION 10 14 00
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Room and door signs.

1.02 RELATED REQUIREMENTS

A. Section 26 51 00 - Interior Lighting: Exit signs required by code.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.

1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
3. Submit for approval by Owner through Architect prior to fabrication.

D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

F. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

D. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

E. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flat Signs:

1. Best Sign Systems, Inc: www.bestsigns.com/#sle.
2. Inpro: www.inprocorp.com/#sle.
3. Mohawk Sign Systems, Inc: www.mohawksign.com/#sle.
4. Seton Identification Products: www.seton.com/aec/#sle.
5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
1. Sign Type: Flat signs with engraved panel media as specified.
2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
3. Office Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings.
4. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
5. Rest Rooms: Identify with pictograms, the names "MEN", "WOMEN", and/or "UNISEX", and braille.

2.03 SIGN TYPES

A. Flat Signs: Signage media without frame.
1. Edges: Square.
2. Corners: Square.
3. Wall Mounting of One-Sided Signs: Tape adhesive.

B. Color and Font: Unless otherwise indicated:
1. Character Font: Helvetica, Arial, or other sans serif font.
2. Character Case: Upper case only.
3. Background Color: To be selected.
4. Character Color: Contrasting color.

2.04 ACCESSORIES

A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

B. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION

SECTION 10 14 14
BUILDING PLAQUES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Provide one (1) cast plaque and related mounting hardware to be installed by Contractor.

B. Provide logos for the Owner, Architect, and Contractor as part of the plaque layout. Owner, Architect and Contractor will provide a .jpg file of logo-mascot to Project Manager. Cost of any computer file conversion costs shall be paid by Contrctor.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate Submit scaled shop drawings showing fabrication method, finish, anchoring methods, layout and installation method.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in the schools name and registered with the manufacturer.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver cast plaque to project site in original shipping packaging.

B. Store cast plaque under cover and elevated above grade.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide five year manufacturer warranty for cast plaque and mounting hardware. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 CAST PLAQUE

A. Characteristics:
   1. Plaque Material: Bronze or Aluminum - to be selected
   2. Plaque Size: 24 inches tall by 24 inches wide.
   3. Letter Style: Helvetica Medium.
   4. Border Style: Style No. 504.
   5. Background Texture: Leatherette.
   6. Plaque Finish: To be selected.
   7. Plaque Mounting: Concealed mounting for masonry.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

3.03 TOLERANCES

A. Install cast plaque level, plumb, and at the height directed by Architect with surfaces free from dirtortion or other defects in appearances.

3.04 CLEANING

A. After installation, clean soiled cast plaque surfaces according to the manufacturer's instructions.

B. Protect installed cast plaque from damage until acceptance by the Owner.

3.05 SCHEDULES

A. Design and lettering for cast plaque to be provided by Architect.

END OF SECTION

SECTION 10 28 00
TOILET ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Commercial shower and bath accessories.

C. Utility room accessories.

1.02 REFERENCE STANDARDS

A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a (Reapproved 2019).

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

D. ASTM C1036 - Standard Specification for Flat Glass; 2021.

E. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2018.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Samples: Submit two samples of each accessory, illustrating color and finish.

D. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet Accessories:
   1. American Specialties, Inc: www.americanspecialties.com/#sle.
   2. Bradley Corporation: www.bradleycorp.com/#sle.
   3. Bobrick: www.bobrick.com.
   4. Substitutions: Section 01 60 00 - Product Requirements.

B. Provide products of each category type by single manufacturer.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. Keys: Provide two keys for each accessory to Owner; master key lockable accessories.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

F. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

G. Adhesive: Two component epoxy type, waterproof.

H. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

2.04 COMMERCIAL TOILET ACCESSORIES

A. Toilet Paper Holder: Double roll, surface mounted bracket type, stainless steel.
   1. Products:
      a. Basis of Design: Bobrick B-69997.
      b. Substitutions: Section 01 60 00 - Product Requirements.

B. Paper Towel Dispenser: Folded paper type, stainless steel, semi-recessed, with viewing slots on sides as refill indicator and tumbler lock.
   1. Capacity: 300 C-fold minimum.
   2. Products:
      a. Basis of Design: Bobrick B-262.
      b. Substitutions: Section 01 60 00 - Product Requirements.

C. Soap Dispenser: Liquid soap dispenser, wall-mounted, surface, with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gauge refill indicator.
   1. Minimum Capacity: 40 ounces.
   2. 20 ga. Type 304 stainless steel with satin finish.
   3. Corrosion-resistant valve shall dispense commercially marketed all-purpose hand soaps. To prevent corrosion, use only chloride-free pH-neutral liquid soaps. Valve shall be operable with one hand and with less than 5 pounds of force (22.2 N) to comply with accessible design guidelines (including ADAAG in U.S.A.).
   4. Products:
      a. Basis of Design: Bobrick B-4112.
      b. Substitutions: Section 01 60 00 - Product Requirements.

D. Mirrors: Stainless steel channel framed, 1/4 inch thick annealed float glass; ASTM C1036.
   1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503; guaranteed for 15 years against silver spoilage.
   2. Size: As indicated on drawings.
   3. Frame: 0.05 inchangle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
   4. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material. Back is protected by full-size, shock-absorbing, water-resistant, nonabrasive, polyethylene padding.
   5. Concealed Wall Hanger— For snap locking design: Heavy gauge steel construction. Incorporates upper and lower members, which engage backplate louvers to keep mirror against the wall. For "2S"-Tab design: Incorporates upper bracket engaging in upper louver and double sided tape below the bottom louver securing mirror to concealed wall hanger
   6. Products:
      a. Basis of Design: Bobrick B-165 2436.
      b. Substitutions: Section 01 60 00 - Product Requirements.

E. Grab Bars: Stainless steel, textured slip-resistant surface.
   1. Standard Duty Grab Bars:

a. Push/Pull Point Load: 250 pound-force, minimum.
b. Dimensions: 1-1/2 inch outside diameter, minimum 18 ga. wall thickness, concealed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
c. Finish: Satin.
d. Length and Configuration: As indicated on drawings.
e. Grab bar shall comply with accessible design (including ADAAG in the U.S.A.) for structural strength.
f. Products:
1) Basis of Design: Bobrick B-6806.
2) Substitutions: Section 01 60 00 - Product Requirements.

2.05 COMMERCIAL SHOWER AND BATH ACCESSORIES

A. Shower Curtain Rod: Stainless steel tube, 1 inch outside diameter, 0.04 inch wall thickness, satin-finished, with 3 inch outside diameter, minimum 0.04 inch thick satin-finished stainless steel flanges, for installation with exposed fasteners.
1. Products:
a. Basis of Design: B-207.
b. Substitutions: Section 01 60 00 - Product Requirements.

B. Shower Curtain:
1. Material: Opaque vinyl, 0.008 inch thick, matte finish, with antibacterial treatment, flameproof and stain-resistant.
2. Size: 36 by 72 inches, hemmed edges.
3. Grommets: Stainless steel; pierced through top hem on 6 inch centers.
4. Color: White.
5. Shower Curtain Hooks: Chrome-plated or stainless steel spring wire designed for snap closure.

C. Robe Hook: Heavy-duty stainless steel, single-prong, rectangular-shaped bracket and backplate for concealed attachment, satin finish.
1. Products:
a. Basis of Design: B-211.

2.06 UTILITY ROOM ACCESSORIES

A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
1. Drying rod: Stainless steel, 1/4 inch diameter.
2. Hooks: Two, 0.06 inch stainless steel rag hooks at shelf front.
3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
4. Length: 36 inches.
5. Products:
a. Basis of Design: B-239.
b. Substitutions: 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
   1. Grab Bars: As indicated on drawings.

3.03 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

SECTION 10 43 00
EMERGENCY AID SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Automated external defibrillators (AEDs).

B. Automated external defibrillator (AED) cabinets.

C. First aid cabinets.

D. Bleeding control cabinets.

E. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 DEFINITIONS

A. Automated External Defibrillator (AED): A Food and Drug Administration (FDA)-approved portable device, which automatically analyzes the heart rhythm and recognizes the presence of ventricular fibrillation and/or tachycardia. If defibrillation is warranted, the AED automatically charges and prompts (visual and/or audio) the operator to deliver an electrical shock.

1.04 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide AED operational features, color and finish, anchorage details, and installation instructions.

C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Maintenance Data: Include test schedules and recertification requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 AUTOMATED EXTERNAL DEFIBRILLATORS (AEDS)

A. Automated External Defibrillators (AEDs) - General: FDA approval required.
   1. Provide automated external defibrillators (AEDs) as indicated.

2.03 EMERGENCY AID CABINETS

A. Type: Automated external defibrillator (AED).

B. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.

C. Fire-Rated Cabinet Construction: One-hour fire rated.

D. Cabinet Configuration: Recessed type.
   1. Size to accommodate AED.
   2. Trim: Flat square edge.

E. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with wire pull handle and nylon catch. Hinge door for 180 degree opening with two butt hinges.

F. Door Glazing: Tempered glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.

G. Cabinet Mounting Hardware: Appropriate to cabinet, with predrilled holes for placement of anchors.

H. Fabrication: Weld, fill, and grind components smooth.

I. Finish of Cabinet Exterior Trim and Door: Powder coat, color as selected.

J. Finish of Door Pull or Handle: Stainless steel.

K. Finish of Cabinet Interior: White powder coat.

2.04 ACCESSORIES

A. Cabinet Door Signage: 'AED" decal, or vinyl self-adhering, prespaced black lettering and identifying graphic in accordance with authorities having jurisdiction (AHJ).

B. Plastic Wall Signage: Flat style.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Wall Signs:
   1. Location: Where shown.

C. Cabinet Lettering:
   1. Location: Face of door framing.

3.03 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

3.04 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training for additional requirements.

C. Demonstrate proper operation of AED to Owner's designated representative.

END OF SECTION

SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

B. Section 09 91 23 - Interior Painting: Field paint finish.

1.03 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2017, with Errata (2018).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher operational features.

C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
   2. Ansul, a Tyco Business: www.ansul.com/#sle.
   3. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
   4. Nystrom, Inc: www.nystrom.com/#sle.
   5. Oval Brand Fire Products: www.ovalfireproducts.com/#sle.
   6. Potter-Roemer: www.potterroemer.com/#sle.
   7. Pyro-Chem, a Tyco Business: www.pyrochem.com/#sle.
   8. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fire Extinguisher Cabinets and Accessories:
   1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
   2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
   3. Larsen's Manufacturing Co: www.larsensmfg.com/#sle.
   4. Nystrom, Inc: www.nystrom.com/#sle.
   5. Oval Brand Fire Products; Cabinets for Low Profile Extinguishers: www.ovalfireproducts.com/#sle.
   6. Potter-Roemer: www.potterroemer.com/#sle.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.

B. Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Class: B:C type.
   2. Size: 10 pound.
   3. Size and classification as scheduled.
   4. Finish: Baked enamel, color as selected.
   5. Temperature range: Minus 40 degrees F to 120 degrees F.

2.03 ACCESSORIES

A. Extinguisher Brackets: Formed steel, galvanized and enamel finished.

B. Lettering: FIRE EXTINGUISHER decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure rigidly in place.

C. Place extinguishers in cabinets.

D. Position cabinet signage at locations where indicated on drawings or as directed by AHJ.

END OF SECTION

SECTION 13 34 19
METAL BUILDING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufacturer-engineered, shop-fabricated structural steel building frame.

B. Insulated Metal wall and roof panels including gutters and downspouts and roof mounted equipment curbs.

C. Exterior louvers.

1.02 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames.

B. Section 08 36 13 - Sectional Doors.

1.03 REFERENCE STANDARDS

A. AISC 360 - Specification for Structural Steel Buildings; 2016 (Revised 2021).

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

D. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021.

E. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

F. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality; 2019.

G. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2021a.

H. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2017.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.

J. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

K. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2020a.

L. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

M. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

N. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference; 2005 (Reapproved 2017).

O. ASTM E1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference; 1995 (Reapproved 2018).

P. ASTM E1680 - Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems; 2016 (Reapproved 2022).

Q. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2020.

R. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2019, with Editorial Revision (2020).

S. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

T. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).

U. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.

V. IAS AC472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems; 2018.

W. MBMA (MBSM) - Metal Building Systems Manual; 2019.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on profiles, component dimensions, fasteners.

C. Shop Drawings: Indicate assembly dimensions, locations of structural members, connections; wall and roof system dimensions, panel layout, general construction details, anchors and methods of anchorage, and installation; framing anchor bolt settings, sizes, locations from datum, and foundation loads; indicate welded connections with AWS A2.4 welding symbols; indicate net weld lengths; provide professional seal and signature.

D. Samples: Submit two samples of precoated metal panels for each color selected, 6 by 6 inch in size illustrating color and texture of finish.

E. Manufacturer's Instructions: Indicate preparation requirements, anchor bolt placement.

F. Erection Drawings: Indicate members by label, assembly sequence, and temporary erection bracing.

G. Designer's Qualification Statement.

H. Manufacturer's Qualification Statement: Provide documentation showing metal building manufacturer is accredited under IAS AC472.
   1. Include statement that manufacturer designs and fabricates metal building system as integrated components and assemblies, including but not limited to primary structural members, secondary members, joints, roof, and wall cladding components specifically designed to support and transfer loads and properly assembled components form a complete or partial building shell.

I. Erector's Qualification Statement.

J. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

K. Project Record Documents: Record actual locations of concealed components and utilities.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design structural components, develop shop drawings, and perform shop and site work under direct supervision of a Professional Structural Engineer experienced in design of this type of work.
   1. Design Engineer Qualifications: Licensed in the State in which the Project is located.
   2. Comply with applicable code for submission of design calculations as required for acquiring permits.
   3. Cooperate with regulatory agency or authorities having jurisdiction (AHJ), and provide data as requested.

B. Perform work in accordance with AISC 360 and MBMA (MBSM).
   1. Maintain one copy on site.

C. Manufacturer Qualifications: Company specializing in the manufacture of products similar to those required for this project.
   1. Not less than three years of documented experience.

D. Erector Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.

E. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Roofing System: 35-year material and 20-year weather tightness warranties.

D. Wall System: 35-year material warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Buildings Systems:
   1. American Buildings company: www.americanbuildings.com.
   2. Butler Manufacturing Company: www.butlermfg.com/#sle.
   3. Ceco Building Systems: www.cecobuildings.com/#sle.
   4. Kirby Building Systems: www.kirbybuildingsystems.com/#sle.
   5. Metallic Building Systems: www.metallic.com/#sle.
   6. Nucor Building Systems: www.nucorbuildingsystems.com/#sle.
   7. VP Buildings: www.vp.com/#sle.
   8. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ASSEMBLIES

A. Single span rigid frame.

B. Primary Framing: Rigid frame of rafter beams and columns, canopy beams, and wind bracing.

C. Secondary Framing: Purlins, and other items detailed.

D. Wall System: Preformed metal panels of vertical profile, with sub-girt framing/anchorage assembly, and accessory components.

E. Roof System: Preformed metal panels oriented parallel to slope, with sub-girt framing/anchorage assembly, insulation, and liner panels, and accessory components.

2.03 PERFORMANCE REQUIREMENTS

A. Installed Thermal Resistance of Wall System: R-value of 19.

B. Installed Thermal Resistance of Roof System: R-value of R-13 + R-13 w/ R-5 Thermal Blocks.

C. Design structural members to withstand dead load, applicable snow load, and design loads due to pressure and suction of wind calculated in accordance with applicable code.

D. Exterior wall and roof system shall withstand imposed loads with maximum allowable deflection of 1/180 of span.

E. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.

F. Permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to temperature range of ____ degrees F.

2.04 MATERIALS - FRAMING

A. Structural Steel Members: ASTM A36/A36M.

B. Structural Tubing: ASTM A500/A500M Grade B cold-formed.

C. Plate or Bar Stock: ASTM A529/A529M, Grade 50.

D. Anchor Bolts: ASTM F1554, Grade 36, Class 1A, with no preference for protective coating.

E. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1; galvanized to ASTM A153/A153M.

F. Welding Materials: Perform in accordance with AWS D1.1/D1.1M.

G. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
   2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.

2.05 MATERIALS - WALLS AND ROOF

A. Steel Sheet: ASTM A792/A792M aluminum-zinc alloy coated to AZ50/AZM150.

B. Insulation: Batt glass fiber type, unfaced, ASTM E84 Class A, flame spread index of 25 or less where exposed, friction fit.
   1. Faced Metal Building Insulation: ASTM C991, Type II, glass fiber blanket insulation 2-inch wide, continuous, vapor-tight edge tabs.
   2. R-Value: See Performance Requirements.

C. Metal Building Type, Factory Applied, Vapor-Barrier Insulation Facings: Water vapor permeance no greater than 0.10 perm when tested in accordance with ASTM E96/E96M; flame spread index of 25 or less, and smoke developed index of 40 or less when tested in accordance with ASTM E84.

D. Joint Seal Gaskets: Manufacturer's standard type.

E. Fasteners: Manufacturer's standard type, galvanized to comply with requirements of ASTM A153/A153M, finish to match adjacent surfaces when exterior exposed.

F. Sealant: Manufacturer's standard type.

2.06 COMPONENTS

A. Doors and Frames: Specified in Section 08 11 13.

B. Overhead Doors: Specified in Section 08 36 13.

2.07 FABRICATION - FRAMING

A. Fabricate members in accordance with AISC 360 for plate, bar, tube, or rolled structural shapes.

B. Provide wall opening framing for doors, windows, and other accessory components.

2.08 FABRICATION - WALL AND ROOF PANELS

A. Wall Panels: Wall panel with a decorative shadow line with semi-concealed fasteners.
   1. Thickness: 24 gage.
   2. Material: Zinc-coated galvanized steel sheet.
   3. Panel Coverage: 36 inch wide, with 1-1/4″ high inverted ribs on 12″ centers.
   4. Exterior Finish: Two-coat fluoropolymer.
   5. Color as selected by Architect from manufacturer's standard colors.
   6. Fasteners: Panels are attached to the secondary framing members by self-drilling carbon steel screws, No. 12 x 1-1/4" hex washer head, cadmium or zinc plated. Fasteners shall be color coordinated with a premium coating system that protects against corrosion and weathering.

7. Panel Testing Requirements:
    a. Air Infiltration per ASTM E283/E283M.
    b. Water Penetration: Tested per ASTM E331.
    c. Class A fire rating when tested in accordance with test procedure ASTM E108.

B. Roofing: Minimum 24 gage metal thickness, standing seam roof panels, with full 360 degree rolled seams using an electrical seaming machine formed with ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; mechanically attaching panels to supports using concrealed clips located under one side of panels and engaging opposite edge of adjacent panels., lapped edges fitted with continuous gaskets.
    1. Material: Zinc-coated galvanized steel sheet.
    2. Exterior Finish: Galvanized.
    3. Clips: Manufacturer's standard, floating type to accommodate thermal movement; fabricated from zinc-coated galvanized steel sheet.
    4. Joint Type: Electrical seaming machine.
    5. Panel Coverage: 16 inches.
    6. Seams: 2-inches high.
    7. Sidelaps, endlaps, roof flashing laps, ridges and eave closures shall be sealed with a mastic type and caulk per manufacturer's recommendations.
    8. Testing Requirements:
        a. Uplift Rating: UL 90 per ASTM E1592.
        b. Air Infiltration per ASTM E1680.
        c. Water Penetration, ASTM E1646.
        d. Fire Rating: Class A per ASTM E108.

C. Liner Panels: Tapered Rib Profile, exposed fastener metal wall liner panels formed with raised trapezoidal ribs with secondary stiffenng ribs; designed to be installed by laping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
    1. Panel Coverage: 36 inches.
    2. Thickness: 24 gage.

D. Girts/Purlins: Rolled formed structural shape to receive siding, roofing and liner sheet.

E. Internal and External Corners: Same material thickness and finish as adjacent material, profile brake formed to required angles. Back brace mitered internal corners with manufacturer's recommened sheet thickness.

F. Expansion Joints: Same material and finish as adjacent material where exposed, ____ inch thick, manufacturer's standard brake formed type, of profile to suit system.

G. Flashing and Trim: formed from 0.022 inch nominal thickness, metallic coated steel sheet or aluminum zinc alloy coated steel sheet prepainted with coil coating, finished to match adjacent metal panels.

H. Fasteners: To maintain load requirements and weather tight installation, same finish as cladding, non-corrosive type.

2.09 FABRICATION - GUTTERS AND DOWNSPOUTS

A. Gutters: Formed from 0.022 inch nominal thickness, metallic coated steel sheet or aluminum zinc alloy coated steel sheet prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim complete with end pieces, outlet tubes and other special pieces as required. Fabricate in minimum 96 inch long sections, sized according to SMACNA's Architectural Sheet Metal Manual.
    1. Gutter Supports: Fabricated from same material and finish as gutters.
    2. Strainers: Bronze, copper or aluminum wire ball type at outlets.

B. Downspouts: Formed from 0 022 inch nominal thickness, zinc-coated galvanized steel sheet or aluminum zinc alloy coated steel sheet prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10 foot long sections, complete with formed elbows and offsets.
   1. Mounting Straps: Fabricated from same material and finish as gutters.

PART 3 EXECUTION

3.01 ERECTION - FRAMING

A. Erect framing in accordance with AISC 360.

B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing. Locate braced bays as indicated.

C. Set column base plates with non-shrink grout to achieve full plate bearing.

D. Do not field cut or alter structural members without approval.

E. After erection, prime welds, abrasions, and surfaces not shop primed.

3.02 ERECTION - WALL AND ROOF PANELS

A. Install in accordance with manufacturer's instructions.

B. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.

C. Fasten cladding system to structural supports, aligned level and plumb.

D. Locate end laps over supports. End laps minimum 2 inches. Place side laps over bearing.

E. Provide expansion joints where indicated.

F. Use concealed fasteners.

G. Install sealant and gaskets, providing weather tight installation.

3.03 ERECTION - GUTTERS AND DOWNSPOUTS

A. Rigidly support and secure components. Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts.

B. Slope gutters minimum 1/4 inch/ft.

C. Install splash pads under each downspout.

END OF SECTION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Basic Requirements for complete plumbing system.

1.02 RELATED SECTIONS

A. Section 22 05 48 – Vibration and Seismic Controls for Plumbing Piping and Equipment.

B. Section 22 10 05 – Plumbing Piping.

C. Section 22 30 00 – Plumbing Equipment.

D. Section 22 40 00 – Plumbing Fixtures.

E. Section 31 23 16 – Excavation.

1.03 SITE INSPECTION

A. Examine premises and understand the conditions which may affect performance of work of this Division before submitting proposals for this work.

B. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

1.04 DRAWINGS

A. Mechanical drawings show general arrangement of piping ductwork, equipment, etc. 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. Because of the small scale of mechanical 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 prints of mechanical drawings, to be furnished by Architect. Return these prints to Architect at completion of project. These will be labeled "Contractor Revised Drawings".

1.05 SUBSTITUTIONS

A. The naming of specified items on the drawings or in the specifications is

intended to establish a level of quality and performance. Substitution requests may be submitted at the time of shop drawing submittal. Review of substituted equipment or material prior to the Bid Date will not be considered unless otherwise specified.

B. Substitution shall be submitted as specified in Division 01.

1.06 CODE REQUIREMENTS, FEES & PERMITS

A. Perform work in accordance with applicable provisions of state and local Plumbing Code, gas ordinances and adoptions thereof. Provide materials and labor necessary to comply with rules, regulations and ordinances.

B. In case of differences between building codes, state laws, local ordinances, utility company regulations and Contract Documents, the most stringent shall govern. Promptly notify Architect in writing of such differences.

1.07 CONTRACTOR REVISED DRAWINGS

A. The contractor shall, during the progress of the work, keep an accurate record of all changes and corrections from the layouts shown on the drawings. Record of changes may be kept by accurately making all changes on a set of prints during the progress of the job.

B. Exact location of all underground utility service entrances and their connections to utility mains, well heads, loop piping and all valves, etc., which will be concealed in the finished work shall be accurately indicated on the drawings by measured distances.

C. Upon completion of the work and prior to final payment, the contractor shall furnish to the Architect, one set of "contractor revised" prints, legibly and accurately marked to indicate all changes, additions, deletions, etc., from the contract drawings.

D. Contractor shall include all addendum items and field change order information on the revised drawings. Revise all schedules shown on the drawings to reflect the actual model numbers, capacities and electrical characteristics of substituted equipment.

1.08 COORDINATION OF WORK

A. It is understood that while Drawings are to be followed as closely as circumstances permit, this Division will be held responsible for installation of systems according to the true intent and meaning of the Contract Documents. Anything not clear or in conflict will be explained by making application to Architect. Should conditions arise where certain changes would be advisable, secure Architect's approval of these changes before proceeding with the work.

B. Coordinate work of various trades in installing inter-related work. Before installation of mechanical items, make proper provisions to avoid interferences in a manner approved by Architect. Changes required in work

specified in Division 22 caused by neglect to do so shall be made at no cost to Owner.

C. Provide inserts and supports required by Division 22 unless otherwise noted. Furnish sleeves, inserts, supports and equipment that are an integral part of other divisions of the Work to Sections involved in sufficient time to be built into construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location of installation of items above shall be borne by Division 22.

D. Be responsible for required digging, cutting and patching incident to work of this Division and make required repairs afterward to satisfaction of Architect. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns or trusses.
   1. Each Section of this Division shall bear expense of cutting, patching, repairing and replacing of work of other Sections required because of its fault, error and tardiness or because of damage done by it.
   2. Cutting, patching, repairing and replacing pavements, sidewalks, roads and curbs to permit installation of work of this Division is responsibility of Section installing work.

E. Adjust locations of pipes, etc. to accommodate work from interferences anticipated and encountered. Determine exact route and location of each pipe and duct prior to fabrication.
   1. Make offsets, transitions, and changes in direction of pipes, as required to maintain proper headroom and pitch of sloping lines whether or not indicated on Drawings.

F. Slots and openings through floors, walls, ceilings and roofs shall be provided by other Divisions in their respective materials. This Division shall see that they are properly located and do any cutting and patching caused by its neglect to do so.

1.09 EXCAVATION AND TRENCHING FOR PIPING

A. Excavate to the depths indicated on the Drawings or as otherwise specified. Excavated materials not required or suitable for backfill or fill shall be removed from the site. Do such grading as is necessary to prevent surface water from flowing into trenches or other excavations. Water accumulated therein shall be removed by pumping or by other approved method. Do sheeting and shoring as may be necessary for protection of the work and for safety of personnel. Excavation shall be by open cut except that short sections of trench may be tunneled if the pipe can be safety and properly installed and backfill can be properly tamped in such tunnel sections.

B. Trench Excavation: Bottom of trench for tile or concrete pipe shall be rounded so that at least the bottom quadrant of the pipe rests firmly on undisturbed soil for as nearly the full length of the barrel as proper jointing operations will permit. Grate bottom of trenches to provide uniform bearing

and support for each section of pipe on undisturbed soil. Where rock is encountered, excavate to a minimum over-depth of 4" below trench depths indicated on the drawings or specified. Over-depths in rock excavation and unauthorized over-depths shall be backfilled. Whenever wet or otherwise unstable soil incapable of properly supporting the pipe is encountered, such soil shall be removed and the trench backfilled to proper grade as hereinafter specified.

C. Depth of Cover: Trenches shall be of depth that will provide a minimum depth of cover of three feet for water, sanitary and storm sewer and two feet for gas piping from existing grade or from indicated finish grade, whichever is lower, unless otherwise specifically shown.

1.10 BACKFILLING OF TRENCHES

A. Trenches shall not be backfilled until required pressure and other tests have been performed and inspections of utility and Code officials have been accomplished, and until the utilities systems as installed conform to requirements of drawings and specifications.

B. Backfill trenches with excavated materials consisting of earth, sandy clay, sand, gravel, soft shale or other approved materials, free from clods of earth or stones over 2-1/2 inch maximum dimension, deposited in 6 inch layers and compacted to 95% of the maximum laboratory density determined in accordance with ASTM D-698, Moisture-Density Relation of Soils. Tests for maximum density will be made with expense borne by contractor. If fills fail to meet the specified densities, the contractor shall remove and re-compact the fill until specified densities are achieved.

C. Tests for Displacement of Sewers: After the trench has been backfilled to 2 feet or more above the pipe, if the pipe shows poor alignment, displaced pipe, or any other defects, such defects shall be remedied by the contractor at his expense.

1.11 GENERAL PIPING INSTALLATION

A. Furnish and install a complete system of piping. The piping drawings are diagrammatic and indicate the general location and connections. If the size of any piping is not clearly evident, obtain instructions from the Architect before proceeding with the work. The piping may have to be offset, lowered or raised as required or as directed at the site. This does not relieve the contractor from responsibility for the proper erection of systems of piping in every respect suitable for the work intended. Piping systems that are not to be installed complete shall be so noted.

B. Erection: Piping shall be cut accurately for fabrication to measurements established at the construction site. Pipe shall be worked into place without springing and/or forcing. Remove all burrs and cutting slag by reaming or other cleaning methods. Changes in direction shall be made with fittings, except that bending of pipe will be permitted, providing a hydraulic pipe

bender is used. Bent pipe showing kinks, wrinkles, or other malformation will not be acceptable. Piping shall be arranged so as not to interfere with removal of other equipment or devices nor to block access manholes or other access openings. Piping shall be installed to insure noiseless circulation.

C. Minimum slope of piping shall be in accordance with the following unless otherwise specifically shown on the drawings or specified:

Type of Piping Fluid Conveyed	System Component	Length for 1" Fall	Direction of Fall
Sewer, Sanitary	Main or Branch	4 feet	Direction of flow
Domestic Water	Main or branch	40 feet	Back to mains

Sanitary and storm drainage piping 4 inches in diameter and larger may be pitched with one (1) inch fall for eight (8) foot lengths.

D. Protection: Open ends of pipes and equipment shall be properly capped or plugged to keep dirt and other foreign materials out of the system. Plugs or rags, wood, cotton, concrete, waste or similar materials must not be used in plugging.

E. Installation of Underground Pipe: Bottom of trench shall be shaped to give substantially uniform circumferential support to lower third of each pipe. Pipe shall be laid true to line and grade in such manner as to form a close concentric joint with adjoining pipe and to prevent sudden offsets to flow line. As work progresses, interior of pipe shall be cleared of dirt and superfluous materials. Where cleaning after laying is difficult because of small pipe size, a suitable swag or drain shall be kept in pipe and pulled forward past each joint immediately after jointing has been completed. Trenches shall be kept free from water until pipe jointing has set and pipe shall not be laid when condition of trench or weather is unsuitable for such work.

F. Cleaning and Flushing: Contractor shall take every precaution to remove dirt, grease, and all other foreign matter from each length of piping before making connections in the field. After each section of piping is installed, it shall be flushed with clean water except where specified otherwise.

G. Pipe Sizes: If the size of any piping is not clearly evident in the drawings, the contractor shall request instructions from the Architect as to the proper sizing. Any changes resulting from the contractor's failure to request clarification shall be at his expense.

1.12 THERMAL AND MOISTURE PROTECTION

A. Install flashing, counterflashing and caulk or seal all penetrations in exterior walls or floors as required to prevent exterior moisture from entering building.

1.13 EQUIPMENT AND MATERIALS

A. Product Approvals:
   1. If approval is received to use other than specified items, responsibility for specified capacities and insuring that items to be furnished will fit space available lies with this Division.
   2. In the event other than specified equipment is used and will not fit job site conditions, this Division assumes responsibility for replacement with items named in specification.

B. Use domestic made pipe, pipe-fittings and motors on project.

C. Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connection and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents.

D. Follow Manufacturer's directions in delivery, storage, protection and installation of equipment and materials.
   1. Promptly notify Architect in writing of conflicts between requirements of Contract Documents and manufacturer's directions and obtain Architect's written instructions before proceeding with work. Bear expenses arising from correcting deficiencies of work that do not comply with Manufacturer's directions or such written instructions from Architect.

E. Deliver equipment and material to site and tightly cover to protect against dirt, water, and chemical or mechanical injury but have readily accessible for inspection. Store items subject to moisture damage (such as controls), in a dry, heated space.

1.14 REVIEW OF MATERIALS AND EQUIPMENT

A. Furnish complete catalog data for manufactured items of equipment to be used in Work to architect for review within 30 days after award of Contract.

B. Submit six (6) copies of data in 3-ring binders with tab indices in same order and name as they appear in specification.
   1. State sizes, capacities, brand names, motor HP, accessories, materials, gauges, dimensions and other pertinent information. Pertinent information shall include as a minimum those items as scheduled on the drawings. Arrange submittal information to reflect these categories scheduled on the drawings.
   2. Provide an index of tab numbers at the front of each binder. List the specification number and category included under each tab as described in the specifications and as scheduled on the drawings.
   3. Provide cover sheet for each tab section. List each piece of equipment by name, model number and supplier.
   4. Underline applicable data and indicate model being supplied on each submittal sheet.

C. If data is not submitted as specified or submittal is not complete, it will be returned without review.

D. Catalog data or shop drawings for equipment which are noted as being reviewed by the Architect, shall not supersede Contract Documents.

E. Review comments of Architect shall not relieve this Division from responsibility for deviations from Contract Documents unless Architects' attention has been called to such deviations in writing at the time of submission, nor shall they relieve this Division from responsibility for errors in items submitted.

F. Check work described in catalog data with Contract Documents for deviations and errors.

1.15 GUARANTEE

A. The work herein specified shall be free from defects in workmanship and material under normal use and service. If, within twelve (12) months from date of substantial completion and Owner acceptance of the work herein described, any of the equipment or materials, or in the installation thereof, is found to be defective in workmanship or material, it shall be replaced or repaired free of charge.

B. The Contractor shall, after completion of the original test of the installation, and acceptance of the Architect, provide any service incidental to the proper performance of the mechanical systems under guarantees outlined above for a period of one (1) year.

1.16 FINALLY

A. It is the intention that this specification shall provide a complete installation except as hereinbefore specifically excepted. All accessory construction and apparatus necessary or advantageous in the operation and testing of the work shall be included.

B. The omission of specific reference to any part of the work necessary for such complete installation shall not be interpreted as relieving this Contractor from furnishing and installing such parts.

PART 2 PRODUCTS

(Not Applicable)

PART 3 EXECUTION

(Not Applicable)

END OF SECTION

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SECTION 22 05 13

COMMON ELECTRICAL REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section specifies the basic requirements for electrical components which are an integral part of packaged PLUMBING equipment. These components include, but are not limited to factory-installed motors furnished as an integral part of plumbing equipment.

B. This section specifies the basic requirements for electrical components required to be furnished under Division 22, which are to be turned over to and installed by Division 26. These components include but are not limited to motors.

C. Specific electrical requirements (i.e., horsepower and electrical characteristics) for plumbing equipment are scheduled on the drawings.

1.02 RELATED SECTIONS

A. Division 22 – All Sections.

1.03 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 (NFPA 70).

F. Compliance and Labeling: Provide motors and starters which have been listed and labeled by a nationally recognized testing facility engaged in and equipped to test electrical equipment and materials.

1.04 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.

1.05 QUALITY ASSURANCE

A. Electrical components and materials shall be UL labeled.

PART 2 - PRODUCTS

2.01 MOTORS

A. The following are basic requirements for simple or common motors, for special motors 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 sizes shall be large enough so that driven load will not requirement the motor to operate in the service factor range.
   3. 2-speed motors shall be 2 separate windings, on a polyphase motor.
   4. Temperature Rating: Rated for 40 deg. 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 timed spaced starts per hour for manually controlled motors.
   6. Service Factor: 1.15 for poly-phase motors and 1.35 for single phase motors.

B. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque.
   1. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit specific application.
   2. Bearings:
      a. Ball or roller bearings with inner and outer shaft seals;
      b. Re-greaseable bearings, 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.
   3. 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;
   4. Overload Protection: Built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.
   5. Noise Rating: "Quiet" rating on motors located in occupied spaces of building.
   6. Efficiency: Provide "Energy Efficient" motors with a minimum efficiency as scheduled in accordance with IEEE Standard 112, test method B. If efficiency not specified, motors shall have a minimum efficiency as listed below.

1HP	80% Efficiency	10HP	87%
1-1/2 to 2HP	82%	15HP	89%
3HP	83%	20HP	90%

5HP	84%	25HP and up	91%
7-1/2 HP	85%		

C. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following:
Baldor Electric Co.
Century Electric, Inc.
General Electric Co.
Marathon Electric Mfg. Co.
Reliance Electric Co.
Westinghouse Electric Corp.

D. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

PART 3 - EXECUTION

(Not Applicable)

END OF SECTION

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SECTION 22 05 16

EXPANSION COMPENSATION FOR PLUMBING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Basic Requirements for expansion compensation for the plumbing system.

1.02 RELATED SECTIONS

A. Section 22 0548 – Vibration and Seismic controls for Plumbing Piping and Equipment.

B. Section 22 1005 – Plumbing Piping.

C. Section 22 3000 – Plumbing Equipment.

D. Section 22 4000 – Plumbing Fixtures.

E. Section 31 2316 – Excavation.

1.03 SUBMITTALS

A. Product Data: Submit catalog cuts, specifications, installation instructions, and dimensioned drawings for each type of expansion compensation product. Submit schedule showing Manufacturer's figure number, size, location, and features for each required expansion compensation product.

B. Shop Drawings: Submit shop drawings for fabricated expansion loops indicating location, dimensions, pipe sizes, location and method of attachment of anchors.

C. Maintenance Data: Submit maintenance data and spare parts lists for each type of expansion compensation product. Include this data in Maintenance Manual.

1.04 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of expansion compensation products of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Comply with standards of the Expansion Joint Manufacturer's Association (EJMA).

PART 2 - PRODUCTS

2.01 PIPE ALIGNMENT GUIDES

A. General: Provide pipe alignment guides on both sides of expansion joints, and elsewhere as indicated. Construct with 4 finger spider traveling inside a guiding sleeve, with provision for anchoring to building substrate.

B. Available Manufacturers: Subject to compliance with requirements,

manufacturers offering pipe alignment guides which may be incorporated in the work include, but are not limited to the following:
Keflex, Inc.
Metraflex (The) Co.

PART 3 - EXECUTION

3.01 EXPANSION LOOPS

A. General: Fabricate expansion loops as indicated, in locations indicated, and elsewhere as determined by Installer for adequate expansion of installed piping system. Subject loop to cold spring which will absorb 50% of total expansion between hot and cold conditions. Provide pipe anchors and pipe alignment guides as indicated, and elsewhere as determined by Installer to properly anchor piping in relationship to expansion loops.

END OF SECTION

SECTION 22 05 19

METERS AND GAUGES FOR PLUMBING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Extent of meters and gauges required by this section is indicated on drawings and/or specified in other Division 22 sections.

B. Types of meters and gauges specified in this section include the following:
   1. Temperature Gauges and Fittings:
      Glass Thermometers
      Dial Type Insertion Thermometers
      Thermometer Wells
      Temperature Gauge Connector Plugs
   2. Pressure Gauges and Fittings:
      Pressure Gauges
      Pressure Gauge Cocks
      Pressure Gauge Connector Plugs

C. Meters and gauges furnished as part of factory-fabricated equipment are specified as part of the equipment assembly in other Division 22 sections.

1.02 RELATED SECTIONS

A. Section 22 1005 – Plumbing Piping.

B. Section 22 3000 – Plumbing Equipment.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of meters, gauges, and fittings, or types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. UL Compliance: Comply with applicable UL standards pertaining to meters and gauges.

C. ANSI and ISA Compliances: Comply with applicable portions of ANSI and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

1.04 SUBMITTALS

A. Product Data: Submit catalog cuts, specifications, installation instructions, and dimensioned drawings for each type of meter, gauge and fitting. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit meter, gauge and fitting schedule shown manufacturer's figure number, scale range, location, and accessories for each meter, gauge and fitting.

B. Maintenance Data: Submit maintenance data and spare parts lists for each

type of meter and gauge. Include this data in maintenance manual.

PART 2 PRODUCTS

2.01 TEMPERATURE GAGES

A. Glass Thermometers:
   1. General: Provide glass thermometers of materials, capacities and ranges indicated, designed and constructed for use in service indicated.
   2. Case: Die cast aluminum, finished in baked epoxy enamel, clear acrylic plastic front, spring secure, 9 inches long.
   3. Adjustable Joint: Die cast aluminum, finished to match case, 180 ° adjustment in vertical plane, 360 ° adjustment in horizontal plane, with locking device.
   4. Tube and Capillary: Mercury filled, magnifying lens, 1 percent scale range accuracy, shock mounted.
   5. Scale: Satin faced, non-reflective aluminum permanently etched markings.
   6. Stem: Copper-plated steel, or brass, for separable socket, length to suit installation.
   7. Range: Conform to the following:
      a. Hot Water: 30 - 240 °F with 2 °F scale divisions (0 ° - 160 °Celsius) with 1 °Celsius scale divisions.
      b. Chilled Water: 30 - 180 °F with 2 °F scale divisions (0 -100 °Celsius) with 1 °Celsius scale divisions.
   8. Available Manufacturers: Subject to compliance with requirements, manufacturers offering glass thermometers which may be incorporated in the work include, but are not limited to, the following:
      Marshalltown Instruments, an Eltra Co.
      Trerice (H.O.) Co.
      Weiss (Albert A) & Son, Inc

B. Dial Type Insertion Thermometers:
   1. General: Provide diameter type insertion thermometers of materials, capacities and ranges indicated, designed and constructed for use in service indicated.
   2. Type: Bi-metal, stainless steel case and stem, 1 inch diameter dial, dust and leak proof, 1/8 inch diameter stem with nominal length of 5 inches.
   3. Accuracy: 0.5 percent of dial range.
   4. Range: Conform to the following:
      a. Hot Water: 0 - 220 °F (-10 ° - 110 °C).
   5. Available Manufacturers: Subject to compliance with requirements, manufacturers offering direct mount dial type insertion thermometers which may be incorporated in the work include, but are not limited to, the following:
      Marsh Instrument Co, Unit of General Signal.
      Taylor Instrument Process Control Div. of Sybron Corp.
      Trerice (H.O.) Co.

Weiss (Albert A.) & Son, Inc

C. Thermometer Separable Wells:
   1. General: Provide thermometer wells constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2inch extension for insulated piping.
   2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering thermometer wells which may be incorporated in the work include, but are not limited to the following:
      Marsh Instrument Co., Unit of General Signal.
      Trerice (H.O.) Co.
      Weiss (Albert A.) & Sons, Inc.

D. Temperature Gage Connector Plugs:
   1. General: Provide temperature gage connector plugs pressure rated for 500 psi and 200 degrees F. Construct of brass and finish in nickel-plate, equip with 1/2 inch NPT fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8 inch O.D. probe assembly from dial type insertion thermometer. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness for insulated piping.
   2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering temperature gage connector plugs which may be incorporated in the work include, but are not limited to, the following:
      Peterson Engineering Co.

2.02 PRESSURE GAGES AND FITTINGS

A. Pressure Gages:
   1. General: Provide pressure gages of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.
   2. Type: General use, 1 percent accuracy, ANSI B40.1, Grade-A, phosphor bronze bourbon type, bottom connection.
   3. Case: Drawn steel or brass, clear acrylic plastic lends, 4-1/2 inch diameter.
   4. Connector: Brass with 1/4 inch male NPT. Provide protective syphon when used for steam service.
   5. Scale: White coated aluminum with permanent etched markings.
   6. Range: Conform to the following:
      a. Water: 0 - 100 psi.
   7. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pressure gauges which may be incorporated in the work include, but are not limited to, the following:
      Ametek, U.S. Gauge Div.
      Marsh Instrument Co., Unit of General Signal.
      Marshalltown, an Eltra Company
      Trerice (H.O.) Co.

Weiss (Albert A.) & Son, Inc

B. Pressure Gage Cocks:
   1. General: Provide pressure gauge cocks between pressure gages and gauge tees on piping systems. Construct gage cock of brass with 1/4 inch female NPT on each end, and "T" handle brass plug.
   2. Syphon: 1/4 inch straight coil constructed of brass tubing with 1/2 inch male NPT on each end.
   3. Snubber: 1/4 inch brass bushing with corrosion resistant porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.
   4. Manufacturers: Subject to compliance with requirements, manufacturers offering pressure gage cocks which may be incorporated in the work include, but are not limited to, the following:
      Ametek, U.S. Gauge Div.
      Marsh Instrument Co., Unit of General Signal.
      Marshalltown, An Eltra Company
      Trerice (H.O.) Co.
      Weiss (Albert A.) & Son, Inc

C. Pressure Gage Connector Plugs:
   1. General: Provide pressure gage connector plugs pressure rated for 500 psi and 200 degrees Fahrenheit. Construct of brass and finish in nickel-plate, equip with 1/2 inch NPT fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8 inch O.D. probe assembly from dial type insertion pressure gage. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness for insulated piping.
   2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pressure gauge connector plugs which may be incorporated in the work include, but are not limited to, the following:
      Peterson Engineering Co.

PART 3 EXECUTION

3.01 INSTALLATION OF TEMPERATURE GAGES

A. General: Install temperature gages in vertical upright position, and tilted so as to be easily read by observer standing on floor.

B. Thermometer Separable Wells: Install in piping for each temperature gage.

C. Temperature Gauge Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

3.02 INSTALLATION OF PRESSURE GAGES

A. General: Install pressure gages in piping with pressure gage cock, located on pipe at most readable position.

B. Locations: Install in the following locations, and elsewhere as indicated:

1. At suction and discharge of each hydronic pump or as a common gauge, if so detailed on drawings.
2. At each pressure reducing valve on both the high pressure and low-pressure sides.
3. At water service outlet.

C. Pressure Gage Cocks: Install in piping tee with snubber.

D. Pressure Gage Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

END OF SECTION

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SECTION 22 0548

VIBRATION AND SEISMIC CONTROLS FOR PLUMBING

PART 1 - GENERAL

1.01 SCOPE

A. The requirements for seismic protection measures to be applied to plumbing equipment specified herein are in addition to any other items called for in other sections of these specifications. The seismic protection shall conform to Category D of the 2021 Arkansas Fire Prevention Code. The Plumbing equipment shall include the following items to the extent required on plans or in other sections of the following specifications:
Piping, 2-1/2 inches or larger
Components weighing more than 75 pounds
Water Heaters

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Basic Requirements - Section.

1.03 APPLICABLE PUBLICATIONS

A. American Society of Civil Engineers: ASCE 7

B. Federal Specifications:
1. RR-W-410D

1.04 REGULATORY REQUIREMENTS

A. Conform to the 2021 Fire Prevention Code.

PART 2 - PRODUCTS

2.01 Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and shown.

2.02 Sway brace of structural steel conforming to ASTM A36.

2.03 Mechanical couplings of the sleeve type to provide a tight flexible joint under all reasonable conditions.

2.04 Square-head bolts and heavy hexagon nuts, ANSI B18.2.1 and B12.2.2 and ASTM A307or 306.

2.05 Guy wires where required shall conform to Fed Spec. RR-W-441 as follows:

5/32" diameter	Type V, Class 1
3/16" to 5/16" diameter	Type V, Class 2
1/4" to 5/8" diameter	Type I, Class 2

PART 3 - EXECUTION

3.01 All rigidly mounted equipment will have a minimum of four (4) anchor bolts securely fastened through bases or backs. Anchor bolts must conform to ASTM A307. Anchor bolts shall have an embedded, straight length equal to at least twelve times the nominal diameter of the bolt and shall conform to the applicable tables for various equipment weights.

Maximum Equipment Weight (Pounds)	
500	1/2
1,000	1/2
5,000	1/2
10,000	1/2
20,000	1/2
30,000	5/8
50,000	3/4
100,000	1

Based on four (4) 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 an equivalent total cross-sectional area when more than four bolts per item are provided. Anchor bolts that exceed the normal depth of equipment foundation piers or pads shall either extend into the concrete floor or the foundation shall be increased in depth to accommodate bolt lengths. When the height-to-width ratio of the equipment exceeds 8.9, overturning must be investigated. Expansion anchors shall not be used to resist seismic or vibratory loads unless test data are provided to verify the adequacy of the specific anchor and application. In no case shall the expansion anchor size be less than that required for bolts in the preceding table. Selection of anchor bolts for vibration isolation devices and/or snubbers to equipment base and foundations shall follow the same procedure, except that an equipment weight equal to five times the actual equipment weight shall be used.

3.02 Equipment Sway Bracing shall be provided for all items supported from the overhead floor or roof structures. Braces shall consist of angles, rods, bars, or pipes run at a 45° angle from the equipment frame to the building structure secured at both ends with no less than 1/2 inch bolts. Braces shall conform to all applicable codes and standards for Seismic Classification. Bracing shall be provided in two planes of directions, 90° apart, for each item of equipment. Details of all equipment bracing shall be submitted for approval. Instead of bracing with vertical supports, these items may be supported with hangers inclined at 45°, provided that supporting members are properly sized to supporting the operating weight of equipment when inclined at a 45° angle.

3.03 Sway bracing shall be provided for all 2-1/2 inch or larger pipes, not

individually supported with hangers 12 inches or less in length.

3.04 All components that weight more than 75 pounds shall have a safety chain or safety cable in addition to its other support.

3.05 Water heaters and pumps shall be bolted to the housekeeping pads per Paragraph 3.01.

3.06 Powder-activated fasteners (shot pins) shall not be used for anchorage.

3.07 Vibration isolators shall have a bumper restraint in each horizontal direction, and vertical restraints shall be provided where required to resist overturning.

3.08 Oversized plate washers extending to the equipment wall shall be used at bolted connections through the base sheet metal if the base is not reinforced with stiffeners or not capable of transferring the required loads.

END OF SECTION

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SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

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 include the following:
Plastic Pipe Markers
Valve Tags
Valve Schedule Frames
Engraved Plastic-Laminate Signs
Ceiling Tacks

C. Mechanical identification furnished as part of factory-fabricated equipment, is specified as part of the equipment assembly in other Division 23 sections.

1.02 RELATED SECTIONS

A. Division 23 – All Sections.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. ANSI Standards: Comply with ANSI A13.1 for lettering size, colors, and viewing angles of identification devices.

1.04 SUBMITTALS

A. Product Data: Submit product specifications and installation instructions for each identification material and device desired.

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 copies for Maintenance Manuals as specified in Division 1.

PART 2 - PRODUCTS

2.01 MECHANICAL IDENTIFICATION MATERIALS

A. General: Provide manufacturer's standard products of categories and types

required for each application as referenced in other Division 21 sections. Where more than single type is specified for application; selection is Installer's option, but provide single selection for each product category.

B. Plastic Pipe Markers:
   1. General: Provide manufacturer's standard pre-printed, flexible or semi-rigid, permanent, color-coded, plastic-sheet pipe markers, complying with ANSI A13.1.
      a. Small Pipes: For external diameters less than 6 inches (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
         (1) Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
         (2) Adhesive lap joint in pipe marker overlap.
         (3) Laminated or bonded application of pipe marker to pipe (or insulation).
      b. Large Pipes: For external diameters of 6 inches 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:
         (1) Laminated or bonded application of pipe marker to pipe (or insulation)
         (2) Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless-steel bands.
      c. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.
      d. Arrows: 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. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide, by 4 mil thick and manufactured for direct burial service.

C. Valve Tags:
   1. At the Contractor's option, provide one of the following:
      a. Brass Valve Tags: provide 19-gauge polished brass valve tags with stamp-engraved piping system abbreviation in 1/4-inch-high letters and sequenced valve numbers 1/2 inch high and with 5/32-inch hole for fastener. Provide 1-1/2-inch diameter tags, except as otherwise indicated.
      b. Plastic Laminate Valve Tags: Provide manufacturer's standard 3/32-inch-thick engraved plastic laminate valve tags, with piping system abbreviation in 1/4-inch-high letters and sequenced valve numbers ½-inch high, and with 5/32-inch hole for fastener. Provide 1-½-inch square black tags with white lettering, except as otherwise indicated.
   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.

D. Valve Schedule Frames:

1. General: For each page of the valve schedule, provide a glazed display frame, with screws for removable mounting on walls. Provide frames of rigid plastic or metal, with plastic glazing.

E. Engraved Plastic-Laminate Signs:
   1. General: Provide engraving stock melamine plastic laminate, complying with FS L- P-387, in the sizes and thicknesses 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.
   2. Thickness: 1/16 inch for units up to 20 square inches or 8-inch length; 1/8 inch for larger units.
   3. Fasteners: Self-tapping stainless-steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering plastic pipe markers which may be incorporated in the work include, but are not limited to, the following:
   Seton Name Plate Company
   EMED Co., Inc.
   Approved equal

2.02 LETTERING AND GRAPHICS

A. General: 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 manufacturer or as required for proper identification and operation/ maintenance of plumbing systems and equipment.

B. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service.

PART 3 - EXECUTION

3.01 APPLICATION AND INSTALLATION

A. General Installation Requirements:
   1. Coordination: 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. Piping System Identification:
   1. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces, (shafts, tunnels, plenums), exterior non-concealed locations and above removable acoustical ceilings.
      a. Near each valve and control device.

b. Near each branch, excluding short take-offs for fixtures, mark each pipe at branch, where there could be question of flow pattern.
c. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
d. At access doors, manholes and similar access points which permit view of concealed piping.
e. Near major equipment items and other points of origination and termination.
f. Spaced intermittently at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
g. On piping above removable acoustical ceilings.

C. Valve Identification:
1. General: Provide valve tag on every valve, cock and control device in each piping system.
2. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by Architect/Engineer.
a. 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.

D. Plumbing Equipment Identification:
1. General: Install engraved plastic laminate sin on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
b. Pumps and similar motor-driven units.
c. Fans, blowers, primary balancing dampers and mixing boxes.
d. Central-station units.
e. Tanks and pressure vessels.
f. Motor starters and other control equipment.

E. Refer to Division 22 sections for identification requirements at central-station mechanical control center; not work of this section.

F. Refer to Division 26 sections for identification requirements of electrical work; not work of this section.

G. Lettering Size: Minimum 3/8-inch-high lettering for name of unity where viewing distance is less than 2'-0"; 3/4 inch 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.

H. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, and warn of hazards and improper operations.

I. 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

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SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Insulation Requirements for complete plumbing piping system.

1.02 RELATED SECTIONS

A. Section 22 0500 – Common Work Results for Plumbing.

B. Section 22 0548 – Vibration and Seismic Controls for Plumbing Piping and Equipment.

C. Section 22 0553 – Identification for Plumbing Piping

D. Section 22 1005 – Plumbing Piping.

E. Section 22 3000 – Plumbing Equipment.

F. Section 22 4000 – Plumbing Fixtures.

1.03 REFERENCES

A. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM C195 - Mineral Fiber Thermal Insulation Cement.

C. ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.

D. ASTM C449 - Mineral Fiber Hydraulic-setting Thermal Insulating and Finishing Cement.

E. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

F. ASTM C547 - Mineral Fiber Preformed Pipe Insulation.

G. ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.

H. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.

I. ASTM D2842 - Water Absorption of Rigid Cellular Plastics.

J. ASTM E96 - Water Vapor Transmission of Materials.

1.04 SUBMITTALS

A. Submit under provisions of Division 01 and Section 22 0500.

B. Product Data: Provide product description, list of materials and thickness for each service, and locations.

C. Manufacturer's Installation Instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Materials: Flame spread/smoke developed rating of 25/100 or less in accordance with ASTM E84, NFPA 255, and UL 723.

1.06 QUALIFICATIONS

A. Applicator: Company specializing in performing the work of this section with minimum three years experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of Section 22 0500.

B. Deliver materials to site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Store insulation in original wrapping and protect from weather and construction traffic.

D. Protect insulation against dirt, water, chemical, and mechanical damage.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

PART 2 - PRODUCTS

2.01 GLASS FIBER

A. Insulation: ASTM C547; rigid molded, noncombustible.
   1. "K" value: ASTM C335, 0.24 at 75 °F.
   2. Minimum Service Temperature: -20 °F.
   3. Maximum Service Temperature: 850 °F.
   4. Maximum Moisture Absorption: 0.2 percent by volume.

B. Vapor Barrier Jacket:
   1. ASTM C921, white Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches.
   3. Secure with adhesive applied to longitudinal laps and butt strips.
   4. Secure with vapor barrier mastic.
   5. Self-sealing laps may be used provided lap seal is additionally sealed with vapor barrier masters.
   6. Maximum Water Vapor Transmission: 0.1 perm.

2.02 APPROVED MANUFACTURERS

A. Glass Fiber:
   1. Owens/Corning Fiberglass.
   2. Architect Approved - Other acceptable manufacturers offering equivalent products.

B. Vapor Barrier Jacket Lap-Adhesive - Compatible with insulation:
   1. Foster 25.
   2. Architect Approved.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. On exposed piping, locate insulation and cover seams in least visible locations.

C. Insulated dual temperature pipes or cold pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory applied or field applied.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe.
   3. Finish with glass cloth and vapor barrier adhesive.
   4. PVC fitting covers may be used.
   5. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
   6. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

D. For insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory applied or field applied.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.
   3. Finish with glass cloth and adhesive.
   4. PVC fitting covers may be used.
   5. For hot piping conveying fluids 140 °F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
   6. For hot piping conveying fluids over 140 °F, insulate flanges and unions at equipment.

E. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert Location: Between support shield and piping and under the finish jacket.
   4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.

F. Finish insulation at supports, protrusions, and interruptions.

G. For exterior applications, provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum or stainless-steel jacket with seams located on bottom side of horizontal piping.

H. For buried piping, provide factory fabricated assembly with inner all-purpose service jacket with self sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

I. For heat traced piping, insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size it large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

J. Valves and fittings insulated with block insulation shall be finished with insulating cement and troweled to a smooth and uniform finish.

3.03 TOLERANCE

A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

3.04 GLASS FIBER INSULATION SCHEDULE

A.

PIPING SYSTEMS	THICKNESS
Plumbing Systems	
Domestic Hot Water Supply	1 inch
Domestic Hot Water Recirculation	1 inch
Domestic Cold Water (Indoors)	1/2 inch
Domestic Cold Water (Out of Doors)	1 inch

END OF SECTION

SECTION 22 10 05

PLUMBING PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Basic Requirements for complete plumbing piping system.

1.02 RELATED SECTIONS

A. Section 22 05 00 – Common Work Results for Plumbing.

B. Section 22 05 48 – Vibration and Seismic Controls for Plumbing.

C. Section 22 05 53 – Identification for Plumbing Piping and Equipment.

D. Section 22 30 00 – Plumbing Equipment.

E. Section 22 40 00 – Plumbing Fixtures.

F. Section 31 23 16 – Excavation.

1.03 QUALITY ASSURANCE

A. Manufacturers shall be firms regularly engaged in manufacturer of plumbing 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. Installer shall be a firm with at least 3 years of successful installation experience on projects with plumbing piping system work similar to that required for project.

C. Comply with applicable provisions of ANSI B31.2 “Fuel Gas Piping”, applicable provisions of NFPA 54 (ANSI Z223.1) “National Fuel Gas Code”, ANSI Z223.1a “Supplement to National Fuel Gas Code” and with requirements of the local gas company.

D. Comply with applicable codes and standards.

1.04 SUBMITTALS

A. Submit under provisions of Division 01 and Section 22 0500.

B. Product Data: Provide product description, list of materials and thickness for each service, and locations.

C. Manufacturer’s Installation Instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALIFICATIONS

A. Applicator: Company specializing in performing the work of this section with minimum three years experience.

PART 2 - PRODUCTS

2.01 DOMESTIC HOT AND COLD-WATER SYSTEMS

A. Pipe
   1. Type "K" hard drawn copper, as made by Mueller Brass Co., for piping underground or beneath concrete slab.
   2. Type "L" hard drawn copper, as manufactured by Mueller Brass Co., for above ground applications.

B. Fittings
   1. Wrought copper.

C. Connections
   1. Sweat copper type with Stay-Safe "Bridgit" lead free silver bearing solder with Stay-Clean liquid or Stay-Clean paste flux as manufactured by J. W. Harris Co., Inc. Joints under slabs shall be brazed with Silfos brazing alloy.

D. Valves
   1. Use gate valves exclusively unless otherwise specified. All valves shall be by a single manufacturer from the approved list (reference Section 22 1006). Valves shall be for 150psi SWP.
   2. All valves shall be brass, of screwed pattern, gland stuffing box, solid wedge double seal for gate valves, non-rising stem.

E. Unions
   1. All union connections on piping 2" and smaller shall be ground joint brass union, having brass taper seat and both screw ends hexagonal and shall be designed for a steam working pressure up to 150 pound.

F. Origin
   1. Unless specifically specified otherwise, all material and products shall be manufactured in the United States of America.

2.02 SANITARY SEWER, SOIL, WASTE VENT AND STORM PIPING SYSTEMS

A. Piping Above Floor:
   1. All lines of 2 inches and larger shall be service weight cast iron soil piping and fittings, coated inside and outside with coal tar varnish and shall be labeled with cast iron mark of quality and permanence as illustrated in Commercial Standard CS188, which indicates that it complies with this Standard.
   2. Pipe and fittings used in the hubless system shall bear the registered insignia indicating that these items used in the system shall comply with the Cast Iron Soil Pipe Institute's Standard 302 (latest revision) and the ASTM "Standard Specifications for Cast Iron Soil Pipe and Fittings".
   3. In horizontal installations hangers shall be provided at ever other point except when the developed length between hangers exceeds four feet (4'0") they shall be provided at each joint. Hangers shall be provided at

each horizontal branch and shall be placed on or immediately adjacent to the coupling. Adequate provision shall be made to prevent "shear". Where hubless components are suspended in excess of 18 inches by means of non-rigid hangers, they shall be suitably braced against movement horizontally. Piping at ceiling of mechanical room shall be suspended from spring hangers.

4. Vertical sections and their connecting branches and components shall be secured at each stack base and at sufficiently close intervals to keep the system in alignment and to adequately support the weight of the pope and its contents.

5. Waste arms for lavatories and urinals shall be DWV copper with cast brass adapters and wrought copper fittings.

B. Piping Below-Grade – PVC Drainage Pipe:
   1. All piping below grade shall be PVC, Schedule 40, DWV, ASTM D-2655, shall adhere to the installation standards set forth in ASTM D2321 or its equivalent and the bedding and backfilling of PVC pipe shall be completed as described below.
   2. For all PVC pipe, the trench excavation shall be extended to a minimum depth of 6 inches below the bottom of the pipe. Where additional excavation is required due to unacceptable soil conditions, the trench bottom shall be brought back up to grade, using Class I or II bedding materials. This bedding material shall be installed in no greater than 8-inch compacted lifts. All bedding material shall be compacted to a minimum density of 90 percent modified proctor as outlined in AASHTO-T180. The intent of this bedding is to provide uniform support for the flexible pipe. The remaining backfill shall be in accordance to the standard details and trench requirements. The Class I or II material shall extend for 6 inches below the pipe to 6 inches above the pipe. The maximum depth of bury for PVC pipe shall be 16 feet. Any depths greater than 16 feet shall require rigid pipe.
   3. Exception:
      a. Exception: The kitchen area shall be piped with hub and spigot type cast iron waste piping below floor to withstand very hot water and frequent rodding.

C. Piping Below-Grade – Hub and Spigot Type (Kitchen Piping):
   1. All piping below the floor and extended outside the building shall be standard weight cast iron soil pipe and fittings unless noted otherwise, as manufactured by Tyler Pipe, Charlotte Pipe, or Griffin Pipe. All cast iron soil pipe and fittings shall be of the reinforced hub type, coated inside and outside with coal tar varnish and shall conform to the ASTM "Standard Specifications for Cast Iron Soil Pipe and Fittings".

D. Soil, waste, drain and vent piping must be of sizes noted and run as indicated on the drawings, and shall be given a uniform grade of ¼ inch per foot wherever possible, but in no case less than 1/8 inch per foot. The soil and waste pipes shall be extended through the roof. Each riser

extending through the roof shall project 14" above roofline. Flashing shall be by roofing contractor. Counter flashing shall be by plumbing contractor. Where so shown, connect vents below roof.

E. Piping Exterior of Building:
   1. Sanitary sewer pipe and fittings (exterior of the building) shall be Schedule 40 PVC pipe, same as waste piping.

F. Pipe Joints
   1. PVC Solvent Welded Joints:
      a. All joints shall first be primed with purple primer/cleaner manufactured for PVC pipe. Do not use water, rags, gasoline, sandpaper or other substitutes for cleaning PVC surfaces.
      b. The cement shall be a bodied cement of approximately 800 to 1000 centipoise viscosity containing 10-20 percent (by weight) virgin PVC material solvated with tetrahydrofuran (THF). Select the proper cement (Schedule 40-cement for PVC shall be used with Schedule 40 PC pipe).
      c. Do not use all-purpose cements, ABS cement to joint PVC pipe and fittings. Apply cement with recommended applicators or pure bristle type paintbrush or the recommended size.
      d. All piping shall be cut squarely and deburred. Remove all excess cement from around the pipe and fittings with a dry cotton rag while cement is still soft. Do not attempt cementing in the rain or the presence of moisture.

G. Cleanouts
   1. Cleanouts shall be provided at the ends and points in change of direction of all drain, soil, and waste pipes and branches thereof, at the foot of each riser, at all offsets, in all horizontal runs at approximately 50-foot intervals for piping 4 inches and smaller and 100 feet for larger piping, and at other points where indicated on the plans or where required.
   2. All cleanouts in connection with cast iron pipe, except the traps and fittings on horizontal branches, shall have tapped "Y" fittings of same size as pipe up to 4 inches, and 4 inches for all larger pipes, closed with screw plugs. All other cleanouts in connection with cast iron pipe, except those that occur in finished floor and walls, shall have heavy cast iron ferrules same size as pipe up to 4 inches, and 4 inches for all larger pipe, caulked into hub and closed with a bronze screw plug.
   3. All cleanouts in finished floors shall be ZURN "LevelTrol" ZN-1400BP, Wade, or approved equal, with membrane anchorage pan and clamping collar, scoriated nickel-bronze access cover and adjustable frame; bronze cleanout plug shall be straight threaded with tapered shoulder that seals against caulked seat in body. Note the outlet must be "NL" Neo-Loc to accept PVC pipe.
   4. All cleanouts in finished walls shall be Zurn ZN-1443-BP, Wade or Jay

R. Smith with polished nickel-bronze access cover and adjustable frame; bronze cleanout plus shall be straight threaded with tapered shoulder.

5. All cleanouts on exterior piping of building shall be Zurn Z-1400-BP, Wade, or approved equal, as detailed on the drawings. Note the outlet must be “NL” Neo-Loc outlet to accept PVC piping.

2.03 NATURAL GAS PIPING SYSTEM

A. Includes:
   1. Necessary labor, materials, appliances and equipment required to provide gas service from street main to meter, building distribution system from (pound to ounce) pressure regulator valve at the building to gas fired equipment connections and accessories as shown on the drawings.
   2. Related Work Specified Elsewhere:

B. Quality Assurance
   1. Manufacturers shall be firms regularly engaged in manufacturer 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.
   2. Installer shall be a firm with at least 3 years of successful installation experience on projects with natural gas piping system work similar to that required for project.
   3. Comply with applicable provisions of ANSI B31.2 “Fuel Gas Piping", applicable provisions of NFPA 54 (ANSI Z223.1) "National Fuel Gas Code", ANSI Z223.1a "Supplement to National Fuel Gas Code" and with

C. Natural Gas Piping Materials and Products
   1. 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 Installer to comply with installation requirements. 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 use in natural gas piping systems. Where more than one type of material or product is indicated, selection is Installer's option.

D. Basic Identification
   1. Provide identification complying with Division 22 Basic Materials and Methods, Section 22 0553 "Identification for Plumbing Piping and Equipment".

E. Piping
   1. Piping inside building shall be ASTM A-120-79, carbon steel, Schedule 40 black steel.

2. Gas service outside building in ground shall be plastic pipe. Plastic pipe shall be "SDR-11 Driscopipe 6500" with copper trace wire, or approved equal, conforming to ASTM C2513. Connections and transition fittings shall be made by heat fusion, mechanical coupling. Mechanical coupling shall have internal stiffeners. Insulated fittings shall be provided at the meter and in the vertical rise above grade at the building. Transition fittings shall be provided at a minimum of 12 inches from all vertical risers to above grade. Gas piping shall be laid at least 24 inches below grade at all points.
3. Risers to building and to meter or pressure regulators shall be standard line pipe provided with a mill installed protective covering of Republic "X-Tru-Coat", high density polyethylene applied over an adhesive undercoating. All field joints and fittings shall be protected with Republic "X-Tru-Tape" and primer, applied as per manufacturer's recommendations. Pipe coat/wrap shall extend a minimum of 6 inches above finish grade.

F. Fittings
1. Black Pipe:
   a. Welded forged steel fittings meeting requirements of ASTM A 234-79a, or standard weight malleable iron screwed.
2. Fittings outside building shall have "X-Tru-Coat" covering.

G. Plug Valves (Cocks)
1. 1 inch and smaller:
   a. Domestic Water shall be bronze, screw pattern, 125 psig, non-shock W.O.G. operating pressure, square head, lubricated tapered brass plug design, less check, FIP thread.
   b. Natural gas and HVAC shall be iron, screw pattern, 125 psig, non-shock W.O.G. operating pressure, square head, lubricated tapered brass plug design, less check, FIP thread.
   c. A.Y. McDonald Mfg. Co. #10686B, Dezurik/Sartell, or A/E approved equal.
2. 1-1/4 inches thru 2 inches:
   a. Shall be semi-steel, screwed gland type, regular pattern, 200 CWP operating pressure, 400 psig test pressure, square head, lubricated tapered plug, FIP thread and conform to ANSI B2.1; ANSI B16.1; B116.10; API 5B; -A126, Class B and MSS SP-78.
   b. Rockwell Nordstrom Valves, Inc. #114, Resun or Homestead.
3. 2-1/2 inches thru 4 inches:
   a. Shall be iron, screw gland type, regular pattern, 200 CWP operating pressure, 400 psig test pressure, square head, lubricated tapered plug design, FIP thread or flanges drilled to ANSI class 125 cast iron flange standard template and conform to ANSI B2.1; ANSI B16.1; B116.10; API 5B; ASTM-A126, Class B and MSS SP-78.
   b. Rockwell Nordstrom Valves, Inc. #115, Resun or Homestead.
4. 6 inches and larger:

a. Shall be iron, bolted gland type, short pattern, 200 CWP operating pressure, 400 psig test pressure, square head, lubricated tapered plug design, flanges drilled to ANSI class 125 cast iron flange standard template and conform to ANSI B2.1; ANSI B16.1; B116.10; API 5B; ASTM-A126, Class B and MSS SP-78.
b. Rockwell Nordstrom Valves, Inc. #143, Resun or Homestead.

H. Pressure Regulating Valves
1. Provide single stage, steel jacketed, corrosion-resistant gas pressure regulators; with atmospheric vent, elevation compensator; with threaded ends for 2 inches and smaller, flanged ends for 2-1/2 inches and larger; for inlet and outlet gas pressures, specific gravity, and volume flow indicated.
2. Regulators installed indoors shall be vented to outside full size or larger as required to eliminate excessive back pressure.
3. Regulators installed outdoors shall be installed such that vent face is downward, so as to avoid the entry of water and matter which would interfere with its operation.
4. Regulators shall be equal to Rockwell Mfg. Co. (Equimeter) with internal relief.

2.04 TRAPS AND DRAINS

A. P-traps shall be placed under all floor drains and where indicated in wastes, and at other points indicated on plans. P-traps shall be Schedule 40 PVC.

B. Drains shall be Zurn, or approved equal, in accordance with the schedule on the drawings. Note all floor drains shall have “NL” Neo-Loc outlet to accept PVC piping.

2.05 DRAIN PANS

A. All floor drains, except for those in concrete slab above earthfill, shall be provided with non-plasticized chlorinated polyethylene, "Chloraloy 240", brand concealed water proofing membrane as manufactured by the Noble Company of Grand Haven, Michigan, Compotite Corp. "Composeal", or approved equal. Membrane shall be medium gray in color, textured surface finish both sides, have white or black lettering continuously marked "Chloraloy 240", size 18 inches by 18 inches, turned up at least 1 inch, and meet applicable standards of ASTM. Complete installation shall be in accordance with manufacturer's recommendations.

2.06 ORIGIN

A. Unless specifically specified otherwise, all material and products shall be manufactured in the United States of America.

PART 3 - EXECUTION

3.01 HOT AND COLD-WATER PIPING SYSTEMS

A. For general piping insulation, see Section 22 0719.

B. Install copper tubing under slabs without joints where possible.

C. Provide adaptors in copper lines for all valves.

D. Locate cold water lines a minimum of 12 inches from hot water line.

E. Before pipes are covered, test systems in presence of Architect at 100 psi hydrostatic pressure for two (2) hours and show no leaks.

F. Sterilize domestic water system with solution containing at least 250 parts per million of available chloride. Introduce chlorinating materials into system in manner approved by Architect. Allow sterilization solution to remain for 24 hours and open and close valves and faucets several times during that time.

G. After sterilization, flush solution from system with clean water until residual chlorine content is less than 0.2 parts per million.

H. Water system will not be accepted until a negative bacteriological test is made on water taken from system and dosing shall be repeated as necessary until such negative test is accomplished. Submit written report of test to Architect for his approval.

I. Install water hammer arresters as noted on the drawings.

J. Extend water service piping of size and in location indicated to water service entrance at building. Provide sleeve in foundation wall for water service entry; make entry weathertight. Provide gate valve at water service entry inside building, strainer, pressure gauge, test tee and valve.

K. Provide hot and cold-water piping runouts to fixtures of sizes indicated, but in no case smaller than required by National Standard Plumbing Code.

L. Connect hot and cold-water piping system to mechanical equipment as indicated, and comply with equipment manufacturer's installation instructions. Provide shut-off valve and union for each connection. Provide drain valve on drain connections.

3.02 SANITARY SEWER, SOIL, WASTE, VENT AND STORM PIPING SYSTEMS

A. Provide floor drains and other specialties as specified in the Schedule on the drawings and set forth in these specifications.

B. Each fixture and appliance discharging water into sanitary sewer or building sewer lines shall have a seal trap in connection with a complete venting system so gasses pass freely to atmosphere with no pressure of syphon condition on water seal.

C. Before piping is covered, conduct tests in presence of Architect and correct leaks or defective work. Do not caulk threaded work. Fill waste and vent system to roof level (a minimum of 10 feet) with water and show no leaks for two (2) hours.

D. Vent entire system to atmosphere. Discharge 14 inches above roof. Joint lines together, in fewest practicable numbers before projecting above roof. Set back vent lines so they will not pierce roof near an edge or valley.

E. Flash pipes passing through roof with six (6) lb. / sq. ft. lead flashing fitted around pipes and turned down into pipe 1/2 inch with turned edge hammered against pipe wall.

3.03 INSTALLATION OF NATURAL GAS PIPING

A. Install natural gas distribution piping in accordance with applicable codes and local Utility Company requirements.

B. 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.

C. Remove cutting and threaded burrs before assembling piping.

D. Do not install defective piping or fittings. Do not use pipe with threads which are chipped, stripped, or damaged.

E. Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping, or equipment connections are completed.

F. Install minimum 6-inch-long drip-legs in gas piping where indicated, and where required by code or regulation.

G. Install "Tee" fitting with bottom outlet plugged or capped, at bottom of pipe risers.

H. Use dielectric unions where dissimilar metals are joined together.

I. Install piping with 1 inch drop in 60-foot pipe run (0.14%) in direction of flow.

J. Install piping parallel to other piping, but maintain minimum of 12-inch clearance between gas piping and steam or hot water piping above 200 °F.

K. Wrap and lay underground pipe with minimum of two (2) feet of cover in accordance with local gas utility company regulations and specifications.

L. Install gas cocks and unions at all final connections to equipment.

M. Do not use flexible pipe connections.

N. All field joints and fittings shall be protected with "X-Tru-Tape" and primer.

O. Bushings will not be accepted.

P. Test all gas piping with air pump and 3-inch dial gauge to pressure that will maintain 25 psig for 15 minutes.

Q. Provide sacrificial type cathodic protection for each vertical riser to the building.

R. Provide 5/8 inch by 8'-0" copper clad steel ground rod, ground rod clamp and No. 6 stranded copper conductor from ground rod to vertical riser at every instance where piping exits the earth.

S. All exposed steel gas piping must be cleaned, primed and painted with (2) two coats of epoxy or similar paint (color as selected by architect).

3.04 GAS SERVICE

A. Consult with Gas Company as to extent of its work, meter requirements with consideration of Owner needs, costs, fees, and permits involved. Pay such costs and fees; obtain permits.

END OF SECTION

SECTION 22 10 06

PLUMBING PIPING SPECIALTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Valves and piping specialties, for complete Plumbing System.

1.02 RELATED SECTIONS

A. Section 22 05 00 – Common Work Results for Plumbing.

B. Section 22 05 53 – Identification for Plumbing Piping.

C. Section 22 05 48 – Vibration and Seismic Controls for Plumbing Piping and Equipment.

D. Section 22 10 05 – Plumbing Piping.

E. Section 22 30 00 – Plumbing Equipment.

F. Section 22 40 00 – Plumbing Fixtures.

G. Section 31 23 16 – Excavation.

1.03 QUALITY ASSURANCE

A. Manufacturers: 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 five (5) years.

1.04 SUBMITTALS

A. Product Data: Submit catalog cuts, specifications, installation instructions, and dimensioned drawings for pipeline strainers. 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 pipeline strainer.

B. Maintenance Data: Submit maintenance data and spare parts lists for each type of pipeline strainer. Include this data in Maintenance Manual.

PART 2 - PRODUCTS

2.01 MANUFACTURED PIPING SPECIALTIES

A. General: 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, or if not 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.

B. Pipe Escutcheons:
   1. General: Provide pipe escutcheons as specified herein with 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.
   2. Pipe Escutcheons for Moist and Wet Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.
   3. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.

C. Low Pressure Y-Type Pipeline Strainers:
   1. General: Comply with FCI 73-1. Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 125 psi working pressure, with Type 304 stainless steel screens, with 3/64 inch perforations at 233 sq. in. Mechanical grooved type strainer may be used in grooved piping system.
   2. Threaded ends, 2 Inches and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with pipe plug.
   3. Flanged Ends, 2-1/2 Inches and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.
   4. Available Manufacturers: Subject to compliance with requirements, manufacturers offering low pressure Y-type strainers which may be incorporated in the work include, but are not limited to, the following:
      American Air Filter, an Allis-Chalmers Co.
      Armstrong Machine Works.
      Hoffman Specialty, ITT Fluid Handling Div.
      Metraflex Co.
      Sarco Co., Div. of White Consolidated.
      Trerice (H.O.) Co.
      Victaulic Co. of America

D. High Pressure Y-Type Pipeline Strainers:
   1. General: Comply with FCI 73-1. Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 250 psi working pressure, with Type 304 stainless steel screens, with 3/64" perforations at 233 sq. in. Mechanical grooved type strainer may be used in grooved piping systems.
   2. Threaded Ends, 2 Inches and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with pipe plug.
   3. Flanged Ends, 2-1/2 Inches and Larger: Cast-iron body and bolted steel retainer with off-center blowdown fitted with pipe plug.
   4. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high pressure Y-type strainers which may be incorporated in the work include, but are not limited to, the following:
      American Air Filter, an Allis-Chalmers Co.
      Armstrong Machine Works.
      Hoffman Specialty, ITT Fluid Handling Div.
      Metraflex Co.
      Sarco Co., Div. of White Consolidated.

Trerice (H.O.) Co.
Victaulic Co. of America

E. Dielectric Unions:
   1. General: Provide standard products recommended by manufacturer for use in service indicated, which effectively isolates ferrous from non-ferrous piping (electrical conductance), present galvanic action, and stop corrosion.
   2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering dielectric unions which may be incorporated in the work include, but are not limited to, the following:
      Atlas Products Co.
      Capital Mfg. Co., Div. of Harsco Corp.
      Eclipse, Inc.
      Epco Sales, Inc.
      FMC Corp.
      McNally, Inc.
      PSI Industries
      Stockham Valves and Fittings

2.02 FABRICATED PIPING SPECIALTIES

A. Drip Pans: Provide drip pans fabricated from not less than 18-gauge corrosion-resistant sheet metal with watertight joints, and with edges turned up 2-1/2 inches. Reinforce top, either by structural angles or by rolling top over 1/4 inch 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 snap-lock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gauges: 3 inches and smaller, 20-gauge; 4 inches to 6 inches, 16-gauge; over 6 inches, 14-gauge.
   2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe, remove burrs.
   3. Iron-Pipe: Fabricate from cast-iron or ductile-iron 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. Lead and Oakum: Caulked between sleeve and pipe.
   2. 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.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering mechanical sleeve seals which may be incorporated in the work include, but are not limited to following:
   Thunderline Corp.

2.03 VALVES

A. General: 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.

2.04 GATE VALVES

A. Packing: Select valves designed for repacking under pressure when fully opened, equipped with packing suitable for intended service. Select valves designed so back seating protects packing and stem threads from fluid when valve is fully opened, and equipped with gland follower.

B. Comply with the following standards.
   1. Cast-Iron Valves: MSS SP-70.
   2. Bronze Valves: MSS SP-80.
   3. Steel Valves: ANSI B16.34.

C. For Domestic Water Service:
   1. Flanged Ends 2-1/2 inches and larger: Class 125, iron body bronze mounted, bolted bonnet, rising stem, OS&Y, solid wedge, Nibco F-617-0.

D. For Fire Protection Service:
   1. Threaded Ends 2 inches and smaller: Class 200, bronze body, yoke bonnet, rising stem, OS&Y, solid wedge, UL/FM approved, Stockham B-133.
   2. Flanged Ends 2-1/2 inches and larger: Class 200, iron body, bolted bonnet, rising stem, OS&Y, solid wedge, UL/FM approved, Stockham G-634.

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering gate valves which may be incorporated in the work include, but are not limited to, the following:
   1. Milwaukee Valve Company.
   2. NIBCO Valve Company.
   3. Stockham Valves and Fittings, Inc.

2.05 GLOBE VALVES

A. Packing: Select valves designed for repacking under pressure when fully opened, equipped with packing suitable for intended service. Select valves designed so back seating protects packing and stem threads from fluid when valve is fully opened, and equipped with gland follower.

B. Composition Discs: Where required, provide suitable material for intended service. For stem throttling service, fit composition disc valve with throttling nut. For metal seated globe valves, provide hardened stainless-steel disc and seat ring.

C. Comply with the following standard:
   1. Cast-Iron Valves: MSS SP-85.
   2. Bronze Valves: MSS SP-80.
   3. Steel Valves: ANSI B16.34.

D. For Domestic Water Service:
   1. Threaded Ends 2 inches and smaller: Class 150, bronze body, union bonnet, rising stem, composition disc, NIBCO No. T-211Y.
   2. Flanged Ends 2-1/2 inches and larger: Class 125, iron body, bronze trimmed, bolted bonnet, rising stem, OS&Y, renewable seat and disc, NIBCO F-718-B.

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering globe valves which may be incorporated in the work include, but are not limited to, the following:
   1. Milwaukee Valve Company.
   2. NIBCO Valve Company.
   3. Stockham Valves and Fittings, Inc.

2.06 DRAIN VALVES

A. For Low Pressure Drainage Service:
   1. Threaded Ends 2 Inches and Smaller: Class 125, bronze body, screwed bonnet, rising stem, composition disc, 3/4 inch hose outlet connection, Milwaukee 1152M.
   2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering drain valves which may be incorporated in the work include, but are not limited to, the following:
      a. Milwaukee Valve Company.
      b. NIBCO Valve Company.
      c. Stockham Valves and Fittings, Inc.

2.07 BALL VALVES

A. General: Select with port area equal to or greater than connecting pipe area, include seat ring designed to hold sealing material.

B. Comply with the following standards:
   1. Steel Valves: ANSI B16.34.

C. For Domestic Water Service:
   1. Threaded Ends 2 inches and smaller: Class 125, bronze 2-piece body, stainless steel ball, bronze, extended stem, Apollo 77c – 14X-04.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering ball valves which may be incorporated in the work include, but are not limited to the, the following:
   1. Milwaukee Valve Company.
   2. NIBCO Valve Company.
   3. Stockham Valves and Fittings, Inc.
   4. Apollo: 77c-100 Series.

2.08 SWING CHECK VALVES

A. General: Construct pressure containing parts of valves as follows:
   1. Bronze Valves, 125 or 150 psi: ANSI/ASTM B62.
   2. Metallic Seated Bronze Valves, 200 or 300 psi: ANSI/ASTM B61.
   3. Iron Body Valves: ANSI/ASTM A126, Grade B.

B. Comply with MSS SP-71 for design, workmanship, material, and testing.

C. Construct valves of pressure castings free of any impregnating materials.

D. 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.

F. Construct disc and hanger as separate parts, with disc free to rotate.

G. Support hanger pins on both ends by removable side plugs.

H. For Domestic Water Service:
   1. Threaded Ends 2 inches and smaller: Class 125, bronze body, screwed cap, horizontal swing, bronze disc, NIBCO T-413-Y-LF.
   2. Flanged Ends 2-1/2 inches and larger: Class 125, iron body bronze mounted, bolted cap, horizontal swing, cast-bronze disc, NIBCO F-918-B.

I. For Fire Protection System:
   1. Threaded Ends 2 inches and smaller: Class 200, bronze body, bolted cap, horizontal swing, composition disc, UL listed, Stockham B-305-B.
   2. Flanged Ends 2-1/2 inches and larger: Class 2005, iron body bronze mounted, bolted cap, horizontal swing, malleable iron disc, UL/FM approved, Stockham G-939.

J. Available Manufacturers: Subject to compliance with requirements, manufacturers offering swing check valves which may be incorporated in the work include, but are not limited to, the following:
   1. Milwaukee Valve Company
   2. NIBCO Valve Company.
   3. Stockham Valves and Fittings, Inc.

2.09 VALVE FEATURES

A. General: Provide valves with features indicated and, where not otherwise indicated, provide proper valve features as determined by Installer for 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 plug complying with Division 15 "Pipe, Tube, and Fittings" section.

D. Flanged: Valve flanges complying with ANSI B16.5 (steel) or ANSI B16.24 (bronze).

E. Threaded: Valve ends complying with ANSI B2.1.

F. Butt-Welding: Valve ends complying with ANSI B16.25.

G. Flangeless: Valve bodies manufactured to fit between flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).

H. Wafer: Flangeless valves.

I. 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.

J. Non-Metallic Disc: Non-metallic material selected for service indicated in accordance with manufacturer's published literature.

K. Renewable Seat: Design seat of valve with removable disc, and assembly valve so disc can be replaced when worn.

L. Extended Stem: Increase stem length by 2 inches minimum, to accommodate insulation applied over valve.

M. Mechanical Actuator: Factory-fabricated gears, gear enclosure, external chain attachment, and chain designed to provide mechanical advantage in operating valve.

N. Bonnet: Part of gate or globe valve through which stem passes to valve body, and attached to valve body by screws, bolts, union, or welding.

O. Solid Wedge: One-piece tapered disc in gate valve, designed for contact on both sides.

P. Outside Screw and Yoke: Stem and handwheel designed to rise out of bonnet or yoke as valve is operated from closed to open position.

2.10 PLUG VALVES (COCKS) (For Complete Gas Valve Specifications See Section 22 1005)

A. Valve body shall be screw pattern, iron, except that sizes 1-1/4 inches through 2 inches shall be semi-steel, rated for 125 psig, non-shock W.O.G. operating pressure.

B. Plug shall be tapered, lubricated brass with square head operator.

C. APPROVED MANUFACTURERS
1. 1-inch and smaller - A. Y. McDonnel Manufacturing Company #10686.
2. 1-1/4 inches through 1-1/2 inches - Nordstrom #114.
3. 2-1/2 inches and larger - Nordstrom #115.
4. Architect Approved.

2.11 PRESSURE RELIEF VALVES

A. Body: Bronze or iron with testing lever.

B. Trim: Bronze or stainless steel.

C. Construction: Comply with ASME Code for Pressure Vessels, Section VIII and shall bear ASME stamp.

D. Maximum Permissible over Pressure: 25 percent (water).

E. Approved Manufacturers
1. Bell and Gossett.
2. McDonnell Miller.
3. Kunkle Valve Company.

2.12 PRESSURE REDUCING VALVES

A. Body: Cast iron.

B. Trim: Bronze.

C. Rating: 125 psig working pressure at 200 °F.

D. Operator: Spring loaded diaphragm with adjustable range.

E. Diaphragms and Disc: Nitrile.

F. Pressure Reducing Valves - Water Service:
   1. Spence Regulators - Type D 34.
   2. Watts Regulators.
   3. Architect Approved.

2.13 BACK FLOW PREVENTERS

A. Reduced pressure type. Rated 175 psig at 140 °F and manufactured in the United States of America.

B. Body:
   1. Bronze construction.
   2. Bronze body test cocks.
   3. NPT body connections.
   4. Non-rising stem gate valves.

C. Check Valve:
   1. Celcon seats.
   2. Rubber check valve.

D. Relief Valve:
   1. Stainless steel seat.
   2. Stainless steel shaft and flange bolts.

E. APPROVED MANUFACTURERS
   1. Watts Regulator Series 909-SAG.
   2. Wilkins Regulators.
   3. Febco.

2.14 HORIZONTAL-PIPING HANGERS AND SUPPORTS

A. General: 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, selected by Installer 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 around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.

B. Adjustable Steel Clevises: MSS Type 1.

C. Steel Double Bolt Pipe Clamps: MSS Type 3.

D. Adjustable Swivel Pipe Rings: MSS Type 6.

E. Split Pipe Rings: MSS Type 11.

F. Extension Split Pipe Clamps: MSS Type 12.

G. Pipe Saddle Supports: MSS Type 36, including steel pipe base support and cast-iron floor flange.

H. Pipe Stanchion Saddle: MSS Type 37, including steel pipe base support and cast-iron floor flange.

I. Adjustable Pipe Saddle Supports: MSS Type 38 including steel pipe base support and cast-iron floor flange.

J. Single Pipe Rolls: MSS Type 41.

K. Adjustable Roller Hangers: MSS Type 43.

2.15 VERTICAL-PIPING CLAMPS

A. General: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with ANSI/MSS SP-58, of one of the following types listed, selected by Installer 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.

B. Two-Bolt Riser Clamps: MSS Type 8.

C. Four-Bolt Riser Clamps: MSS Type 42.

2.16 HANGER ROD ATTACHMENTS

A. General: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer 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.

B. Steel Turnbuckles: MSS Type 13.

C. Swivel Turnbuckles: MSS Type 15.

D. Malleable Iron Sockets: MSS Type 16.

E. Steel Weldless Eye Nuts: MSS Type 17.

2.17 BUILDING ATTACHMENTS

A. General: Except as otherwise indicated, provide factory-fabricated building attachments complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer 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.

B. Concrete Inserts: MSS Type 18.

C. Top Beam C-Clamps: MSS Type 19.

D. Side Beam or Channel Clamps: MSS Type 20.

E. Center Beam Clamps: MSS Type 21.

F. C-Clamps: MSS Type 23.

G. Top I-Beam Clamps: MSS Type 25.

H. Side I-Beam Clamps: MSS Type 27.

I. Steel I-Beam Clamps with Eye Nut: MSS Type 28.

J. Steel WF-Beam Clamps with Eye Nut: MSS Type 29.

K. Malleable Beam Clamps: MSS Type 30.

L. Steel Brackets: One of the following for indicated loading:
Light Duty: MSS Type 31.
Medium Duty: MSS Type 32.
Heavy Duty: MSS Type 33.

2.18 SADDLES AND SHIELDS

A. General: Except as otherwise indicated, provide saddles or shields for piping hangers and supports, factory-fabricated, for all insulated piping. Side saddles and shields for exact fit to mate with pipe insulation.

B. Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.

C. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.

2.19 MANUFACTURERS OF HANGERS AND SUPPORTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering hangers and supports which may be incorporated in the work include, but are not limited to the following:
C & S Mfg. Corp.
Carpenter and Patterson, Inc.
Elcen Metal Products Co.
F & S Central Mfg. Corp.
ITT Grinnell Corp.

2.20 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 A36.

C. Cement Grout: Portland cement (ANSI/ASTM C150, Type I or Type III) and clean uniformly graded, natural sand (ANSI/ASTM C404, Size No. 2). Mix at a ratio of 1.0 part cement to 3 parts sand, by volume, with minimum amount of water required for placement and hydration.

D. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for load required; weld steel in accordance with AWS standards.

E. Pipe Guides: Provide factory-fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of a bolted two-section outer cylinder and base with a two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), by cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

PART 3 - EXECUTION

3.01 INSTALLATION OF MANUFACTURED PIPING SPECIALTIES

A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through 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 is 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 inches and smaller installed ahead of control valves feeding individual terminals. Where indicated, provide drain line from shutoff valve to plumbing drain, full size of blow down connection.
   1. Locate Y-type strainers in supply line ahead of the following equipment, and elsewhere as indicated, if integral strainer is not included in equipment.
      Pumps
      Steam traps serving steam main drips
      Temperature control valves
      Pressure reducing valves
      Temperature or pressure regulating valves

C. Dielectric Unions: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.

3.02 INSTALLATION OF FABRICATED PIPING SPECIALTIES

A. Drip Pans: Locate drip pans under piping passing over or within 3' horizontally of electrical equipment, and 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 inch 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 of work, except as detailed on drawings, or as reviewed by

Architect/Engineer. 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 that 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 sleeve. Extend floor sleeves 1/4 inch above level floor finish, and 3/4 inch 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.

1. Install sheet-metal sleeves at interior partitions and ceilings other than suspended ceilings.
2. Install iron-pipe sleeves at exterior penetrations, both above and below grade.
3. Install steel-pipe sleeves except as otherwise indicated.

C. Sleeve Seals: Install in accordance with the following:
   1. 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.

3.03 INSTALLATION OF VALVES

A. General: 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.
   3. Ball valves shall not be substituted for gate valves or plug valves. Install ball valves only where shown on the Drawings.

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 actuator 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. Pipe Size 2 inches and smaller: One of the following, at Installer's option:
      a. Threaded valves.
      b. Grooved-end valves (Fire Protection Only).
      c. Flanged valves.
   2. Pipe Size 2-1/2 inches and larger: One of the following, at Installer's option:
      a. Grooved-end valves (Fire Protection Only).
      b. Flanged 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 discs 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, gate, 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 valve.

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.
   2. Horizontal Lift Check Valve: Install in horizontal piping line with stem vertically upward, position for proper direction of flow.
   3. Vertical Lift Check Valve: Install in vertical piping line with upward flow with stem vertically upward.
   4. Spring Loaded Horizontal Lift Check Valve: Install in horizontal piping line with stem vertically upward, position for proper direction of flow.

3.04 INSTALLATION OF BACKFLOW PREVENTERS

A. Install backflow preventers where shown on the plans with elbow and air gap, and as may be required to prevent cross contamination of potable water systems.

B. Pipe discharge drain to nearest floor drain.

3.05 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/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.06 INSTALLATION OF BUILDING ATTACHMENTS

A. Install building attachments at required locations, within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-59. 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 openings at top of inserts.

3.07 INSTALLATION OF HANGERS AND SUPPORTS

A. General: 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 spacing 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, ductwork or other supported mechanical or electrical items.
   1. 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.
   2. Support fire-water piping independently of other piping.
   3. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

B. 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 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.

C. Insulated Piping: Comply with the following installation requirements.
1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; 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 galvanized coated protective shields. Install Foam-Glas insulation saddles.
3. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

3.08 INSTALLATION OF ANCHORS

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of 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 maximum recommended by manufacturer for each unit.

D. Anchor Spacing: 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.

3.09 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.

3.10 EQUIPMENT BASES

A. Concrete housekeeping bases will be provided as work of Division 3. Furnish to Contractor, scaled layouts of all required b bases with dimensions of bases, and location to column center lines. Furnish templates, anchor bolts, and accessories, necessary for base construction.

B. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands. Structural steel stands to be supported from housekeeping pad bases. Steel supports shall not be allowed to be in direct contact with slab

floors.

END OF SECTION

SECTION 22 30 00

PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Water Heaters.

1.02 RELATED SECTIONS

A. Section 22 05 00 – Common Work Results for Plumbing.

B. Section 22 05 53 – Identification for Plumbing Piping

C. Section 22 05 48 – Vibration and Seismic Controls for Plumbing Piping and Equipment.

D. Section 22 10 05 – Plumbing Piping.

E. Section 22 40 00 – Plumbing Fixtures.

1.03 REFERENCES

A. ANSI/ASHRAE 90A - Energy Conservation in New Building Design.

B. ASME Section VIII-D - Pressure Vessels: Boiler and Pressure Vessel Codes.

C. ANSI/NFPA 30 - Flammable and Combustible Liquids Code.

D. ANSI/NFPA 54 - National Fuel Gas Code.

E. ANSI/NFPA 70 - National Electrical Code.

F. ANSI/NEMA 250 - Enclosure for Electrical Equipment (1000 Volts Maximum).

1.04 SUBMITTALS

A. Submit under provisions of Division 01 and Section 22 0500.

B. Shop Drawings:
   1. Include heat exchanger dimensions, size of tapping and performance data.
   2. Include dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tapping and drains.

C. Product Data:
   1. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Provide electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions.

1.05 OPERATION AND MAINTENANCE DATA:

A. Submit under provisions of Division 01 and Section 22 0500.

B. Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with Arkansas State Plumbing Code.

B. Provide pumps with manufacturer's name, model number, and rating/capacity identified.

C. Ensure products and installation of specified products, are in conformance with recommendations and requirements of the following organizations:
   1. National Sanitation Foundation (NSF).
   2. American Society of Mechanical Engineers (ASME).
   3. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
   4. National Electrical Manufacturers' Association (NEMA).
   5. Underwriters Laboratories (UL).

D. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation; operate within 25 percent of midpoint of published maximum efficiency curve.

1.07 REGULATORY REQUIREMENTS

A. Conform to AGA, NSF, NBBPVI, ANSI/NFPA 54, ANSI/NFPA 58, ANSI/NFPA 70, ANSI/UL 174, and ANSI/UL 1453 requirements for water heaters.

B. Conform to ASME Section VIIID for manufacture of pressure vessels for heat exchangers.

C. Conform to ASME Section VIIID, ANSI/NFPA 30, and ANSI/NFPA 31 for tanks.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 22 0500.

B. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.09 WARRANTY

A. Provide one-year warranty under provisions of hereinafter set forth.

B. Warranty: Include coverage of domestic water heaters and submersible

sump pumps.

PART 2 - PRODUCTS

2.01 WATER HEATERS – SEE DRAWINGS FOR WATER HEATER SCHEDULE

PART 3 - EXECUTION

3.01 WATER HEATER INSTALLATION

A. Install water heaters in accordance with manufacturer's instructions and to AGA, NSF, ANSI/NFPA 54 and UL requirements.

B. Coordinate with plumbing piping and related electrical work to achieve operating system.

C. Install tanks in accordance with manufacturer's instructions.

D. Pipe relief valves and drains to nearest floor drain or as noted on drawings.

E. Support Unit on 4" concrete housekeeping pad.

F. Make adjustments such that stored water temperature is set at 120° F (max).

3.02 GUARANTEE

A. The entire installation shall be guaranteed for one (1) year against defective equipment, materials and workmanship beginning on signing of substantial completion form.

END OF SECTION

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SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Basic Requirements for Plumbing Fixtures.

1.02 RELATED SECTIONS

A. Section 22 05 00 – Common Work Results for Plumbing Piping and Equipment.

B. Section 22 05 48 – Vibration and Seismic Controls for Plumbing Piping and Equipment.

C. Section 22 10 05 – Plumbing Piping.

D. Section 22 30 00 – Plumbing Equipment.

1.03 QUALITY ASSURANCE

A. Die-cast zinc alloy will not be accepted.

B. All faucets, stops, and traps shall be of the same manufacturer unless herein noted otherwise.

C. Corrosion-resistant steel (CRS).
   1. CRS flat products shall conform to not less than chemical composition requirements of any 300 series steel specified in ASTM A276.
   2. Exposed surfaces shall have standard polish (ground and polished) equal to Finish No. 4 as specified in NAAMM.

D. All enameled ironware shall be acid resisting.

E. All fixtures shall be new and best of their respective kinds. They shall be non-absorbent throughout and free from waves, kiln marks or discoloration.

F. All surfaces coming in contact with walls, floors or surface of other fixtures shall be ground truly flat and shall be bedded with fine dental plaster before being caulked to wall with silicone sealant.

G. Job must be turned over to the Owner with all fixtures clean and free from damage. All fixtures including service sinks shall be protected during construction with application of material sufficient to prevent use and damage by personnel and equipment.

1.04 SUBMITTALS

A. Submit under provisions of Division 01 and Section 22 0500.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim and finishes.

C. Manufacturer's Installation Instructions.

1.05 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 01 and Section 22 05 00.

B. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 22 0500.

B. Accept fixtures on site in factory packaging. Inspect for damage.

C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.07 FIELD MEASUREMENTS

A. Verify that field measurements are as instructed by the manufacturer.

B. Confirm that millwork is constructed with adequate provision for the installation of countertop lavatories and sinks.

1.08 WARRANTY

A. Provide year warranty under provisions of Section 22 0500.

1.09 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the test by the basic designation only.

1. American National Standards (ANSI):
   A112.1.2-42.....Air Gaps in Plumbing System
   A112.6.1M-79.....Supports for Off-the-Floor Plumbing Fixtures for Public Use
   A112.18.1M-79....Finished and Rough Brass Plumbing Fixture Fittings
   A112.19.1M-79....Enameled Cast Iron Plumbing Fixtures
   A112.19.2-82.....Vitreous China Plumbing Fixtures
2. American Society for Testing and Materials (ASTM):
   A276-83.....Stainless and Heat-Resisting Steel Bars and Shapes
3. National Association of Architectural Metal Manufacturers (NAAMM):
   Metal Finishes Manual.

PART 2 - PRODUCTS

2.01 GENERALLY

A. This contractor shall furnish and install complete all fixtures shown on the plans and hereinafter specified.

B. All fixtures shall be new and best of their respective kinds. They shall be non-absorbent throughout and free from waves, kiln marks or discoloration.

C. All surfaces coming in contact with walls, floors or surface of other fixtures shall be ground truly flat and shall be bedded with fine dental plaster before being caulked to wall with silicone sealant.

D. All fixtures shall have water hammer arresters equal to Zurn or Wade, installed in their water supplies as shown on Drawings or as recommended by the shock absorber manufacturer.

E. Provide polished chromium plated, heavy brass lock-shield loose key or screwdriver pattern angle stops, straight stops, or stops integral with faucet, with each compression type faucet whether specifically called for or not. Locate stops centrally above or below fixture in accessible location. Furnish keys for lock-shield stops to Owner upon completion of installation. All supplies shall be I.P.S. brass.

F. Traps shall be two-piece chrome plated cast brass P-traps with cleanout and 17 gauge tubing outlet with escutcheon.

G. All escutcheons on supplies and wastes shall be heavy chrome plated cast brass set screw type.

H. All faucets throughout shall have removable units comprising all the wearing parts.

I. Unless specifically specified otherwise, all material and products shall be manufactured in the United States of America.

J. Unless specifically specified otherwise, all fixture trim, stops, and traps shall be of the same manufacturer.

K. Protect fixtures against use and damage during construction in a manner approved by the Architect. Job must be turned over to the Owner with all fixtures and trim clean and free from damage. Fixtures shall not be used during construction unless approved by the Owner and/or Architect/Engineer.

L. All sink and lavatory type plumbing fixtures to have loose key type stops and flexible supply risers (unless noted otherwise).

M. All exposed plumbing piping shall be chrome plated unless noted

otherwise.

N. The Contractor must review the Architectural Drawings for exact location of plumbing fixtures and floor drains. If a plumbing fixture or floor drain is shown on the Architectural Drawings, it must be included in the Contract even if it does not appear on the Mechanical Drawings.

O. All thermostatic and pressure balancing mixing valves shall have check stops on the hot and cold supplies.

P. All hot and cold-water supplies to plumbing fixtures or to shower heads shall have a "Drop Ell" fitting securely attached, inside wall, to prevent movement.

Q. All lavatory or sink fixtures designated for handicapped use must have insulation installed on the water supplies and P-trap equal to "Lav-Guard" by Truebro, Inc.

R. All drinking fountain bubblers shall be chrome-plated brass.

S. All lavatory and urinal waste arms shall be DWV copper with cast brass adapters and wrought copper fittings.

T. All water closet flush valves that have grab bars mounted on walls behind them shall have a minimum of 1-1/2 inch flush valve pipe offset to clear grab bar. Coordinate with Architectural drawings.

U. All handicapped water closet flush valves shall be roughed-in and installed so that the flush valve control will be on the wide side of the toilet stall. Contractor shall coordinate this.

V. All water closet flush valves shall have cast wall flange with set screw, and be supplied with sweat-solder adapter kits.

W. Check millwork architectural and shop drawings. Verify exact location and size of fixtures and openings before rough-in and installation. Coordinate with millwork supplier for special cutouts, blocking, special or additional supports, etc.

X. This contractor shall furnish and install all backing for lavatories, or any equipment requiring same.

Y. Job must be turned over to the Owner with all fixtures clean and free from damage.

Z. Where water closets, lavatories or sinks are installed back-to-back and carriers are specified, provide one carrier to serve both fixtures in lieu of individual carriers, unless noted otherwise on Drawings.

2.02 STOPS

A. Provide polished chromium plated, heavy brass lock-shield loose key or screw driver pattern angle stops, straight stops, or stops integral with faucet, with each type faucet whether specifically called for or not, including sinks in wood and metal casework, laboratory furniture. Locate stops centrally above or below fixture in an accessible location with 6-inch minimum length chrome plated brass nipples from wall and escutcheon. Furnish keys for lock-shield stops to Owner upon completion of installation.

2.03 TRAPS

A. Two-piece chromium plated cast brass with cleanout and 17-gauge tubing outlet with cast brass set screw type escutcheon.

2.04 ESCUTCHEONS

A. All escutcheons on supplies and wastes shall be heavy pattern, chrome plated, cast brass set screw type.

2.05 FAUCETS

A. All faucets shall be provided with aerators unless specified otherwise and shall have removable units comprising all the wearing parts.

2.06 CARRIERS

A. Where water closets, lavatories or sinks are installed back-to-back, and carriers are specified, provide one carrier to serve both fixtures in lieu of individual carriers.

2.07 ORIGIN

A. Unless specifically specified otherwise, all material and products shall be manufactured in the United States of America.

2.08 FIXTURES

A. The following catalog numbers are for reference as to type and quality.

SEE DRAWINGS FOR PLUMBING FIXTURE SCHEDULE

PART 3 - EXECUTION

3.01 INSTALLATION

A. Fixture Setting: Opening between fixture and floor and wall finish shall be caulked with white or clear Silicone sealants, which complement the fixture color.

B. Supports and Fastening: Secure all fixtures, equipment and trimmings to partitions, walls, etc. with brass through bolts, toggle bolts, expansion bolts, or power set fasteners, as required. Exposed heads of bolts and

nuts in finished rooms to be hexagonal, polished chromium-plated brass with rounded tops.

3.02 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

B. Install components level and plumb secured in place with wall carriers and bolts.

3.03 ADJUSTING

A. Adjust work under provisions of Section 22 0500.

B. Provide adjustment of all stops, valves faucets, etc., for intended water flow rates to fixtures, as required to eliminate excessive splashing, noise, or overflow.

C. Where water closet waste pipe has to be offset due to beam interference, provide correction and/or additional piping necessary to eliminate relocation of water closet.

3.04 CLEANING

A. At completion of all work, fixtures, exposed materials, accessible chases and equipment shall be thoroughly cleaned of all manufacture's labels, papers, paint, paste, and other foreign material.

3.05 FIXTURE HEIGHTS

A. Install fixtures to heights above finished floor as herein specified and indicated on the Architectural drawings. Architectural drawings shall rule where discrepancies occur.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HEATING, VENTILATING AND AIR CONDITIONING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Basic Requirements for complete heating, ventilating, and air conditioning system.

1.02 RELATED SECTIONS

A. Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.

B. Section 23 31 00 – HVAC Ducts and Casings.

C. Division 23 – All Sections.

D. Section 31 23 16 – Excavation.

1.03 SITE INSPECTION

A. Examine premises and understand the conditions which may affect the performance of work of this Division before submitting proposals for this work.

B. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

1.04 DRAWINGS

A. Mechanical drawings show the general arrangement of piping, ductwork, equipment, etc. 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 the design and construction of buildings. These drawings take precedence over mechanical drawings.

C. Because of the small scale of mechanical drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required. Investigate structurally and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

D. Record the difference between mechanical work as installed and as shown in Contract Documents on a set of prints of mechanical drawings to be furnished by Architect. Return these prints to Architect after the project. These will be labeled "Contractor Revised Drawings".

1.05 SUBSTITUTIONS

A. The naming of specified items on the drawings or in the specifications is

intended to establish a level of quality and performance. Substitution requests may be submitted at the time of shop drawing submittal. A review of substituted equipment or material before the Bid Date will not be considered unless otherwise specified.

B. Substitution shall be submitted as specified in Division 01.

1.06 CODE REQUIREMENTS, FEES & PERMITS

A. Perform work per applicable provisions of state and local Plumbing Code, gas ordinances, and adoptions thereof. Provide materials and labor necessary to comply with rules, regulations, and ordinances.

B. In case of differences between building codes, state laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Promptly notify Architect in writing of such differences.

C. Obtain all required permits in connection with this work under the contract and pay all fees in connection therewith. Arrange with serving utility companies for the connection to all utilities and pay all charges for the same including inspection fees and meters if required.

1.07 OPERATIONS AND MAINTENANCE MANUAL FOR MECHANICAL SYSTEMS

A. Bind two (2) Operations & Maintenance Manuals for Mechanical Systems in 3-ring, hardback binders. The spine of each binder shall have the following lettering done in silk-screen:

CHARLIE CRAIG HATCHERY
ARKANSAS GAME AND FISH COMMISSION
CENTERTON, ARKANSAS

1. Provide a master index at beginning of Manual showing items included. Include the name and phone number of the nearest supplier and Manufacturer's representative. Use plastic tab indexes for sections of Manual.
2. Step by step procedure to follow in putting each piece of mechanical equipment into operation.
3. Provide schematic control diagrams for each separate fan system, refrigeration system, heating system, control panel, etc. Each diagram shall show locations of start-stop switches, insertion thermostats, room thermostats, thermometers, fire-stats, pressure gauges, automatic valves, and refrigeration accessories. Mark correct operating settings for each control instrument on these diagrams.
4. Provide diagram for electrical control system showing the wiring of related electrical control items such as fire-stats, fuses, interlocks, electrical switches, and relays.
5. Provide drawings of each temperature control panel identifying components on the panels and their function.

B. Maintenance instructions shall include:

1. Manufacturer's maintenance instructions for each piece of mechanical equipment installed in the project. Instructions shall include the name of the vendor, installation instructions, parts numbers and lists, operations instructions of equipment and maintenance, and lubrication instructions.
2. Summary list of mechanical equipment requiring lubrication showing the name of equipment, location, and type and frequency of lubrication.
3. List of mechanical equipment used to indicate name, model, serial number, and nameplate data of each item together with number and name associated with each system item.

C. Air Balance and Test Run Reports.
1. Include a copy of air balance reports and certifications.
2. Include a copy of the operating test data.

D. Provide a complete set of approved shop drawing submittals as an Appendix item.

1.08 OPERATIONS AND MAINTENANCE INSTRUCTIONS

A. Instruct Owner/Owner's Representative in operation and maintenance of mechanical systems utilizing Operations and Maintenance Manual when so doing.

B. Minimum instruction periods shall be as follows:
1. Mechanical - Eight (8) hours.
2. Refrigeration - Eight (8) hours.

C. Instruction periods shall occur after pre-final inspection when systems are properly working and before final payment is made.

D. None of these instructional periods shall overlap another.

1.09 CONTRACTOR REVISED DRAWINGS

A. The contractor shall, during the progress of the work, keep an accurate record of all changes and corrections from the layouts shown on the drawings. Record of changes may be kept by accurately making all changes on a set of prints during the progress of the job.

B. The exact location of all underground utility service entrances and their connections to utility mains, wellheads, loop piping, and all valves, etc., which will be concealed in the finished work shall be accurately indicated on the drawings by measured distances.

C. Upon completion of the work and before final payment, the contractor shall furnish to the Architect, one set of "contractor revised" prints, legibly and accurately marked to indicate all changes, additions, deletions, etc., from the contract drawings.

D. The contractor shall include all addendum items and field change order information on the revised drawings. Revise all schedules shown on the

drawings to reflect the actual model numbers, capacities, and electrical characteristics of substituted equipment.

1.10 VISIT SITE

A. This contractor shall visit the site of the building before submitting a proposal on this work, and shall thoroughly familiarize himself with the existing conditions and operations. Failure on his part to do this will not be cause for extras after the contract is signed because of unforeseen conditions. Any existing electrical wiring and conduit, gas, water drainage piping encountered within the building area shall be relocated or removed where required by this contractor at no extra cost to the Owner.

1.11 COORDINATION OF WORK

A. It is understood that while Drawings are to be followed as closely as circumstances permit, this Division will be held responsible for the installation of systems according to the true intent and meaning of the Contract Documents. Anything not clear or in conflict will be explained by making an application to Architect. Should conditions arise where certain changes would be advisable, secure Architect's approval of these changes before proceeding with the work.

B. Coordinate work of various trades in installing inter-related work. Before installation of mechanical items, make proper provisions to avoid interferences in a manner approved by Architect. Changes required in work specified in Division 23 caused by neglect to do so shall be made at no cost to the Owner.

C. Provide inserts and supports required by Division 23 unless otherwise noted. Furnish sleeves, inserts, supports, and equipment that are an integral part of other divisions of the Work to Sections involved insufficient time to be built into construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from an improper location of installation of items above shall be borne by Division 23.

D. Be responsible for required digging, cutting, and patching incident to work of this Division and make required repairs afterward to satisfaction of Architect. Cut carefully to minimize the necessity for repairs to existing work. Do not cut beams, columns, or trusses.
   1. Each Section of this Division shall bear the expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, and tardiness or because of damage done by it.
   2. Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is the responsibility of Section installing work.

E. Adjust locations of pipes, etc. to accommodate work from interferences anticipated and encountered. Determine the exact route and location of each pipe and duct before fabrication.
   1. Make offsets, transitions, and changes in direction of pipes, as required to

maintain proper headroom and pitch of sloping lines whether or not indicated on Drawings.

F. Slots and openings through floors, walls, ceilings, and roofs shall be provided by other Divisions in their respective materials. This Division shall see that they are properly located and do any cutting and patching caused by its neglect to do so.

1.12 EXCAVATION AND TRENCHING FOR PIPING

A. Excavate to the depths indicated on the Drawings or as otherwise specified. Excavated materials not required or suitable for backfill or fill shall be removed from the site. Do such grading as is necessary to prevent surface water from flowing into trenches or other excavations. Water accumulated therein shall be removed by pumping or by other approved methods. Do sheeting and shoring as may be necessary for the protection of the work and safety of personnel. Excavation shall be by open-cut except for that short sections of the trench may be tunneled if the pipe can be safely and properly installed and backfill can be properly tamped in such tunnel sections.

B. Trench Excavation: The bottom of the trench for tile or concrete pipe shall be rounded so that at least the bottom quadrant of the pipe rests firmly on undisturbed soil for as nearly the full length of the barrel as proper jointing operations will permit. Grate bottom of trenches to provide uniform bearing and support for each section of pipe, on undisturbed soil. Where rock is encountered, excavate to a minimum over-depth of 4" below trench depths indicated on the drawings or specified. Over-depths in rock excavation and unauthorized over-depths shall be backfilled. Whenever wet or otherwise unstable soil incapable of properly supporting the pipe is encountered, such soil shall be removed and the trench backfilled to proper grade as hereinafter specified.

C. Depth of Cover: Trenches shall be of a depth that will provide a minimum depth of cover of three feet for water, sanitary and storm sewer, and two feet for gas piping from existing grade or from indicated finish grade, whichever is lower, unless otherwise specifically shown.

1.13 BACKFILLING OF TRENCHES

A. Trenches shall not be backfilled until required pressure and other tests have been performed, an inspection of utility, and Code officials have been accomplished, and until the utility systems as installed conform to requirements of drawings and specifications.

B. Backfill trenches with excavated materials consisting of earth, sandy clay, sand, gravel, soft shale or other approved materials, free from clods of earth or stones over 2-1/2 inch maximum dimension, deposited in 6-inch layers and compacted to 95% of the maximum laboratory density determined per ASTM D-698, Moisture-Density Relation of Soils. Tests for maximum density will be made with expense borne by the contractor. If fills fail to meet the specified densities,

the contractor shall remove and re-compact the fill until specified densities are achieved.

C. Tests for Displacement of Sewers: After the trench has been backfilled to 2 feet or more above the pipe, if the pipe shows poor alignment, displaced pipe, or any other defects, such defects shall be remedied by the contractor at his expense.

1.14 GENERAL PIPING INSTALLATION

A. Furnish and install a complete system of piping. The piping drawings are diagrammatic and indicate the general location and connections. If the size of any piping is not evident, obtain instructions from the Architect before proceeding with the work. The piping may have to be offset, lowered or raised as required or as directed at the site. This does not relieve the contractor from responsibility for the proper erection of systems of piping in every respect suitable for the work intended. Piping systems that are not to be installed completely shall be so noted.

B. Erection: Piping shall be cut accurately for fabrication to measurements established at the construction site. Pipe shall be worked into place without springing and/or forcing. Remove all burrs and cutting slag by reaming or other cleaning methods. Changes in direction shall be made with fittings, except that bending of pipe will be permitted, providing a hydraulic pipe bender is used. Bent pipe showing kinks, wrinkles, or other malformation will not be acceptable. Piping shall be arranged so as not to interfere with the removal of other equipment or devices, nor to block access manholes or other access openings. Piping shall be installed to ensure noiseless circulation.

C. A minimum slope of piping shall be per the following unless otherwise specifically shown on the drawings or specified:

Type of Piping Fluid Conveyed	System Component	Length for 1" Fall	Direction of Fall
Condensate	Return main	20 feet	Condensate flow
Freon	Main	20 feet	Direction of flow

D. Protection: Open ends of pipes and equipment shall be properly capped or plugged to keep dirt and other foreign materials out of the system. Plugs or rags, wood, cotton, concrete, waste, or similar materials must not be used in plugging.

E. Installation of Underground Pipe: The bottom of the trench shall be shaped to give substantially uniform circumferential support to the lower third of each pipe. Pipe shall be laid true to line and grade in such manner as to form a close concentric joint with adjoining pipe and to prevent sudden offsets to flow line. As work progresses, the interior of the pipe shall be cleared of dirt and superfluous materials. Where cleaning after laying is difficult because of small pipe size, a suitable swag or drain shall be kept in the pipe and pulled forward past each joint immediately after jointing has been completed. Trenches shall

be kept free from water until pipe jointing has set and pipe shall not be laid when the condition of trench or weather is unsuitable for such work.

F. Cleaning and Flushing: The contractor shall take every precaution to remove dirt, grease, and all other foreign matter from each length of piping before making connections in the field. After each section of piping is installed, it shall be flushed with clean water except where specified otherwise.

G. Pipe Sizes: If the size of any piping is not evident in the drawings, the contractor shall request instructions from the Architect as to the proper sizing. Any changes resulting from the contractor's failure to request clarification shall be at his expense.

1.15 THERMAL AND MOISTURE PROTECTION

A. Install flashing, counterflashing, and caulk or seal all penetrations in exterior walls or floors as required to prevent exterior moisture from entering the building.

1.16 EQUIPMENT AND MATERIALS

A. Product Approvals:
   1. If approval is received to use other than specified items, responsibility for specified capacities, and ensuring that items to be furnished will fit space available lies with this Division.
   2. In the event other than specified equipment is used and will not fit job site conditions, this Division assumes responsibility for replacement with items named in the specification.

B. Use domestic-made pipe, pipe fittings, and motors on the project.

C. Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connection and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents.

D. Follow the Manufacturer's directions in delivery, storage, protection, and installation of equipment and materials.
   1. Promptly notify Architect in writing of conflicts between requirements of Contract Documents and manufacturer's directions and obtain Architect's written instructions before proceeding with work. Bear expenses arising from correcting deficiencies of work that do not comply with Manufacturer's directions or such written instructions from Architect.

E. Deliver equipment and material to the site and tightly cover to protect against dirt, water, and chemical or mechanical injury but have readily accessible for inspection. Store items subject to moisture damage (such as controls), in a dry, heated space.

1.17 REVIEW OF MATERIALS AND EQUIPMENT

A. Furnish complete catalog data for manufactured items of equipment to be used

in Work to Architect for review within 30 days after award of Contract.

B. Submit all mechanical items in (1) complete submittal. Provide an index of all items submitted, including specification section number, in the order, they appear in the specifications.
   1. State sizes, capacities, brand names, motor HP, accessories, materials, gauges, dimensions, and other pertinent information. Pertinent information shall include as a minimum those items as scheduled on the drawings. Arrange submittal information to reflect these categories scheduled on the drawings.
   2. Provide an index of tab numbers at the front of each binder. List the specification number and category included under each tab as described in the specifications and as scheduled on the drawings.
   3. Provide a cover sheet for each tab section. List each piece of equipment by name, model number, and supplier.
   4. Underline applicable data and indicate the model being supplied on each submittal sheet.

C. If data is not submitted as specified or submittal is not complete, it will be returned without review.

D. Catalog data or shop drawings for equipment which are noted as being reviewed by the Architect, shall not supersede Contract Documents.

E. Review comments of Architect shall not relieve this Division from responsibility for deviations from Contract Documents unless Architect's attention has been called to such deviations in writing at the time of submission, nor shall they relieve this Division from responsibility for errors in items submitted.

F. Check work described in catalog data with Contract Documents for deviations and errors.

1.18 GUARANTEE

A. The work herein specified shall be free from defects in workmanship and material under normal use and service. If within twelve (12) months from date of substantial completion and Owner acceptance of the work herein described, any of the equipment or materials, or in the installation thereof, is found to be defective in workmanship or material, it shall be replaced or repaired free of charge.

B. The Contractor shall, after completion of the original test of the installation, and acceptance of the Architect, provide any service incidental to the proper performance of the mechanical systems under guarantees outlined above for one (1) year.

1.19 FINALLY

A. It is the intention that this specification shall provide a complete installation except as hereinbefore specifically excepted. All accessory construction and apparatus necessary or advantageous in the operation and testing of the work

shall be included.

B. The omission of specific reference to any part of the work necessary for such complete installation shall not be interpreted as relieving this Contractor from furnishing and installing such parts.

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

(Not Applicable)

END OF SECTION

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SECTION 23 05 29

HANGERS & SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe and equipment hangers and supports.

B. Equipment bases and supports.

C. Sleeves and seals.

D. Flashing and sealing equipment and pipe stacks.

1.02 RELATED SECTIONS

A. Section 23 0719 - Piping Insulation.

1.03 REFERENCES

A. ASME B31.2 - Fuel Gas Piping

B. ASTM F708 - Design and Installation of Rigid Pipe Hangers.

1.04 SUBMITTALS

A. Submit under provisions of Section 23 0500.

B. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A. Plumbing Piping - Water:
1. Conform to ASME B31.9 and ASTM F708.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.
5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
6. Wall Support for Pipe: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
10. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

B. Hydronic Piping:
1. Conform to ASME B31.9 and ASTM F708.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.
5. Multiple or Trapeze Hangers: Steel channels with welded spacers and

hanger rods.
6. Vertical Support: Steel riser clamp.
7. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.02 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

2.03 FLASHING

A. Metal Flashing: 28-gauge 304 stainless steel.

B. Copper Flashing: 16 oz. / sq. ft.

C. Lead Flashing:
1. Waterproofing: 6 lb. / sq. ft.

D. Caps: Steel, 22-gauge minimum; 16-gauge at fire-resistant elements.

2.04 SLEEVES

A. Sleeves for Pipes thru Non-fire Rated Floors: 18-gauge galvanized steel.

B. Sleeves for Pipes thru Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe.

C Sleeves for Ductwork and Pipes thru Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire-rated sleeves including seals, UL listed.

D. Sleeves for Round Ductwork: Galvanized steel.

E. Sleeves for Rectangular Ductwork: Galvanized steel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install per manufacturer's instructions.

B. Coordinate wall and floor penetration sealant requirements with a general contractor.

3.02 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as scheduled.

B. Install hangers to provide minimum 1/2 inch space between the finished covering and adjacent work.

C. Place hangers within 12 inches of each horizontal elbow.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

F. Support vertical piping on every floor. Support vertical cast iron pipe at each floor at the hub.

G. Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Provide copper plated hangers and supports for copper piping.

J. Design hangers for pipe movement without disengagement of supported pipe.

K. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl space,
Pipe-shafts and suspended ceiling spaces are not considered exposed.

3.03 EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, where indicated on Drawings, minimum 4 inches thick, and extending 6 inches beyond supported equipment. Refer to Section 03 3000. Coordinate the exact size required for pads.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.04 FLASHING

A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 4 inches minimum above-finished roof surface with lead worked one-inch minimum into a hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and calk, metal counter-flash, and seal.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36-inch sheet size. Fasten flashing to drain clamp device.

D. The sealed floor drains watertight to adjacent materials.

E. Adjust storm collars tight to pipe with bolts; calk around the top edge. Use storm collars above roof jacks. Screw vertical flange section to the face of the curb.

3.05 SLEEVES

A. Set sleeves in position in formwork. Provide reinforcing around sleeves.

B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

C. Extend sleeves through floors one inch above the finished floor level. Caulk sleeves.

D. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with fire stopping insulation and calk. Provide close-fitting metal collar or escutcheon covers at both sides of penetration. Secure collar or escutcheon to prevent blow-out. Fire stopping materials shall meet the requirements of ASTM E119.

E. Install chrome-plated steel escutcheons at finished surfaces.

3.06 SCHEDULES

PIPE SIZE	MAX. HANGER SPACING	HANGER ROD DIAMETER
Inches	Feet	Inches
1/2 to 1-1/4	6.5	3/8
1-1/2 to 2	10	3/8
2-1/2 to 3	10	1/2
4 to 6	10	5/8

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The extent of mechanical identification work required by this section is indicated on drawings and/or specified in other Division 23 sections.

B. Type of identification devices specified in this section, include the following:
Plastic Pipe Markers
Valve Tags
Valve Schedule Frames
Engraved Plastic-Laminate Signs
Ceiling Tacks
Thermostat Identification

C. Mechanical identification furnished as part of factory-fabricated equipment is specified as part of the equipment assembly in other Division 23 sections.

1.02 RELATED SECTIONS

A. Section 23 21 13 – Hydronic Piping.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. ANSI Standards: Comply with ANSI A13.1 for lettering size, colors, and viewing angles of identification devices.

1.04 SUBMITTALS

A. Product Data: Submit product specifications and installation instructions for each identification material and device desired.

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 the 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 a margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals as specified in Division 1.

PART 2 - PRODUCTS

2.01 MECHANICAL IDENTIFICATION MATERIALS

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division-21 sections. Where more than a single type is specified for the application, the selection is the Installer's option but provides a single selection for each product category.

B. Plastic Pipe Markers:
   1. General: Provide manufacturer's standard pre-printed, flexible or semi-rigid, permanent, color-coded, plastic-sheet pipe markers, complying with ANSI A13.1.
      a. Small Pipes: For external diameters less than 6 inches (including insulation if any), provide full-band pipe markers, extending 360° around the pipe at each location, fastened by one of the following methods:
         (1) Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
         (2) Adhesive lap joint in pipe marker overlap.
         (3) Laminated or bonded application of pipe marker to pipe (or insulation).
      b. Large Pipes: For external diameters of 6 inches 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:
         (1) Laminated or bonded application of pipe marker to pipe (or insulation)
         (2) Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless-steel bands.
      c. Lettering: Manufacturer's standard pre-printed nomenclature which best describes the piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.
      d. Arrows: Print each pipe marker with arrows indicating the direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as a separate unit of plastic.
      e. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum of 6 inches wide X 4 mil thick, manufactured for direct burial service.

C. Valve Tags:
   1. At the Contractor's option, provide one of the following:
      a. Brass Valve Tags: provide 19-gauge polished brass valve tags with stamp-engraved piping system abbreviation in 1/4-inch-high letters and sequenced valve numbers 1/2 inch high and with 5/32-inch hole for a fastener. Provide 1-1/2-inch diameter tags, except as otherwise indicated.
      b. Plastic Laminate Valve Tags: Provide manufacturer's standard 3/32-inch-thick engraved plastic laminate valve tags, with piping system

abbreviation in 1/4-inch-high letters and sequenced valve numbers 1/2 inch high, and with 5/32-inch hole for a fastener. Provide 1-1/2-inch square black tags with white lettering, except as otherwise indicated.

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.

D. Valve Schedule Frames:
   1. General: For each page of the valve schedule, provide a glazed display frame, with screws for removable mounting on walls. Provide frames of rigid plastic or metal, with plastic glazing.

E. Engraved Plastic-Laminate Signs:
   1. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses 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 the substrate.
   2. Thickness: 1/16 inch for units up to 20 square inches or 8-inch length; 1/8 inch for larger units.
   3. Fasteners: Self-tapping stainless-steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

F. Provide identification in or on all thermostats, CO2 Sensors, Humidistats, etc., indicating which unit number it serves.

G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering plastic pipe markers which may be incorporated in the work include, but are not limited to, the following:
   Seton Name Plate Company
   EMED Co., Inc.
   Approved equal

2.02 LETTERING AND GRAPHICS

A. General: 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 the manufacturer or as required for proper identification and operation/ maintenance of mechanical systems and equipment.

B. Multiple Systems: Where multiple systems of the same generic name are shown and specified, provide identification which indicates individual system number as well as service.

PART 3 - EXECUTION

3.01 APPLICATION AND INSTALLATION

A. General Installation Requirements:
   1. Coordination: Where identification is to be applied to surfaces that require insulation, painting, or other coverings or finishes, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification before installation of acoustical ceilings and similar removable concealment.

B. Ductwork Identification:
   1. General: Identify air supply, return, exhaust intake and relief ductwork with plastic signs and arrows, showing ductwork service and direction of flow, in black or white (whichever provides most contrast with ductwork color).
   2. Location: In each space where ductwork is exposed, or concealed only by a removable ceiling system, locate signs near points where ductwork originates or continues into concealed enclosures (shaft, underground or similar concealment), and at 50' spacing along with exposed areas.
   3. Access Doors: Provide plastic-laminate type signs on each access door in ductwork and housings, indicating the purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information.
   4. Concealed Doors: Where access doors are concealed above acoustical ceilings or similar concealment, plasticized tags may be installed for identification instead of specified signs, at Installer's option.

C. Piping System Identification:
   1. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces, (shafts, tunnels, plenums), exterior non-concealed locations and above removable acoustical ceilings.
      a. Near each valve and control device.
      b. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at the branch, where there could be a question of flow pattern.
      c. Near locations where pipes pass through walls or floors/ceilings or enter non-accessible enclosures.
      d. At access doors, manholes and similar access points which permit a view of concealed piping.
      e. Near major equipment items and other points of origin and termination.
      f. Spaced intermittently at a maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
      g. On piping above removable acoustical ceilings.

D. Valve Identification:
   1. General: 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 lawn-watering 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 the valve schedule for each piping system.
   2. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by Architect/Engineer.
      a. Where more than one major machine room is shown for the 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 signet machine room.

E. Mechanical Equipment Identification:
   1. General: Install engraved plastic laminate sin on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
      a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
      b. Pumps and similar motor-driven units.
      c. Fans, blowers, primary balancing dampers, and mixing boxes.
      d. Central-station units.
      e. Tanks and pressure vessels.
      f. Motor starters and other control equipment.

F. Refer to Division-23 sections for identification requirements at the central-station mechanical control center; not work of this section.

G. Refer to Division-26 sections for identification requirements of electrical work; not work of this section.

H. Lettering Size: Minimum 3/8-inch-high lettering for name of unity where the viewing distance is less than 2'-0"; 3/4 inch 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.

I. Text of Signs: In addition to the name of the identified unit, provide lettering to distinguish between multiple units, and warn of hazards and improper operations.

J. Operational valves and similar minor equipment items located in non-occupied spaces (including machine rooms) may, at the installer's option, be identified by the installation of plasticized tags instead of engraved plastic signs.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Basic Requirements for Testing, Balancing and Adjusting Heating, Ventilating, and Air Conditioning Systems.

1.02 RELATED SECTIONS

A. Section 23 0500 – Common Work Results for Heating, Ventilating, and Air Conditioning.

B. Section 23 0548 – Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 23 2113 – Hydronic Piping.

D. Section 23 3100 – HVAC Ducts and Casings.

E. Section 23 0923 – DDC System for HVAC.

1.03 REFERENCES

A. AABC - National Standards for Field Measurement and Instrumentation, Total System Balance.

B. ASHRAE - 2007 Systems Handbook: Chapter 37, Testing, Adjusting, and Balancing.

C. NEBB - Procedural Standards for Testing, Balancing, and Adjusting of Environmental Systems.

1.04 SUBMITTALS

A. Submit the name of adjusting and balancing agency for approval within 30 days after the award of Contract.

B. Submit test reports as a submittal under provisions of Section 01300 and Section 23 0500.

C. Before commencing work, submit draft reports indicating adjusting, balancing, and equipment data required.

D. Submit draft copies of the report for review before final acceptance of the Project. Provide final copies for Architect/Engineers and inclusion in operating and maintenance manuals.

E. Provide reports in hardback, letter size manuals, complete with an index page, and indexing tabs, with cover identification at front and side.

F. Include detailed procedures, agenda, and sample report forms before commencing system balance.

1.05 QUALITY ASSURANCE

A. The mechanical contractor may at his option perform a hydrostatic pressure test and hydronic balancing of the HVAC piping systems.

B. Air Balance Subcontractor shall be a qualified representative of the Air Distribution Manufacturer whose devices are used on the project or a qualified Independent Balancing Contractor. Air Balance Subcontractor may not be the Mechanical Contractor or the Sheet Metal Contractor on the project.

C. To be considered qualified, the Air Distribution Manufacturer shall include with air device shop drawings evidence of qualifications as follows:
   1. Resume of Air Balance Technician(s) to be used on the project including a list of major air balance projects within the last five (5) years. The minimum acceptable experience shall be three (3) years as Air Balance Technician and five (5) projects similar in size and complexity.
   2. Resume of the firm's experience in air balance and list of air balance projects within the last five (5) years.
   3. Evidence of certification of calibration of equipment.

D. To be considered to be qualified, Independent Air Balance Contractor shall submit evidence of qualifications as follows:
   1. Resume of a firm's experience in air balance representing a minimum of two (2) years as an Air Balance Contractor. Resume shall include a list of air balance projects within the last five (5) years.
   2. Resume of Air Balance Technicians(s) to be used on the project, including a list of major air balance projects within the last five (5) years. The minimum acceptable experience shall be three (3) years as Air Balance Technician and five (5) projects similar in size and complexity.
   3. Evidence of certification of calibration or equipment.

1.06 SEQUENCING AND SCHEDULING

A. Sequence work under the provisions of Division 01.

B. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.

C. Schedule and assist in final adjustment and test of life safety, smoke evacuation, and/or smoke control system with Fire Authority.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. All measurements during air balance operations shall be made utilizing the "Velometer" or "Anemometer" method. Instruments used for check of air quantities shall have recent certification of calibration.

B. The Air Balance Subcontractor shall furnish balance forms for all air systems. Forms shall list air distribution devices by location, system, size,

pattern, CFM flow factor, and required velocity.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Before commencing work, verify that systems are complete and operable. Ensure the following:
   1. Equipment is operable and in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Correct fan rotation.
   7. Fire and volume dampers are in place and open.
   8. Coil fins have been cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
   10. Air outlets are installed and connected.
   11. Duct system leakage has been minimized.
   12. Hydronic systems have been flushed, filled, and vented.
   13. Correct pump rotation.
   14. Proper strainer baskets are clean and in place.
   15. Service and balance valves are open.

B. Report any defects or deficiencies noted during the performance of services to Architect/Engineer.

C. Promptly report abnormal conditions in mechanical systems or conditions which prevent system balance.

D. If, for design reasons, the system cannot be properly balanced, report as soon as observed.

3.02 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineers to facilitate spot checks during testing.

B. Provide additional balancing devices as required.

3.03 INSTALLATION TOLERANCES

A. Adjust air handling systems to plus or minus 5 percent for supply systems plus or minus 10 percent for return and exhaust systems from figures indicated.

B. Adjust hydronic systems to plus or minus 10 percent of design conditions indicated.

3.04 ADJUSTING

A. Recorded data shall represent measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

E. At final inspection, recheck random selections of data recorded in the report. Recheck points or areas as selected and witnessed by the Owner.

3.05 HYDROSTATIC TEST

A. After completion of the installation, all piping shall be tested under 100 psi hydrostatic pressure, which shall be maintained for one hour without loss of pressure; after the system is proven tight and put in service, the contractor shall perform the equipment start-up and operating tests. All equipment shall be placed in complete operating conditions subject to the approval of the Architect.

3.06 AIR BALANCE PROCEDURE

A. All air quantities shall, after completion of the job; be adjusted to provide air quantities shown on plans. After complete adjustment, additional re-adjustment shall be performed if necessary to satisfy the desired temperature.

B. The balance procedure shall include the checking of each supply, return, and exhaust fan. As a minimum, CFM, RPM, and ampere readings shall be taken. Pulley adjustments, etc., shall be performed to obtain the required CFM readings.

C. Air Balance Subcontractor shall also furnish all balancing instruments required. Air Balance Subcontractor shall provide one experienced technician to the team with the Contractor's technician to balance the system. The Air Balance Subcontractor's Technician and the Contractor's Technician shall perform as a team during the entire field balancing operation.

D. After all adjustments and corrections have been performed to balance the system as designed and required, the Air Balance Subcontractor shall prepare and submit three (3) copies of completed balance form to Architect/Engineer for approval.

E. At the time of balancing, the Air Balance Contractor's Technician shall verify that each device is the size and pattern submitted and includes accessories such as volume controls and deflectrols, where specified.

F. Where the project includes controlled Air Terminal Units, the Terminal Unit

Manufacturer's Supplier shall be responsible for testing the automatic control devices on the Terminal.

3.07 WATER BALANCE PROCEDURE

A. With all manual valves in the fully open position and all control valves full flow to coil, adjust pump discharge valves to design flow on pumping systems.

B. Automatic flow control valves will balance flow to coils.

C. Balance flow through pumps at chillers, towers, and boilers.

3.08 SYSTEM OPERATING TEST

A. After the successful completion of all equipment start-up and individual item test requirements, formal tests shall be performed on the complete Mechanical systems, measurements shall be made and reports prepared as specified below. Provide all instruments, materials, and labor to perform the tests and to obtain and record the measurements specified herein, including the furnishing of all required record forms. Submit for the Architect's approval the form on which the measurements specified herein. Furnish all required record forms. Submit for the Architect's approval, complete shop drawings or catalog data for all instruments to be used for the 3-day operating test, and obtain approval at least two weeks before the forms and instruments will be required. Sample forms can be provided by the Architect if the Contractor requests.

B. First operating test by Contractor: Prove the operation of the Mechanical systems and each item in the systems. At least 10 days' notice shall be given the Architect of such tests. Should any item of the systems fail to perform in an approved manner, this test shall be repeated until the operating test is approved by the Architect. During this test, balance circulation of steam, condensate, heating and chilled water, air, and all other fluids conveyed to provide proper quantities to all items of equipment. Adjust and set all balancing cocks, valves, dampers, and similar items to ensure that the systems perform as intended.

C. Checking by Owner and Architect: Following the successful completion of first operating tests by the Contractor, the Owner and Architect shall have the privilege of making such tests as they may desire for three weeks to ascertain if any corrections are to be made to the system. At the end of the testing by the Owner and Architect, the Architect shall direct the Contractor in writing to make such corrections to the systems as are within the scope of the contract.

D. Contractor's corrections to systems: Make all required connections to the systems and notify the Architect in writing that the corrections outlined have been completed and give at least seven days' notice of a final 3-day operating test.

E. Three-day operating test: An operating test shall then be performed by the Contractor to the satisfaction of the Architect for three days. Should any element of the systems not perform properly, the Contractor shall make all required corrections, and the test shall be repeated until successfully performed.

F. Measurements: Make the following measurements at two-hour intervals (5 measurements per 8-hour day) during the 3-day operating test.
   1. Electrical: Running ampere and voltage of each motor 3/4HP or larger.
   2. Air pressures at the entrance and exit of each electronic air cleaner, filter, coil, fan, and damper.
   3. Air temperatures in each heated or air-conditioned space, at the entrance and exit of each coil, downstream from each pair of dampers where the air of two different temperatures is mixed and outside the structure.
   4. Relative humidity at the location of each humidity sensor.
   5. Water pressures at each pump suction and discharge and entrance and exit of each convertor, and each heating and cooling coil.
   6. Water temperature at the entrance and exit of each convertor and each heating and cooling coil.
   7. Domestic hot water supply temperature at the fixtures closest to and farthest away from the domestic water heater on each system (only once during a 3-day test.
   8. Running ampere and voltage on recirculating pumps.
   9. The static pressure of cold-water line at building service connection (only once during a 3-day test).

G. Report: Four copies of a written report of the 3-day operating test, on the approved form of record, shall be submitted to the Architect for approval and subsequent transmittal to the Owner.

END OF SECTION

SECTION 23 0713

DUCT INSULATION FOR HVAC

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Basic Requirements for Duct Insulation for HVAC Systems.

1.02 RELATED SECTIONS

A. Section 23 3100 – HVAC Ducts and Casings.

1.03 REFERENCES

A. ASTM C553 - Mineral Fiber Blanket and Felt Insulation.

B. ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.

C. ASTM E96 - Water Vapor Transmission of Materials.

D. NFPA 255 - Surface Burning Characteristics of Building Materials.

E. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

F. Test standards and procedures for evaluating and a rating performance of fire-resistive and zero-inch clearance, duct wrap systems.
   1. Underwriters Laboratories Inc., (UL):
      a. UL 723, Surface Burning Characteristics per ASTM E 84.
      b. UL 1978, First Edition of the Standard for Grease Ducts.
      c. UL 1479, Through-Penetration Firestop Test.
   2. American Society for Testing and Materials (ASTM):
      a. E119, Standard Method of Fire Test of Building Construction and Materials; 2-hour External Total Engulfment Test.
      b. E814, Standard Method of Fire Tests of Through-Penetration Fire Stops.
   3. NFPA 96, 1994 Edition, Ventilation Control and Fire Protection of Commercial Cooking Operations.

1.04 SUBMITTALS

A. Submit under provisions of Division 01 and Section 23 0500.

B. Product Data: Provide product description, list of materials, and thickness for each service, and locations.

C. Manufacturer's Installation Instructions: Indicate procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Materials: Flame spread/smoke developed rating of 25/100 per NFPA 255.

1.06 QUALIFICATIONS

A. Applicator: Company specializing in performing the work of this section

with a minimum of three years- experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of Section 23 0500.

B. Deliver materials to site in original factory packaging, labeled with manufacturer's density, and thickness.

C. Store insulation in the original wrapping and protect from weather and construction traffic.

D. Protect insulation against dirt, water, chemical, and mechanical damage.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cement.

PART 2 - PRODUCTS

2.01 GLASS FIBER, FLEXIBLE

A. Insulation: ASTM C553 and C612; flexible, non-combustible blanket.
   1. "K" value: 0.27 at 75 °F.
   2. Maximum service temperature: 250 °F.
   3. Maximum moisture absorption: 0.20 percent by volume.
   4. Density: 1.0 lb./cu ft.

B. Vapor Barrier Jacket:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
   2. Moisture vapor transmission: 0.04 perm.
   3. Secure with adhesive and tape.

C. Vapor Barrier Tape
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with a pressure-sensitive rubber-based adhesive.

2.02 GLASS FIBER, RIGID

A. Insulation: ASTM C612; rigid, non-combustible blanket.
   1. "K" value: 0.24 at 75 °F.
   2. Maximum service temperature: 350 °F.
   3. Maximum moisture absorption: 0.20 percent by volume.
   4. Density: 4.2 lb./cu ft.

B. Vapor Barrier Jacket:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
   2. Moisture vapor transmission: 0.04 perm.
   3. Secure with adhesive tape.

C. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with a pressure-sensitive rubber-based adhesive.

2.03 GLASS FIBER DUCT LINER, FLEXIBLE

A. Insulation: ASTM C553; flexible, bonded fibers, non-combustible blanket with edge coating.
   1. "K" value: 0.26 at 75 °F.
   2. Maximum service temperature: 250 °F.
   3. Density: 1.5 lb./cu ft.

B. Adhesive:
   1. Waterproof, fire-retardant type.

C. Liner Fasteners: Galvanized steel, the impact applied, or welded with a press on head conforming to Mechanical Fastener Standard MF-19/1.

2.04 APPROVED MANUFACTURERS

A. Glass Fiber, Flexible:
   1. Owens Corning Fiberglass, Type 100.
   2. Architect Approved.

B. Glass Fiber, Rigid:
   1. Owens Corning Fiberglass, Type 704.
   2. Architect Approved.

C. Glass Fiber Duct Liner, Adjustable:
   1. CertainTeed ToughGard 150.
   2. Architect Approved.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that ductwork has been tested and joints and seams sealed, before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install materials per the manufacturer's instructions.

B. Insulated ductwork conveying air below or above ambient temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate the entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

C. Ducts exposed outside the building shall be externally insulated with 2" thick rigid glass fiber insulation, and covered with a "peel and stick" membrane jacket system equal to "Alumguard" (50-60 mil thickness and .3

lbs./sf weight).

3.03 TOLERANCE

A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

3.04 FLEXIBLE GLASS FIBER DUCTWORK INSULATION SCHEDULE

DUCTWORK	THICKNESS
All supply, return and outside air ducts inside the building Unless noted otherwise.	2 inches
Dishwasher exhaust duct	2 inches

3.05 RIGID GLASS FIBER DUCTWORK INSULATION SCHEDULE

DUCTWORK	THICKNESS
Provide on exposed supply and return ducts at upper level up to 6' -0" above floor.	2 inches

3.06 FLEXIBLE GLASS FIBER DUCT LINER INSULATION SCHEDULE

DUCTWORK	THICKNESS
Furnace Plenums & ductwork shown Cross-hatched on drawings.	1 inch

END OF SECTION

SECTION 23 07 19

HVAC PIPING INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Basic Requirements for Piping Insulation for Heating, Ventilating, and Air Conditioning systems.

1.02 RELATED SECTIONS

A. Section 23 2300 – Refrigerant.

1.03 REFERENCES

A. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM C195 - Mineral Fiber Thermal Insulation Cement.

C. ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.

D. ASTM C449 - Mineral Fiber Hydraulic-setting Thermal Insulating and Finishing Cement.

E. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

F. ASTM C547 - Mineral Fiber Preformed Pipe Insulation.

G. ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.

H. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.

I. ASTM D2842 - Water Absorption of Rigid Cellular Plastics.

J. ASTM E96 - Water Vapor Transmission of Materials.

1.04 SUBMITTALS

A. Submit under provisions of Division 01 and Section 23 0500.

B. Product Data: Provide product description, list of materials, and thickness for each service, and locations.

C. Manufacturer's Installation Instructions: Indicate procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Materials: Flame spread/smoke developed rating of 25/100 or less per ASTM E84, NFPA 255, and UL 723.

1.06 QUALIFICATIONS

A. Applicator: Company specializing in performing the work of this section

with a minimum of three years of work experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of Section 23 0500.

B. Deliver materials to site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Store insulation in the original wrapping and protect from weather and construction traffic.

D. Protect insulation against dirt, water, chemical, and mechanical damage.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cement.

PART 2 - PRODUCTS

2.01 CELLULAR FOAM

A. Insulation: SASTM C534; flexible, cellular elastomeric, tubing.
   1. "K" Value: ASTM C177 C518; 0.27 at 75 °F.
   2. Minimum Service Temperature: -40 °F.
   3. Maximum Service Temperature: 220 °F.
   4. Maximum Moisture Absorption: ASTM D1056; 1.0 percent pipe by volume, .0 percent sheet by volume.
   5. Moisture Vapor Transmission: ASTM E96, 0.20 perm inches.
   6. Maximum Flame Spread: ASTM E84; 25.
   7. Maximum Smoke Developed: ASTM E84; 25
   8. Connection: Waterproof vapor barrier adhesive.

2.02 APPROVED MANUFACTURERS

A. Cellular Foam:
   1. Armstrong-Armaflex - FR.
   2. Architect Approved.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install materials per the manufacturer's instructions.

B. On exposed piping, locate insulation and cover seams in the least visible locations.

C. Insulated dual temperature pipes or cold pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field applied.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as an adjacent pipe.
   3. Finish with glass cloth and vapor barrier adhesive.
   4. PVC fitting covers may be used.
   5. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
   6. Insulate the entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

D. For insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without a vapor barrier, factory-applied, or field applied.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as an adjoining pipe.
   3. Finish with glass cloth and adhesive.
   4. PVC fitting covers may be used.
   5. For hot piping conveying fluids 140 °F or less, do not insulate flanges and unions at equipment, but bevel and seal end of the insulation.
   6. For hot piping conveying fluids over 140 °F, insulate flanges and unions at equipment.

E. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert Location: Between support shield and piping and under the finished jacket.
   4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.

F. Finish insulation at supports, protrusions, and interruptions.

G. For exterior applications, provide a vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum or stainless-steel jacket with seams located on the bottom side of horizontal piping.

H. For buried piping, provide the factory-fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of a bituminous compound; outer surface faced with a polyester film.

I. For heat traced piping, insulate fittings, joints, and valves with insulation of like material, thickness, and finish as an adjoining pipe. Ensure the size is

large enough to enclose pipe and heat tracer. Cover with an aluminum jacket with seams located on the bottom side of horizontal piping.

J. Valves and fittings insulated with block insulation shall be finished with insulating cement and troweled to a smooth and uniform finish.

3.03 TOLERANCE

A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

3.04 REFRIGERANT PIPING

A. Refrigerant suction lines shall be insulated with ¾ inch thickness Armstrong FR/Armaflex, or approved equal, and shall be installed to manufacturer's recommendations. Joint-butt, joints with 520 adhesives. The insulation shall not be slit for installation.

B. All suction lines exposed to weather shall have two (2) coats of Armstrong aluminum cold storage paint applied directly to the Armaflex insulation surface.

3.05 ARMAFLEX INSULATION SCHEDULE

A. Refrigerant Suction	¾ inch
B. Humidity Drain (Interior)	½ inch

END OF SECTION

SECTION 23 09 23

HVAC CONTROLS

PART 1 - GENERAL

1.01 SCOPE

A. Low voltage electric controls system.

B. Includes:
   1. This section includes but is not necessarily limited to the automatic control of heating, ventilating and air conditioning equipment as follows:
      a. Split system heating and cooling
      b. Packaged air conditioning units
      c. Exhaust fans.
      d. Unit Heaters.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Common Work Results for Heating Ventilating and Air Conditioning - Section 23 0500.

B. Basic Materials and Methods - Section 23 0500.

C. Raceway and Boxes for Electrical Systems – Section 26 0533.

1.03 COORDINATION

A. All power and motor and line voltage interlock wiring shall be done by the electrical contractor unless otherwise noted for specific items.

B. The mechanical contractor shall furnish and install all conduit and back boxes for controls and interlock wiring.

C. Low voltage control and interlock wiring shall be done by the mechanical contractor. Motors shall be as shown on the drawings.

D. The mechanical contractor shall furnish and install any low voltage relays, thermostats and similar items required for the proper operation of the mechanical equipment.

E. The mechanical contractor shall coordinate exact requirements with the electrical contractor.

1.04 SUBMITTALS

A. The contractor shall submit complete temperature control diagrams with written "sequence of operation" and factory printed specification data sheets, covering each control device proposed to be used for review prior to installation of any equipment or part of the system. Diagrams shall

contain a Bill of Materials list for each device used.

B. Submittals shall show complete piping diagrams (part designations) and terminal-to-terminal wiring diagrams of all control and interlock wiring furnished under this specification.

C. Submittal shall include a schematic one-line riser diagram noting conduit sizes and number of conductors contained therein for approval.

1.05 QUALITY ASSURANCE

A. Wiring:
   1. The wiring and conduit system for the control and operation of the mechanical system items shall comprise a unitary separate wiring system. The installation of this wiring system shall be governed by Division 26 - ELECTRICAL.
   2. Control system wiring shall not be run in conduit installed for power wiring by Division 26 - ELECTRICAL, without direct approval of the Architect.

B. Control system shall consist of all thermostats, temperature sensors, controllers, automatic valves, damper operators, control panels, controls and interlock wiring to fill the intent of the specifications and provide for a complete and operable system.

1.06 INSTRUCTION TO OWNER'S REPRESENTATIVES

A. Upon completion of the work, the contractor shall instruct operating personnel in use and programming of each control system. Owner shall be furnished two (2) copies of reference control system brochure covering equipment control diagrams and sequence of operation, in addition to framed schematics, located where directed by the Architect, of the control system and sequence of operation.

PART 2 PRODUCTS

2.01 THERMOSTATS

A. Thermostats shall be programmable low voltage.

B. Thermostats shall be single stage or two stage heating and cooling, as shown on the plans.

PART 3 EXECUTION

3.01 INSTALLATION

A. Contractor shall be responsible for the control and interlock wiring associated with the heating, ventilation and air conditioning system. Coordinate location, power requirements, conduit runs, etc. with the Electrical Contractor.

B. Furnish and install all low voltage wiring between thermostats and controlled equipment. Number of wires and wire gauge shall be as recommended by the equipment manufacturer for this specific application.

C. Minimum size for line voltage wiring (over 24-volts) shall be No. 14 TW or RH. Minimum size on 24-volt and under wiring shall be No. 16 TW or RH. All wiring shall be in accordance with the National Electrical Code for current carrying capacity.

D. Interlock controls shall be made through auxiliary contacts with pairs of conductors. Cross-phasing or single wire interlocking will not be acceptable.

E. Provide all necessary boxes, fittings and accessories as required.

F. Do not run conduit concealed under insulation or inside ducts. Mount control devices and conduit located on ducts or apparatus with external insulation on stand-off support to avoid interference with insulation.

G. Run wire connecting devices on or in control cabinet parallel with the sides of the cabinet neatly racked to permit tracing. Rack connections bridging a cabinet door along the hinge side and protect from damage. Provide grommets, sleeves or vinyl tape to protect wires from sharp edges of panels, conduit and other items.

H. Install low-voltage control wiring to condensing units in conduit when run outside the building.

3.02 SEQUENCE OF OPERATION

A. See Sequence of Operations on drawings.

END OF SECTION

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SECTION 23 23 00

REFRIGERANT AND CONDENSATE PIPING

PART 1 - GENERAL

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

1.02 SCOPE

A. Interconnecting piping between evaporator-coil and condensing unit on split system packaged units.

B. Equipment condensate drains.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Section 23 0500 – Common Work Results for Heating, Ventilating, and Air Conditioning System.

B. Section 23 0548 – Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 23 0719 – HVAC Piping Insulation.

PART 2 - PRODUCTS

2.01 PIPING

A. Type "L", hard drawn copper (degreased) – refrigerant piping.

B. Type “M” hard drawn copper – condensate drains

2.02 FITTINGS

A. Wrought copper.

2.03 SOLDER

A. Brazing alloy with 1000 °F melting point and suitable flux.

2.04 VALVES

A. Pack-less bellows or diaphragm type for use with Freon type refrigerant.

2.05 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper tubing: ASTM B88, Type M, hard drawn.
   1. Fittings: ANSI/ASME B16.23 cast brass, or ANSI/ASME B16.92 solder wrought copper.
   2. Joint: ASTM B32 solder, Grade 95TA.

2.06 APPROVED MANUFACTURERS

A. Valves:
   1. Mueller Brass Company.
   2. Architect approved equal.

B. Solder:
   1. Phoson Fifteen.
   2. Architect approved equal.

PART 3 - EXECUTION

3.01 Install refrigerant accessories as shown on the drawings and as may be recommended by the unit manufacturer.

3.02 Provide double suction risers and pitch lines as required to ensure positive oil return to the compressor.

3.03 Testing shall be done during the progress of work or at completion to ensure a tight system. Change the system with dry nitrogen and soap test hot gas lines at 300 psi and liquid and suction lines at 245 psi. Allow the system to stand for 24 hours under pressure and if a change in pressure, the system may be considered tight.

3.04 Before charging, evacuate the system to 0.15 inches of mercury absolute pressure. All pumps to operate at least four (4) hours at this reading.

3.05 REFRIGERANT CONTAINMENT

A. The contractor shall take all necessary precautions to prevent the accidental or intentional release of refrigerant to the atmosphere.

B. When a sealed system must be broken, provide all necessary equipment and containers as required to pump down the entire system volume, or that volume not contained in isolated receivers on the equipment.

C. The contractor shall clean and re-use refrigerant to the greatest extent possible. Un-used refrigerant shall be properly disposed of or recycled at the Contractor's expense.

3.06 Provide proper charge of refrigerant and oil for proper operation per manufacturer requirements.

3.07 Condensate drains for furnaces and cooling coils shall be combined and routed to floor drains, or as indicated on the drawings. Route piping, as required to not block access to the unit.

3.08 Insulate all condensate drain piping inside the building.

3.09 Condensate drains from outdoor packaged units mounted on concrete pads shall be piped to the edge of the slab in a manner as to not impede access to the unit.

END OF SECTION

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SECTION 23 3100

HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Basic Requirements for HVAC Ducts and Casings.

1.02 RELATED SECTIONS

A. Section 23 0500 – Common Work Results for Heating, Ventilating, and Air Conditioning System.

B. Section 23 0548 – Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 23 0713 – Duct Insulation.

D. Section 23 0593 – Testing, Adjusting, and Balancing.

1.03 QUALITY ASSURANCE

A. Installer: A firm with at least 3-years of successful installation experience on projects with low-pressure ductwork systems work, similar to that required for the project.

B. SMACNA Standards: Comply with SMACNA HVAC Duct Construction Standards for fabrication and installation of low-pressure ductwork.

C. NFPA Compliance: Comply with ANSI/NFPA 9OA 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" and ANSI/NFPA96 "Standard for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment".

D. Field Reference Manual: Have available at the project field office, copy of "SMACNA HVAC Duct Construction Standards", latest Edition.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's specifications on manufactured products and factory-fabricated ductwork, used for work of this section.

B. Record Drawings: At project closeout, submit record drawings of installed ductwork, duct accessories, and outlets and inlets, per requirements of Division 01.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect shop-fabricated and factory-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. Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.01 LOW-PRESSURE DUCTWORK

A. Fabricate and support per SMACNA HVAC Metal Duct Standard and ASHRAE handbooks, except as indicated. Provide duct material, gages, reinforcing and sealing for operating pressures indicated.

B. Size round ducts installed in place of rectangular ducts per ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by written permission.

C. Construct T's, bends, and elbows with the radius of not less than 1-1/2 times the width of the duct on the centerline. Where not possible and where rectangular elbows are used, provide turning vanes.

D. Increase duct sizes gradually, not exceeding 15 ° divergence wherever possible. Divergence upstream of equipment shall not exceed 30 °; convergence downstream shall not exceed 45 °.

E. Provide easements where low-pressure ductwork conflicts with piping and structure. Where easements exceed 10 percent duct area, split into two ducts maintaining original duct area.

F. Use double nuts and lock washers on threaded rod supports.

G. Provide “paint grip” finish where indicated on drawings.

2.02 HIGH-VELOCITY SINGLE AND DUAL WALL DUCTWORK

A. Sheet metal gages, reinforcing joints, seams, etc. shall be as called for in the latest edition of SMACNA Manual "VAC Duct Construction Standards", except metal gauges and reinforcing shall be designed for minimum 3-inch static pressure.

2.03 FLEXIBLE DUCT CONNECTOR

A. Flexible duct connectors shall be of two-element spiral construction composed of a corrosion-resistant metal supporting spiral and a coated fabric with a mineral base.

B. Flexible duct connectors shall be listed by UL and shall have a flame spread rating not exceeding 25 and a smoke-developed rating not exceeding 30.

C. Lengths shall not exceed 24 inches unless shown otherwise and shall be the same as spiral run-out or box inlet, whichever is larger.

2.04 DUAL WALL DUCT AND FITTINGS

A. Dual wall duct shall be comprised of an airtight outer pressure shell, a 2-

inch insulation layer, and solid metal inner shell. The liner shall be supported by the steel by welded spacers. Where indicated on the drawings, ductwork shall have a perforated inner shell for sound attenuation.

B. Insulation shall fill the space between the liner and outer shell and have the following UL ratings:

Flame Spread	10-20
Fuel Contributed	10-15
Smoke Developed	0-20

C. The outer shell of the duct shall be minimum 20-gauge galvanized steel. The inner liner of the duct shall be minimum 28-gauge galvanized steel.

D. Manufactured end fittings shall be installed at all connections of dual wall and single wall duct.

E. All-round and oval ductwork shall be spiral lock seam pipe. The spiral pipe shall have been laboratory tested for leakage rate, friction loss, bursting, and collapsing strength.

F. Fitting shall be of the standard machine-formed fittings as manufactured by the duct manufacturer. Fittings shall match those shown on the drawings as closely as possible. All fittings shall have a turning radius of 1-1/2 times the diameter of the duct where possible.

G. Provide "paint grip" finish where indicated on drawings.

2.05 SINGLE WALL DUCT AND FITTINGS

A. Round and oval ductwork shall be 26-gauge galvanized steel minimum, spiral locked seam pipe.

B. Fittings shall be machine formed fittings as manufactured by the duct manufacturer. Fittings shall match those shown on the drawings as closely as possible. All fittings shall have a turning radius of 1-1/2 times the diameter of the duct where possible.

2.06 EXTERIOR DUCTWORK

A. Supply ductwork on the exterior shall be dual-wall duct herein specified, except insulation thickness shall be 3 inches and ductwork shall be built and installed for exterior application with aluminum cover.

B. Joints shall be bolted circular type with seals for 8-inch static pressure.

C. The exterior shall have a prime coat for the field finish coat.

2.07 RANGE HOOD AND DISHWASHER HOOD EXHAUST DUCTS

A. Range hood exhaust ducts shall be 14-gauge welded steel. Duct construction, joints, cleanouts, and installation shall comply with Chapter 5 of the Arkansas Mechanical Code. U.L. listed pre-fabricated double wall round grease exhaust duct is an acceptable alternative.

B. Dishwasher hood exhaust ductwork shall be 16-gauge aluminum with all joints and seams welded.

C. Insulate range hood exhaust ducts per Section 23 0713.

D. Insulate dishwasher hood exhaust ducts with 2" wrap-on insulation as specified in Section 23 0713.

2.08 DRYER VENT

A. Dryer vent duct shall have smooth interior finish with joints running in direction of airflow.

B. Dryer vents shall not be assembled with sheet metal screws or other means which extend into the duct. Seal each joint with non-combustible material.

C. Provide vent cap with backdraft damper and no screen. See detail on plans.

D. Provide Complete UL listed kit with everything needed to connect the dryer to wall vent:
- Close fit for 4-in wall clearance.
- 6-ft of flexible pipe.
- 2 close elbows resist crushing and maintain airflow.
- Swivel cuffs on close elbows allow moving dryer without disconnecting.
- Conforms to UL safety requirements.

2.09 FUME HOOD EXHAUST DUCTS

A. Furnish and install all exhaust ducts from laboratory fume hoods as indicated on the Drawings.

B. Fume hood exhaust duct shall be Type II/Grade I rigid, un-plasticized polyvinyl chloride. The duct shall be a seamless extruded type with 3/16-inch-thick walls through a 40-inch diameter. All field joints shall be sealed with PVC solvent adhesive as supplied by the duct manufacturer. Fittings shall be constructed per manufacturer's standards. Exterior duct and fittings shall be UV Resistant. Flexible connectors at exhaust fans shall be furnished by duct supplier.

C. Rectangular to round pipe fittings and fume hood exhaust system rectangular duct shall be fabricated using Type 316 stainless steel with Heliarc-welded seams. All rectangular or round pipe fume hood ductwork run exposed within classrooms shall be constructed of Type 316 stainless steel.

D. All flexible connections shall be made of Koroseal plasticized PVC.

E. Provide "Butterfly" caps at the termination of the exhaust ductwork after it has penetrated the roof.

2.10 APPROVED MANUFACTURERS

A. Semco (single wall and dual wall ductwork).

B. Wire-Mold (Type 57 flexible ductwork).

C. Architect Approved.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. Provide openings in ductwork that were required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with a metal cap with spring device or screw to insure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

B. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

C. Connect diffusers or troffer boots to low-pressure ducts with 3 feet maximum length of flexible duct. Hold in place with a strap or clamp.

D. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

E. Seal all traverse joints and longitudinal seams in all ductwork with Hard-cast sealant.

F. Clean the duct system and force air at high velocity through a duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters or bypass during cleaning.

3.02 INSTALLATION (LOW PRESSURE DUCTWORK)

A. Straight and smooth on inside with joints neatly finished unless otherwise directed.

B. Duct panels through a 48-inch dimension having acoustic duct liner need not be cross-broken or beaded.

C. Cross-break all unlined duct and lined duct panels larger than 48 inches or bead 12 inches on center.

D. Securely anchor ducts to building structure with specified duct hangers attached with screws.

E. Brace and install ducts so they shall be free of vibration under all conditions of operation.

F. Ducts shall not bear on the top of structural members.

G. Make duct take-offs to branches, registers, grilles, and diffusers as detailed on drawings.

H. Ducts shall be large enough to accommodate inside acoustic duct liner. Dimensions shown on drawings are actual sheet metal sizes.

I. Properly flash where ducts penetrate above the roof.

J. Install internal ends of slip joints in direction of flow. Make joints airtight using a mastic type duct sealer.

K. Cover horizontal and longitudinal joints on the exterior of ducts with two (2) layers of Hard-cast tape installed with Hard-cast, HC-20 adhesive according to manufacturer's recommendations.

L. All longitudinal seams shall be Pittsburgh Lock seams. All ductwork shall be strengthened by diamond crimping of the sheets.

M. All elbows shall have a throat radius equal to the width of the duct wherever possible. Air Turns, as manufactured by Tuttle & Bailey, Inc., or approved locally made vanes, shall be installed in all square elbows. Horizontal ducts over 400 square inches in cross-sectional area shall be supported from overhead structure members by 3/4-inch x 1/8-inch strap iron. Horizontal ducts, under 400 square inches in cross-sectional area shall be supported from an overhead structure with the use of 1 inch wide 18-gauge galvanized metal straps.

3.03 DUCT SEALS

A. All-round ductwork shall be either welded or joint shall be sealed with duct sealer, sheet metal screws, and duct tape. The sealing procedure shall be as follows:
   1. Apply duct sealer to fittings and slip fitting or coupling into a duct.
   2. Install sheet metal screws at 8 inches on centers as close to fitting head as possible with a minimum of three (3) screws per fitting.
   3. Apply a layer of sealer to the outside of the joint, approximately 2-1/2 inches wide. Make sure that sheet metal screw heads are completely covered, as well as joint and coupling head.
   4. Apply a single pass of duct tape over the wet sealer. Pull tight and smooth to make complete contact.

3.04 Exterior supply duct shall be covered with 14-gauge sheet metal cover for top 200 ° of duct circumference with drip rim on each side. Provide a prime coat for the field finish coat.

3.05 Paint ductwork visible through registers, grilles, and diffusers flat black.

END OF SECTION

SECTION 23 3300

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Basic Requirements for Air Duct Accessories for complete Heating, Ventilating, and Air Conditioning Systems.

1.02 RELATED SECTIONS

A. Section 23 0500 – Common Work Results for Heating, Ventilating, and Air Conditioning Controls.

B. Section 23 0548 – Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 23 3100 – HVAC Ducts and Casings.

D. Section 23 0593 – Testing, Adjusting, and Balancing.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacturer of duct accessories, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) high pressure and low-pressure duct construction standards.

C. Industry Standards: Comply with the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE) recommendations of construction of duct accessories, except as otherwise indicated.

D. UL Compliance: Construct, test, and label fire dampers per Underwriters Laboratories (UL) Standard 555 "Fire Dampers and Ceiling Dampers".

E. NFPA Compliance: Comply with applicable provisions of ANSI/NFPA 9OA "Air Conditioning and Ventilating Systems", of installation of duct accessories.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's data for each type of duct construction; and installation instructions.

B. Shop Drawings: Submit assembly-type shop drawings for each type of duct assembly showing interfacing requirements with ductwork and method of fastening or support.

C. Maintenance Data: Submit manufacturer's maintenance data including

parts lists for each type of duct accessory include this data in Maintenance Manual.

PART 2 - PRODUCTS

2.01 DAMPERS

A. Low-Pressure Manual Dampers: Provide dampers of single blade type of multi-blade type, constructed per SMACNA "Low-Pressure Duct Standards".

B. Control Dampers: Refer to Division 23 section "Temperature Control Systems" for control dampers; not work of this section.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering dampers which may be incorporated in the work include, but are not limited to, the following:

Air Balance, Inc.
Airguide Corp.
Airstream Products Div., Penn Ventilator Co., Inc
American Warming & Ventilating, Inc.
Arrow Louver and Damper Corp
Elgo Shutter and Mfg. Co
Imperial Damper and Louver Co., Inc
Louvers & Dampers
Ruskin Mfg. Co.

2.02 FIRE AND SMOKE DAMPERS

A. Fire Dampers: Provide fire dampers, of types and sizes, indicated. Construct casings of 11 gauge galvanized steel with bonded red acrylic enamel finish. Provide fusible link rated at 160-165 °F (71-74 °C) unless otherwise indicated. Provide damper with positive lock in a closed position, and with the following additional features:
   1. Damper Blade Assembly: Single-blade type (ducts less than 10 inches deep).
   2. Damper Blade Assembly: Curtain type.
   3. Blade Material: Steel, match casing.

B. Motor-Driven Smoke Dampers: Provide smoke damper, resettable type linkage of sizes indicated, designed and constructed per NFPA-9OA, motor operated, frame constructed of 10-gauge galvanized steel with provisions for securing to building and attaching to ducts, electric motor operator, casing to have a bonded red acrylic enamel finish, low leakage with friction-free metal seals, 32" long wire leads for connecting to smoke detector, and the following additional features:
   1. Damper Blade Assembly: Single-blade type (ducts less than 10 inches deep).
   2. Damper Blade Assembly: Multi-blade type.

3. Blade Material: Steel, matching casing.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering fire and smoke dampers which may be incorporated in the work include, but are not limited to, the following:
Air Balance, Inc.
Airstream Products Div., Penn Ventilator Co, Inc
American Warming & Ventilating, Inc.
Arrow Louver and Damper Corp
Louvers & Dampers
Phillips-Aire
Ruskin Mfg. Co.

2.03 TURNING VANES

A. Fabricated Turning Vanes: Provide fabricated turning vanes and vane runners, constructed per SMACNA "Low-Pressure Duct Standards".

B. Manufactured Turning Vanes: Provide turning vanes constructed of 1-1/2-inch-wide curved blades set at 1-1/2-inch o.c., supported with bars perpendicular to blades set at 2 inches o.c., and set into side strips suitable for mounting in ductwork, per SMACNA Standards for low-pressure duct.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering turning vanes which may be incorporated in the work include, but are not limited to, the following:
Air Filter Corp.
Anemostat Products Div., Dynamics Corp. of America
Duro-Dyne Corp.
Environmental Elements Corp., Subs. Koppers Co., Inc.
Tuttle & Bailey Div. of Interpace Corp.

2.04 DUCT HARDWARE

A. General: Provide duct hardware, manufactured by one manufacturer for all items on a project, for the following:
1. Test Holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.
2. Quadrant Locks: Provide for each damper, quadrant lock device on one end of the shaft; and end bearing plate on another end for damper lengths over 12 inches. Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering duct
hardware which may be incorporated in the work include, but are not limited to, the following:
Ventfabrics, Inc.
Young Regulator Co.

2.05 DUCT ACCESS DOORS

A. General: Provide, where indicated and at all fire and smoke dampers, duct access doors of the size indicated.

B. Construction: Construct of same or greater gage as ductwork served, provide double panel insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. Provide one side hinged, another side with 1 handle-type latch for doors 12 inches high and smaller, 2 handle-type latches for larger doors.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering duct access doors which may be incorporated in the work include, but are not limited to, the following:
Air Balance Inc.
Duro Dyne Corp.
Register & Grille Mfg. Co., Inc.
Ruskin Mfg. Co.
Semco
Ventfabrics, Inc.
Zurn Industries, Inc., Air Systems Div.

2.06 FLEXIBLE CONNECTIONS

A. General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.

2.07 DUCT ACCESS DOOR/PRESSURE RELIEF DOOR

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which duct accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install duct accessories per manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and per recognized industry practices to ensure that products serve intended function.

B. Install turning vanes in square or rectangular 90 ° elbows in supply.

C. Install access doors to open against system air pressure, with latches operable from either side, except outside only where the duct is too small for a person to enter.

D. Coordinate with other work, including ductwork, as necessary to interface installation of duct accessories properly with other work.

E. Field Quality Control: Operate installed duct accessories to demonstrate compliance with requirements. Test for air leakage while the system is operating. Repair or replace faulty accessories as required to obtain proper operation and leak-proof performance.

END OF SECTION

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SECTION 23 3423

POWER VENTILATORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: HVAC Power Ventilators
   1. 23 00 00 Heating, Ventilating, and Air-Conditioning (HVAC)
   2. 26 00 00 Electrical

1.02 REFERENCES

A. Air Movement and Control Association Inc. (AMCA):
   1. 99 - Standards Handbook
   2. 200 - Publication, Air Systems
   3. 201-90 - Publication, Fans and Systems
   4. 202-88 - Publication, Troubleshooting
   5. 203-90 - Publication, Field Performance Measurement of Fan Systems
   6. 211-05 - Publication, Certified Ratings Program – Product Rating Manual for Fan Air Performance
   7. 300-96 - Standard Reverberant Room Method for Sound Testing of Fans
   8. 311-05 - Publication Certified Ratings Program – Product Rating Manual for Fan Sound Performance
   9. 99-0401-86 - Classification for Spark Resistant Construction
   10. 99-2408-69 - Operating Limits for Centrifugal Fans

B. Air Movement and Control Association Inc. (AMCA), American National Standards Institute (ANSI):
   1. 204-05 - Standard Balance Quality and Vibration Levels for Fans
   2. 210-99 - Standard Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

C. American Society of Civil Engineers (ASCE):
   1. 7-02 - Minimum Design Loads for Building and Other Structures

D. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):
   1. Chapter 45 - 2003 handbook, HVAC Applications
   2. Chapter 7 - 2001 Fundamentals handbook, Sound-Vibration
   3. Chapter 32 - 2001 Fundamentals handbook, Duct Design
   4. Chapter 18 - 1992 HVAC System and Equipment handbook, Fans

E. National Fire Protection Association (NFPA)
   1. 70 - National Electrical Code
   2. 90A-02 - Standard for the Installation of Air-Conditioning and Ventilating Systems

3. 92A-06 - Recommend Practice for Smoke-Control System
4. 92B-05 - Standard for Smoke Management System in Malls, Atria, and Large Areas
5 96-04 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

F. Occupational Safety and Health Administration (OSHA):
1. 1910.212 - General requirements for Machine Guarding
2. 1910.219 - General requirements for guarding safe use of mechanical power transmission apparatus
3. 1926.300 - General requirements for safe operation and maintenance of hand and power tools

G. Underwriters Laboratories (UL):
1. 507 - Electric Fans
2. 555 - Fire Dampers
3. 555S - Smoke Dampers
4. 705 - Standard Power Ventilators
5. 762 - Standard Power Roof Ventilators for Restaurant Exhaust Appliances
6. 793 - Snow Load

1.03 SUBMITTALS

A. General: Submit in accordance with Section 01 3300 Submittal Procedures.

B. Provide dimensional drawings and product data on each fan.

C. Provide fan curves for each fan at the specified operation point, with the flow, static pressure and horsepower clearly plotted.

D. Provide outlet velocity and fan's inlet sound power readings for the eight octave bands, decibels and sones.

E. Strictly adhere to QUALITY ASSURANCE requirements as stated in section 1.04 of this specification.

F. Provide manufacturer's certification that exhaust fans are licensed to bear Air Movement and Control Association (AMCA), Certified Rating Seal for sound and air performance.

G. Installation, Operation, and Maintenance Manual (IOM): Provide manufacturer's installation, operations, and maintenance manual, including instructions on installation, operations, maintenance, pulley adjustment, receiving, handling, storage, safety information and cleaning. A troubleshooting guide, parts list, warranty and electrical wiring diagrams.

1.04 QUALITY ASSURANCE

A. Performance ratings: Conform to AMCA standard 211 and 311. Fans must be tested in accordance with ANSI/AMCA Standard 210-99 and AMCA Standard 300-96 in an AMCA accredited laboratory. Fans shall

be certified to bear the AMCA label for air and sound performance seal.

B. Classification for Spark Resistant Construction, levels A, B, and C conform to AMCA 99

C. Each fan shall be given a balancing analysis which is applied to wheels at the outside radius. The maximum allowable static and dynamic imbalance is 0.05 ounces (Balance grade of G6.3).

D. Comply with the National Electrical Manufacturers Association (NEMA), standards for motors and electrical accessories.

E. The High Wind models have been analyzed and stamped by a state license P.E. to the ASCE 7-02 Standard which meets the IBC, Florida and Miami-Dade codes.

F. Each High Wind model is subject to be certified by a third party to the ASTM E330 Static Pressure Difference Standard.

G. All High Wind models have been analyzed using Computational Fluid Dynamics (CFD). The CFD simulates the flow of high speed (150MPH) winds over the surface of objects.

H. The Finite Element Analysis (FEA) is the results from the CFD and it can accurately predict the stress, strain, and deflection resulting from high wind loads.

1.05 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to site in manufacturer’s original, unopened containers and packaging, with labels clearly indicating manufacturer, material, products included, and location of installation.

B. Storage: Store materials in a dry area indoor, protected from damage, and in accordance with manufacturer’s instructions. For long term storage follow manufacturer's Installation, Operations, and Maintenance Manual.

C. Handling: Handle and lift fans in accordance with the manufacturer’s instructions. Protect materials and finishes during handling and installation to prevent damage. Follow all safety warnings posted by the manufacturer

1.06 WARRANTY

A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

1. The warranty of this equipment is to be free from defects in material and workmanship for a period of one year from the

purchase date. Any units or parts which prove defective during the warranty period will be replaced at the Manufacturers option when returned to Manufacturer, transportation prepaid.

2. Motor Warranty is warranted by the motor manufacturer for a period of one year. Should motors furnished by us prove defective during this period, they should be returned to the nearest authorized motor service station.

1.07 MAINTENANCE

A. Refer to Manufacturer's Installation, Operation and Maintenance Manual (IOM), to find maintenance procedures.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Greenheck

B. Cook

C. Twin City

D. Architect Approved

2.02 DIRECT DRIVE DELUXE CEILING MOUNTED CENTRIFUGAL EXHAUST FANS - GREENHECK MODEL SP-B

A. General Description:
1. Base fan performance at standard conditions (density 0.075 Lb/ft3)
2. Ceiling mounted applications
3. Performance capabilities up to 200 cubic feet per minute (cfm) and static pressure to 0.75 inches of water gauge
4. Fans are available in nineteen sizes (50 - 200-unit sizes)
5. Maximum operating temperatures is 130° Fahrenheit (54.4 Celsius)
6. Sound levels as low as 1.7 AMCA sones
7. UL/cUL listed for above bathtub exhaust
8. Fans are UL/cUL listed 507 - Electric Fans
9. Each fan shall bear a permanently affixed manufacture's nameplate containing the model number and individual serial number

B. Wheel:
1. Forward curved centrifugal wheel
2. Constructed of calcium carbonate filled polypropylene
3. Statically and dynamically balanced in accordance to AMCA Standard 204-05

C. Motors:
1. Motor enclosures shall be open drip proof (ODP), opening in the frame body and or end brackets

2. Motors are permanently lubricated sleeve bearing type to match with the fan load and furnished at the specific voltage and phase
3. Motors shall be mounted on vibration isolators and be accessible for maintenance
4. Compatible for use with speed controls
5. Thermal overload protection

D. Housing:
1. Constructed of heavy gauge galvanized steel
2. Profile as low as 6 15/16 inches

E. Aluminum Backdraft Damper:
1. Prevents air from entering back into the building when fan is off
2. Eliminates rattling or unwanted backdrafts

F. Outlet:
1. Steel duct collar shall be six or four inches in diameter to accept a six- or four-inch round duct work.
2. Shall include a backdraft damper

G. Grille:
1. Types: Provide optional aluminum grille.
2. Constructed of high impact polystyrene plastic shall be factory standard on all units. (Not for this Project.)
3. Attached to the housing with screws

H. Mounting Brackets:
1. Fully adjustable for multiple installation conditions

I. Options/Accessories:
1. Disconnect Switches:
   a. NEMA rated: 1
   b. Positive electrical shut-off
   c. Access for wiring shall be external
2. Grille Filter:
   a. Washable aluminum mesh filter that goes between fan and grille
   b. Reduces sound levels
   c. Traps dirt before entering the fan.
3. Speed Controls:
   a. Controls the fan's output
   b. Fan can be adjusted to 60 percent of full speed
   c. Can be used to operate more than one fan at a time
4. Wall Discharge:
   Type: [Round Connection, hooded wall cap model WC] [Square / Rectangular Connection, hooded wall cap model WC
   Vibration Kit:
   a. Available for suspended installations
   b. Includes pre-punched hole for ease of installation and shall have all hardware to mount one unit.

2.03 BELT DRIVE SIDEWALL MOUNTED PROPELLER FANS - GREENHECK MODEL SBE-3

A. General Description:
   1. Fan arrangement shall be exhaust
   2. Sidewall mounted applications
   3. Performance capabilities up to 53,200 cubic feet per minute (cfm) and static pressure to 1 inches of water gauge
   4. Fans are available in eight sizes with nominal wheel diameters ranging from 20 inches through 60 inches (20 - 60-unit sizes)
   5. Maximum continuous operating temperature 130 Fahrenheit (54.4 Celsius)
   6. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number

B. Wheel:
   1. H Type (high pressure): Propeller is a fabricated Steel with a straight, moderately pitched blade. Typically run at higher RPM's and generate higher sound levels than the "L" propeller.
   2. Securely attached to fan shaft with a standard square key and set screw or tapered bushing
   3. Statically and dynamically balanced in accordance to AMCA Standard 204-05
   4. The propeller and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency

C. Motors:
   1. Motor Enclosure: Open drip proof - opening in the frame body and or end brackets
   2. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and furnished at the specific voltage and phase
   3. Accessible for maintenance

D. Shaft and Bearings:
   1. Fan Shaft shall be ground and polished solid steel with an anti-corrosive coating
   2. Bearing shall be cast pillow block
   3. Bearings shall be selected for a minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed
   4. Bearing shall be air handling quality and 100% factory tested by bearing manufacturer
   5. Fan Shaft first critical speed is at least 25 percent over maximum operating speed

E. Drive Frame:
   1. Drive frame assemblies shall be galvanized steel, and bolted construction
   2. Drive frame shall have formed channels and fan panels shall have pre-punched mounting holes, formed flanges and a deep formed one piece inlet venturi

F. Disconnect Switches:
   1. NEMA rated: Nema1
   2. Positive electrical shut-off

3. Wired from fan motor to junction box

G. Drive Assembly:
1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower
2. Belt: Static free and oil resistant
3. Fully machined cast iron pulleys, keyed and securely attached to the wheel and motor shafts
4. The motor pulley shall be adjustable for final system balancing
5. Readily accessible for maintenance

H. Options/Accessories:
1. Dampers:
a. Type: VCD-20, 208 VAC
b. Prevents outside air from entering back into the building when fan is off
c. Balanced for minimal resistance to flow
d. Galvanized frames with pre-punched mounting holes
2. Mounting:
a. Fan panel will be mounted vertically directing the air horizontally out of the building. Motor and drives will be accessible from the interior of the building
3. Wall Collar:
a. Constructed of galvanized steel with heavy gauge mounting flanges and pre-punched mounting holes
4. Motor Side Guard:
a. OSHA Motor Side Guard: Protective guards of expanded metal screen in structural steel frames completely enclose the motor and drive side of the fan
b. Protective guard completely encloses the motor and drive side of the fan

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including technical bulletins, product catalog installation instructions

3.02 EXAMINATION

A. Examine areas to receive fans. Notify the Engineer of conditions that would adversely affect installation or subsequent utilization and maintenance of fans. Do not proceed with installation until unsatisfactory conditions are corrected

3.03 PREPARATION

A. Ensure roof openings are square, accurately aligned, correctly located, and in tolerance

B. Ensure duct is plumb, sized correctly, and to proper elevation above roof deck. Install duct as specified in Air Distribution (Division 23)

3.04 INSTALLATION

A. Install fans system as indicated on the Installation, Operation and Maintenance Manual (IOM) and contract drawings

B. Install fans in accordance with manufacturer's instructions

3.05 SYSTEM STARTUP

A. Refer to Installation, Operation, and Maintenance Manual (IOM)

3.06 ADJUSTING

A. Adjust exhaust fans to function properly

B. Adjust Belt Tension

C. Lubricate bearings

D. Adjust drive for final system balancing

E. Check wheel overlap

3.07 CLEANING

A. Clean as recommended by manufacturer. Do not use material or methods which may damage finish surface or surrounding construction

3.08 PROTECTION

A. Protect installed product and finished surfaces from damage during construction

B. Protect installed exhaust fans to ensure that, except for normal weathering, fans will be without damage or deterioration at time of substantial completion

END OF SECTION

SECTION 23 37 00

AIR INLETS AND OUTLETS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Basic Requirements for Air Inlets and Outlets.

1.02 RELATED SECTIONS

A. Section 23 05 00 – Common Work Results for Heating, Ventilating, and Air Conditioning System.

B. Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 23 31 00 – HVAC Ducts and Casings.

D. Section 23 05 93 – Testing, Adjusting, and Balancing.

1.03 REFERENCES

A. ADC 1062 - Certification, Rating, and Test Manual.

B. ANSI/NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

C. ARI 650 - Air Outlets and Inlets.

D. ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.

E. SMACNA - Low-Pressure Duct Construction Standard.

1.04 QUALITY ASSURANCE

A. Test and rate performance of air outlets and inlets per ADC Equipment Test Code 1062 and ASHRAE 70.

B. Air distribution devices have been specifically selected based on the specified manufacturer's performance data. If the Contractor submits on devices other than those specified the submittal must include an item-by-item selection of substitutions listed by space location.

C. Where compliance with performance requires different dimensions, such as neck or face size than the specified item, the submittal must note where these dimension changes occur listing both the original and the new dimensions.

D. Any additional costs by any trade resultant from air device substitution shall be borne by the Contractor.

1.05 REGULATORY REQUIREMENTS

A. Conform to ANSI/NFPA 90A.

1.06 SUBMITTALS

A. Submit product data under provisions of Division 01 and Section 23 05 00.

B. Submit a schedule of air devices indicating type, size, location, and application.

C. The schedule must include model number, size, air pattern, CFM, pressure drop, throw NC noise level, finish, and mounting method for both the submitted and a specified device.

D. Review requirements of outlets and inlets as to size, finish, and type of mounting before submitting product data and schedules of outlets and inlets.

E. Submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.01 AIR DEVICES

A. All air devices shall be equal to products scheduled on the Drawings.

2.02 LOUVERS (ALUMINUM)

A. Frame shall be a 6-inch-deep channel of .081 inch thick 6063-T5 extruded aluminum alloy.

B. Blades shall be constructed of .081-inch-thick aluminum. Blades shall be adjustable and drainable.

C. Insect screen shall be aluminum mesh, removable type. The screen shall be mounted on the exterior of the louver.

D. Finish shall be as selected by Architect.

2.03 APPROVED MANUFACTURERS

A. Air Devices
   1. Tuttle & Bailey.
   2. Price
   3. Metal Aire
   4. Architect Approved.

B. Louvers
   1. American Warming and Ventilating LE-31.
   2. Ruskin.
   3. Architect Approved.

PART 3 - EXECUTION

3.01 INSTALLATION (AIR DEVICES)

A. Install air devices per the manufacturer’s instructions.

B. Check the location of air devices and make necessary adjustments in

position to conform to architectural reflected ceiling plan, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with the airtight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, regardless of whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Provide mounting frame or additional ceiling grid tees as required to mount air devices. Support devices as required to prevent ceiling sag.

3.02 INSTALLATION (LOUVERS)

A. Locate and place louver units, plumb, level, and in proper alignment with adjacent work.

B. Use concealed anchorages wherever possible. Provide brass or lead washers fitted to screws were required to protect metal surfaces and to make a weathertight connection.

C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joints fillers, as indicated.

D. Repair finishes damaged by installation operations. Restore finishes so that there is no evidence of corrective work. Return items that cannot be refinished in the field to the shop, make the required alterations and refinish the entire unit, or provide a new unit, at the contractor's option.

E. Protection non-ferrous metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

F. Provide concealed gaskets, flashings, joint fillers, and insulations, and install as work progresses to make the installations weathertight.

G. Refer to Division 7, Section 07 900, for sealants in connection with the installation of louvers.

H. Field verified exact opening dimensions and coordinate mounting requirements with General Contractor.

END OF SECTION

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SECTION 23 5533

GAS FIRED UNIT HEATERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This section includes gas-fired unit heaters

1.03 INFORMATIONAL SUBMITTALS

A. Product Data: For each type of gas-fired unit heater indicated. Include rated capacities, operating characteristics, and accessories.

B. Shop Drawings: For gas-fired unit heaters.
   1. Detail equipment assemblies and indicate dimensions, weights, required clearances, components, and location and size of each field connection.
   2. Wiring Diagrams: Power and control wiring.

1.04 MAINTENANCE MATERIAL SUBMITTALS

A. Operation and Maintenance Data: For gas-fired unit heaters to include, installation, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

A. Equipment, Electrical Components, Devices, and Accessories: Listed and labeled as defined by Intertek's ETL certification.

B. Comply with the following codes and standards where applicable:
   1. ANSI Z83.8 -2009/CSA 2.6-2009 – American National Standard/CSA Standard for Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters and Gas-Fired Duct Furnaces.
   2. ASHRAE/IESNA 90.1-2010 – Applicable requirements in ASHRAE/IESNA 90.1-2010, Section 6 – "Heating, Ventilating, and Air-Conditioning".
   3. NFPA 70, National Electric Code for electrical components and installation.
   4. NFPA 54, National Fuel Code for gas components and installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements,

provide products by one of the following or approved equal:
1. Trane
2. Sterling
3. Reznor

B. Manufacture must have a minimum of 5-year experience manufacturing the products specified in this section.

2.02 GENERAL

Unit is completely factory assembled, piped, wired and test fired. Unit is ETL certified, minimum of 82 percent thermal (combustion) efficient. These propeller type units are provided with aluminized steel tubes heat exchanger, single-orifice burner, direct spark ignition, individually adjustable and removable louvers, 100 percent baked enamel finish, removable access panel, power vented, single-stage combination gas valve, 24V control transformer and 115/60/1 volt fan motor with internal overload protection. OSHA fan guard is standard on all units.

2.03 TUBULAR HEAT EXCHANGER

Heat exchanger construction consists of 20-gauge aluminized steel. The tubular design provides maximum and uniform heat transfer. The low-pressure drop enables heated air to be evenly distributed. The curved, non-welded serpentine design, experiences less thermally induced stress making it highly durable for longer service life.

2.04 CABINET

The cabinet is constructed of 20-gauge cold rolled steel. All components are individually electrostatically painted with a baked grey enamel.

2.05 DIRECT SPARK IGNITION

Tubular units utilize a direct spark pilotless ignition of the burner, providing fast heat delivery. When there is a call for heat, the single stage, redundant gas valve opens and the igniter provides a spark in an attempt to light the in-shot burners. The burner flame is then proven by the flame sensor and continues to burn until the call for heat is satisfied.

This highly reliable and efficient ignition system incorporates an integrated electronic control board to regulate the system sequence of operation, including an onboard LED indicator for simple troubleshooting.

2.06 VENTING

The tubular design is ETL certified in accordance with Categories I and III venting requirements.

Category I enables units to be vented vertically with either single- or double wall, or B-vent venting material. Category III allows for horizontal or vertical venting utilizing single- or double-wall venting material. This venting flexibility makes installation easier and more cost effective.

2.07 CONTROL ACCESSIBILITY

The control transformer and pressure switch is factory mounted in a main control cabinet located on the side of the unit. The side panel is removable creating easy access.

2.08 MOTOR—115V ODP

Motor is 115V, 60 Hz, single phase, open drip-proof with built-in thermal overload protection.

2.09 FACTORY-INSTALLED OPTIONS

A. Totally Enclosed Motor
Motor is 115V, 60 Hz, single phase, totally enclosed with built-in thermal overload protection.

B. Type 409 Stainless Steel Heat Exchanger
Heat exchanger tubes and vestibule panel are 20-gauge Type 409 stainless steel. UH-PRC002L-EN 37

2.10 WARRANTY

The heat exchanger, flue collector and burners are covered by a 10-year warranty from the date of manufacture.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine area to receive unit heater for compliance with requirements for installation clearances and other conditions affecting unit heater performance. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install unit heater level and plumb, according to manufacturer's written instructions and referenced standards.

B. Install gas fired unit heater according to NFPA 54, and applicable federal and local code.

C. Support suspended unit heater per manufactures instructions.

D. Install electrical devices furnished with unit heater, but not specified to be factory mounted.

3.03 CONNECTIONS

A. All gas piping should be sized in accordance with the latest edition of ANSI Standard Z223.1, National Fuel Gas Code; in Canada, according to CSA B149.

B. If supply gas pressure exceeds 14 inches W.C. a high-pressure regulating valve must be installed in the line upstream from the main shut off valve.

C. Connect gas piping to unit heater gas train inlet with ground joint union (field provided). A manual shut off valve (field provided) should be field install immediately upstream of the gas supply connection to the unit heater.
   1. Piping must be adequately supported to prevent strain on the gas manifold and controls.
   2. To prevent the mixing of moisture with the gas, run the take-off piping from the top or side of the main gas line.
   3. Provide a drip leg in the gas piping near the unit heater.
   4. Make certain that all connections have been adequately doped and tightened.

D. Electrical: Comply with applicable requirements in Division 26 Sections.
   1. All external wiring must conform to the latest edition of ANSI/NFPA No. 70, United States National Electrical Code, and applicable local codes; in Canada, to the Canadian Electrical Code, Part 1, CSA Standard C22.1
   2. A disconnect switch (field provided) of suitable electrical rating should be located as close to the gas valve and controls as possible.
   3. Each unit heater must be electrically grounded in accordance with the latest edition of ANSI/NFPA No. 70, United States National Electrical Code, and applicable local codes; in Canada, to the Canadian Electrical Code, Part 1, CSA Standard C22.1.

E. Thermostat must be mounted on a vertical, vibration free surface, free from air currents and in accordance with the furnished instruction.
   1. Thermostat shall be mounted at a height of approximately 5 feet above the floor, in an area where it will be exposed to a free circulation of average temperature air.

F. Venting: All venting installations shall be in accordance with the latest edition of ANSI Z223.1, Part 7, Venting of Equipment of the National Fuel Gas Code or applicable provisions of local building codes.
   1. Pipe exhaust venting per manufactures instructions.
   2. Venting must be sloped to prevent any condensate from draining into the unit heater.

3.04 CLEANING

A. Gas line should be purged prior to startup of unit heater.

B. Unit should be cleaned of all construction debris and any dust that may have accumulated on interior of unit, burner or any part of the heat exchanger.

C. All vent piping must be free of any blockage that may affect airflow.

END OF SECTION

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SECTION 23 8126

DUCTED MINI-SPLITS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Mini-split heat pump air handling unit.

B. Mini-split heat pump system outdoor unit.

1.02 QUALITY ASSURANCE

A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995 – Heating and Cooling Equipment and bear the Listed Mark.

B. All wiring shall be in accordance with the National Electric Code (NEC).

C. The system shall be rated in accordance with Air Conditioning Refrigeration Institute's (ARI) Standard 210/240 and bear the ARI label.

D. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.

E. Mechanical equipment for wind-born debris regions shall be designed in accordance with ASCE 7-2002 and installed to resist the wind pressures on the equipment and the supports.

F. The outdoor unit will be factory charged with R-410A.

G. A holding charge of dry nitrogen shall be provided in the evaporator.

H. System efficiency shall meet or exceed 16.0 SEER and 9.2 HSPF.

1.03 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled according to the manufacturer's recommendations.

PART 2 - PRODUCTS

2.01 SINGLE ZONE WITH LGRED° HEAT PUMP INDOOR UNIT (DUCTED – VAHU)

A. Operating Conditions
   1. The indoor unit shall be capable of the following ambient operating range.
      a. Cooling: 57°F WB to 77°F WB
      b. Heating: 59°F DB to 81°F DB

B. General:
   1. Unit shall be manufactured by LG.
   2. Unit shall be factory assembled, wired, piped and run tested.
   3. Unit shall be designed to be installed for indoor application.
   4. Unit shall be designed to mount fully concealed behind the wall, in a closet or above the finished ceiling.
   5. The unit case shall be designed to accept an internal, optional LG electric strip heater mounted in the reheat position,
   6. The supply air shall be flanged for field installed ductwork that shall not exceed the external static pressure limitation of the unit.
   7. Unit shall bear the ETL mark.

C. Casing/Panel
   1. Unit case shall be manufactured using 22-gauge Pre-Coated Metal (PCM).
   2. The external surface shall be finished with a high gloss baked enamel finish.
   3. The finish color shall be morning fog.
   4. The cold surfaces of the unit shall be internally insulated with 1/2-inch foil faced polystyrene fiber insulation.
   5. The inside surface of fan assembly door access panel shall be treated with 1/2-inch polystyrene fiber insulation, encapsulated on both sides.
   6. The access panel shall be sealed along the edges with reinforced foil faced covering to prevent deterioration caused by panel removal.
   7. All the access panels shall be provided with gasket seals to minimize air leakage.
   8. The external insulation shall be plenum rated and conform to ASTM Standard D-1418.

D. Cabinet Assembly
   1. The unit shall be designed to operate in the vertical (up flow and down flow) configuration and horizontal (left and right) end discharge. Down flow configuration shall require an optional kit.
   2. Unit shall, in the vertical position, have opening for supply air from top (or bottom) with a dedicated bottom (or top) vertical return and in the horizontal position supply air shall be from the left (or right) end with the return air from the right (or left) end.
   3. The unit shall be designed to operate in the vertical (up flow and down flow) configuration and horizontal (left and right) end discharge. Down flow configuration shall require an optional kit.
      a. Unit shall, in the vertical position, have opening for supply air from top (or bottom) with a dedicated bottom (or top) vertical return and in the horizontal position supply air shall be from the left (or right) end with the return air from the right (or left) end.
   4. Unit shall be equipped with factory installed temperature thermistors for:
      a. Return air

b. Refrigerant entering coil
c. Refrigerant leaving coil

5. Unit shall have a factory assembled, piped and wired electronic expansion valve (EEV) for refrigerant control.
6. Unit shall have a built-in control panel to communicate with other indoor units and to the outdoor unit.
7. Unit shall have the following functions as standard:
   a. Self-diagnostic function
   b. Auto changeover function (Single zone systems only)
   c. Auto operation function
   d. Dehumidifying function
   e. Child lock function
   f. Hot start
   g. Dual thermistor control
   h. Sleep mode
   i. External static pressure (ESP) control
   j. Aux heater applications

E. Fan Assembly:
1. The unit shall have an integral fan assembly consisting of galvanized steel housing and forward curve fan wheel.
2. The fan motor shall be Electronically Commutated Motor (ECM) and Brushless Digitally (BLDC) commutated with permanently lubricated and sealed ball bearings.
3. The fan speed shall be controlled using microprocessor based direct digitally controlled algorithm.
4. In cooling mode, the indoor fan shall have the following settings: Low, Med, High, and Auto.
5. In heating mode, the indoor fan shall have the following settings: Low, Med, High, and Auto.
6. The Auto fan setting shall adjust the fan speed to most effectively achieve the set-point.
7. The ECM fan shall adjust and deliver constant airflow regardless of permitted external static pressure.
8. The BLDC fan settings can be field adjusted from the factory setting (RPM/ESP)
   a. Unit manufactured starting October 2020, shall have Auto ESP Control to adjust and deliver constant airflow regardless of permitted external static pressure
9. The unit shall be designed for high-speed air volume against an external static pressure of up to 0.7" water gauge.
10. The unit shall be designed for high-speed air volume against an external static pressure of up to 1.0" water gauge.

F. Filter Assembly:
1. The unit shall be supplied with a filter rack capable of accepting a field supplied 16" x 20" x 1" filter cartridge and a filter rack capable of accepting a field supplied 24" x 20" x 1" filter cartridge.
2. The filter rack shall be equipped with guides to keep filter centered in the rack.
3. The filter access shall be from the front of the unit without removing coil or fan area access panel.
4. The filter access door shall be fitted with thumb screws that

can be removed without the use of any tool.

G. Coil Assembly
1. Unit shall have a factory-built coil comprised of aluminum fins mechanically bonded on copper tubing.
2. The copper tubing shall have inner grooves to expand the refrigerant contact surface for high efficiency heat exchanger operation.
3. Unit shall have minimum two row coil, 18 fins per inch.
4. Unit shall have a factory supplied condensate drain pan below the coil constructed of HIPS (high impact polystyrene resin).
5. Unit shall be designed for gravity drain.
6. The unit shall have a secondary drain port plug for overflow.
7. Unit shall have provision of 45° flare refrigerant pipe connections.
8. The coil shall be factory pressure tested at a minimum of 550 psig.
9. All refrigerant piping from outdoor unit to indoor unit shall be field insulated. Each pipe should be insulated separately. Thickness and heat transfer characteristics shall be determined by the design engineer and shall meet all code requirements.

H. Microprocessor Control
1. The unit shall have a factory installed microprocessor controller capable of performing functions necessary to operate the system.
2. The unit shall be able to communicate with the outdoor unit using a field supplied minimum of 14 AWG, 4 conductor, stranded, shielded or unshielded power/communication cable. If shielded, it must be grounded to chassis at ODU only.
3. Central control shall be available through an optional control board for the outdoor unit.
4. Group control shall be available to allow multiple indoor units to operate from a single controller, or allow connection of more than one controller to an indoor unit.
5. The unit controls shall operate the indoor unit using one of the five operating modes:
   a. Auto operation
   b. Heating
   c. Cooling
   d. Dry
   e. Fan only
6. The units shall have provision for W-2 terminal connection for second stage heat.
7. The unit shall be able to operate in either cooling or heating mode for testing and/or commissioning.
8. The unit shall be able to operate with the fan turned off during system cooling thermal off.
9. The unit shall be able to operate with a continuous fan setting.

I. Electrical:
1. The unit electrical power shall be 208-230/1/60 (V/Ph/Hz).
2. The unit shall be capable of operating within voltage limits of +/- 10% of the rated voltage.

J. Controls:
1. The indoor unit shall use controls provided by the manufacturer to perform all functions necessary to operate the system effectively and efficiently.
2. An optional wireless handheld controller shall be available as an additional accessory for use with installed LG wired controller.
3. The indoor unit shall have a built-in interface for 3rd party thermostats.
4. The indoor unit shall accommodate an optional Wi-Fi module as an additional accessory to allow monitoring and control through a smart device with the LG Smart ThinQ© application.

K. Warranty
1. Please refer to the respective outdoor unit for applicable warranty.

2.02 SINGLE ZONE WITH LGRED° HEAT PUMP OUTDOOR UNIT (CASSETTE/DUCTED/VAHU)

A. Operating Conditions
1. The outdoor unit shall be capable of the following ambient operating range.
a. Cooling: 5°F DB to 118°F DB
b. Heating: -13°F WB to 64°F WB

B. General
1. Unit shall be manufactured by LG.
2. The air-conditioning system shall use R410A refrigerant.
3. Each system shall have one air source outdoor unit.
4. The refrigerant circuit shall be field piped to a single matching indoor unit to effectively and efficiently control the heating or cooling operation of the system.
5. All refrigerant piping from outdoor unit to indoor unit shall be field insulated.
6. Factory installed microprocessor controls in the outdoor unit and indoor unit shall perform functions to efficiently operate the single zone system and communicate via minimum 14 AWG, 4 conductor, stranded, shielded or unshielded power/communication cable. If shielded, it must be grounded to chassis at ODU only.
7. The outdoor unit shall be internally assembled, wired and piped from the factory.
8. The factory assembled system shall have the outdoor unit fitted with refrigerant strainer, check valves, oil separator, accumulator, 4-way reversing valve, electronic expansion valve, high side and low side refrigerant charging ports, and a service port.
a. The outdoor unit shall include a sub cooler, vapor injection valve and vapor bypass circuit.

C. Piping capabilities
1. The outdoor unit shall be capable of operating at an elevation of 98.4 feet above or below the indoor unit.

2. The outdoor unit shall be capable of operating with up to 164 feet <LUU180HHV><LUU240HHV> or 246 feet <LUU360HHV><LUU420HHV>of total equivalent refrigerant piping length.

D. Defrost Operations
1. The outdoor unit shall be capable of auto defrost operation to melt accumulated ice off the outdoor unit heat exchanger. The defrost cycle control shall be based on outdoor ambient temperatures and outdoor unit heat exchanger temperatures.
2. Factory installed base pan heater shall be included for outdoor units.

E. Oil Management
1. The outdoor unit shall have an oil injection mechanism to ensure a consistent film of oil on all moving compressor parts at low speed.
2. The outdoor unit shall have an oil separator to separate oil mixed with the refrigerant gas during compression and return oil to the compressor.

F. Cabinet
1. The outdoor unit cabinet shall be made of pre-coated metal (PCM).
2. The front/side panels of the outdoor unit shall be removable type for access to internal components.
3. Outdoor unit cabinet shall be tested in accordance with ASTM B-117 salt spray test procedure for a minimum of 1000 hours.

G. Fan Assembly
1. Each 1-1/2-to-2-ton outdoor unit shall be equipped with one direct drive variable speed propeller fan with Brushless Digitally Controlled (BLDC) motor with a horizontal air discharge.
2. Each 3-to-4-ton outdoor unit shall be equipped with two direct drive variable speed propeller fans with BLDC motors with a horizontal air discharge.
3. The fan blades shall be made of Acrylonitrile Butadiene Styrene (ABS) material.
4. The fan(s) shall be equipped with permanently lubricated bearings.
5. The fan motor(s) shall have variable speed to a maximum of 800 RPM.
6. The fan(s) shall have a raised guard to help prevent contact with moving parts.

H. Outdoor Coil
1. Variable Path Heat Exchanger
   a. System shall have a variable flow path and outdoor heat exchanger function to vary the refrigerant flow volume and path. Control of the variable path circuits shall be based on system operating mode and operating conditions as targeted to manage the coil heat transfer capacity and efficiency.

b. The variable path heat exchanger technology shall be provided to maintain stable refrigeration cycle operation during mild weather conditions and maintain a robust hot vapor temperature system head pressure that delivers "gas-furnace leaving air temperature" from the indoor unit at sub-zero outdoor air temperature down to minus (-) 13°F.

2. The aluminum fins shall have factory applied corrosion resistant GoldFin™ material.
3. Coil coating shall be tested in accordance with ASTM B-117 salt spray test procedure for a minimum of 1000 hours.
4. The outdoor unit coil shall be factory tested to a pressure of 600 psig.
5. The coil for each outdoor unit shall have a minimum of 14 Fins per Inch (FPI).
6. The coil for each outdoor unit shall have a 2-row heat exchanger.
7. The outdoor unit cabinet shall have a coil guard.

I. Compressor

1. The outdoor unit shall be equipped with one hermetically sealed, digitally controlled, inverter driven R1 scroll compressor.
2. The inverter driven, digitally controlled compressor shall be capable of operating in a frequency range from 10 Hz to 95 Hz (cooling), 10Hz to 130Hz (heating), with control in 1 Hz increments.
3. The inverter driven, digitally controlled compressor shall be capable of operating in a frequency range from 15 Hz to 120 Hz (cooling), 15Hz to 135Hz (heating) with control in 1 Hz increments.
4. The inverter driven, digitally controlled compressor shall be capable of operating in a frequency range from 10 Hz to 120 Hz (cooling), 10Hz to 135Hz (heating), with control in 1 Hz increments.
5. The outdoor unit shall have a medium pressure gas vapor injection function employed in the heating and cooling modes to increase system capacity when the outdoor ambient temperatures are low and lower compressor lift when temperatures are high. The compressor vapor injection flow amount shall be controlled by the vapor injection sub-cooling algorithm reset by discharge gas temperatures of the compressor.
6. The compressor shall be mounted on vibration attenuating rubber grommets.
7. The compressor shall use a factory charge of Polyvinyl Ether (PVE) oil.
8. The compressor bearing(s) shall have Teflon™ coating.
9. The compressor shall be equipped with over-current protection.
10. Standard, non-inverter driven compressors shall not be permitted nor shall a compressor without vapor injection or direct sump oil return capabilities.

J. Sound Levels
   1. The outdoor unit shall have sound levels not exceeding 56 dB(A) tested in an anechoic chamber under ISO 3745 standard.
   2. A field setting shall be available to program the outdoor unit to reduce sound levels at night, when desired, to a selectable level while still able to meet building load requirement. This mode is available in both cooling and heating modes.

K. Sensors
   1. The outdoor unit shall have
      a. Suction temperature sensor
      b. Discharge temperature sensor
      c. High pressure sensor
      d. Low Pressure sensor
      e. Outdoor temperature sensor
      f. Outdoor unit heat exchanger temperature sensor
      g. Vapor injection inlet temperature sensor
      h. Vapor injection outlet temperature sensor

L. Wind Load Installations for Outdoor Units
   1. Provide Florida wind Load Installation Drawings that meet the requirements of the 2017 Florida Building Code, 6th Edition and ASCE Standard 7-2010 with submittal.

M. Warranty
   1. Limited Warranty Period
      a. STANDARD FIVE (5) YEAR WARRANTY FOR A QUALIFIED SYSTEM - The Part(s) of a qualified System, including the compressor, are warranted for a period (the “Standard Parts Warranty Period”) ending five (5) years after the date of original installation. In absence of proof of installation, the warranty date will end five (5) years from the date of manufacture.
      b. ADDITIONAL TWO (2) YEAR COMPRESSOR PART WARRANTY - The Compressor is warranted for an additional two (2) year period after the end of the applicable Standard Part Warranty Period (the “Compressor Warranty Period”).
   2. Extended Warranty
      a. The Standard Warranty Period and the Compressor Warranty Period are extended to a total of ten (10) years (the “Extended Warranty Period”) for qualified Systems that have been (a) installed by a party that has completed the Training Requirements, (b) installation is pursuant to LG’s published instructions, and (c) product is registered within 60 days of startup at www.lg-dfs.com or www.lg-dfs-warranty.com.

2.03 APPROVED MANUDFACTURERS

A. LG

B. Daikin

C. Mitsubishi

D. Architect Approved.

PART 3 – EXECUTION

3.01 Orient unit to obtain maximum air flow to condenser coil and adequate clearance for service (refer to manufacturer's installation instructions.

3.02 Install unit level and attach to supports.

3.03 Install interconnecting refrigerant piping between outdoor unit and indoor air handler. Arrange piping to provide access for service panel removal and to avoid restricting service walk area.

3.04 Coordinate location of electrical connections with electrical contractor.

3.05 Install condensate drain piping.

3.06 Install control wiring in conduit.

3.07 Install unit identification tags.

3.08 Secure outdoor units to concrete base.

END OF SECTION

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SECTION 26 0500

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Basic Electrical Requirements specifically applicable to Division 26 Sections, in addition to Division 1 - General Requirements.

1.02 REFERENCES

A. The following specifications and standards of issues listed below but referred to thereafter by basic designation only, form a part of these specifications:
   1. American Society for Testing Materials.
   2. American Standards Association.
   3. Americans with Disabilities Act (ADA).
   4. Arkansas Energy Code (ASHRAE 90.1).
   5. Arkansas Fire Prevention Code.
   6. Illuminating Engineering Society.
   7. Institute of Electrical and Electronic Engineers.
   8. International Building Code, 2000 Edition.
   9. Local, City and State Codes and Ordinances.
   10. National Electrical Code, 2005 Edition.
   11. National Electrical Manufacturers Association.
   12. National Electrical Safety Code, 2002 Edition.
   13. National Fire Protection Association's Recommended Practices.
   14. Occupational Safety and Health Act.
   15. Power Cable Engineers Association.
   16. Service requirements of serving utility company.
   17. Underwriter's Laboratories, Inc.

1.03 SUBMITTALS

A. Submit six (6) sets of shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal. The basic information for each item of equipment to be included is as follows:
   1. Index.
   2. Installation and Operating Instructions
      a. Individual tabbed sections.

b. Manufacturer descriptive literature.
c. Applicable control diagrams.
d. Composite wiring diagrams.

3. Each submittal sheet shall be clearly marked with equipment Catalog Number and accessory items being submitted.

1.04 REGULATORY REQUIREMENTS

A. Work shall conform to all applicable codes, specifications, local ordinances, industry standards and utility company regulations.

B. Notwithstanding any reference in the specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, such references shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. The Contractor, in such cases, may at his option propose any article, approved equal to or better than that specified, as approved in writing by the Engineer.

C. All materials and workmanship shall comply with all applicable codes, specifications, local ordinances, industry standards and utility company regulations.

D. In case of difference between building codes, specifications, state laws, local ordinances, industry standards, and utility company regulations and the contract documents, the most stringent shall govern. The Contractor shall promptly notify the Engineer in writing of any such difference.

E. Non-Compliance: Should the contractor perform any work that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards and utility company regulations, he shall bear all costs arising in correcting the deficiencies.

F. All required fees, permits and inspections shall be obtained and paid for by the contractor under the section of the specifications for which they are required.

1.05 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 Examiner's 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.

C. The Arkansas Department of Labor requires that the worker, who installs raceway for low voltage cables of temperature controls, fire alarm, telecommunications, intrusion detection, access control, public address, television distribution, etc., be paid the electrician's minimum wage rate.

1.06 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions. The Engineer/Owner reserves the right to relocate any device a maximum distance of 6'-0" at the time of installation without an extra cost being incurred.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Engineer before proceeding.

1.07 CONTRACTOR REVISED DRAWINGS

A. The Contractor shall, during the progress of the work, keep an accurate record of all changes and corrections from the layouts shown on the drawings. Record of changes may be kept by accurately making all changes on a set of prints during the progress of the job.

B. Upon completion of the work and prior to final payment, the Contractor shall furnish to the Engineer, one set of "contractor revised" reproducibles, legibly and accurately marked to indicate all changes, additions, deletions, etc., from the contract drawings.

1.08 GUARANTEE

A. The work herein specified shall be free from defects in workmanship and material under normal use and service. If, within twelve (12) months from date of substantial completion and Owner acceptance of the work herein described, any of the equipment or materials, or the installation thereof, is found to be defective in workmanship or material, it shall be replaced or repaired free of charge.

B. The Contractor shall, after completion of the original test of the installation, and acceptance by the Engineer, provide any service incidental to the proper performance of the electrical systems under guarantees outlined above for a period of one (1) year.

1.09 OPERATING AND MAINTENANCE MANUALS

A. After approval of materials and equipment for use in this project, 3 copies of an Operation and Maintenance Manual shall be submitted for approval.

B. The basic information for each item of equipment to be included is as follows:
   1. Index
   2. Maintenance and operating instructions
      a. Manufacturer's descriptive literature and maintenance manuals
      b. An Approved Set of Shop drawings
      c. Applicable control diagrams
      d. Composite wiring diagrams as applicable showing all motor controllers, relays, etc., with interlocking provisions as built in the job, along with a written description of the control sequence if applicable.
      e. Spare parts list (when parts are provided)
      f. Listing of part suppliers and their addresses
      g. Single line diagram of the "as built" building electrical distribution system.

C. Upon final approval, submit one (1) bound copy of the approved Operation and Maintenance Manual to the Engineer and hold two (2) copies for instruction of Owner as hereinafter specified.

1.10 CONFLICTS BETWEEN DRAWINGS AND SPECIFICATIONS

A. If a conflict between the drawings and the specifications occur, the most stringent requirement shall apply.

PART 2 - PRODUCTS

2.01 UL LISTING

A. Where the Underwriter's Laboratories have an applicable standard, the product shall be listed with UL and shall be so marked.

2.02 SUBSTITUTIONS

A. Each Section of the Project Manual, when applicable has a paragraph entitled “Manufacturers”. If “Engineer Approved Equal” is not in the list of manufacturers, no substitutions will be accepted. Submit one of the manufacturers listed.

B. The Engineer does not give any prior approvals on submittals. Do not call the Engineer for prior approval.

PART 3 - EXECUTION

3.01 600 VOLT INSULATION TEST

A. Prior to energizing the electrical system, the contractor shall provide insulation resistance tests for all distribution and utilization equipment. The Contractor shall provide a suitable and stable source of test power. The insulation test shall be a "megger" test at 500 volts D.C. for one-half minute. A test report shall be submitted to the Engineer. The minimum insulation resistance for No. 12 AWG conductors shall be 1,000,000 ohms and for larger conductors shall be 250,000 ohms. Conductors testing below the minimum insulation resistance shall be replaced and tested again.

3.02 CONTINUITY TEST

A. The Contractor shall perform a continuity test on the entire electrical system prior to energizing the system to insure proper cable connections.

3.03 CONNECTION TORQUE TESTS

A. All No. 1/0 AWG and larger conductors with bolted connections shall be torque tested using a torque wrench. Torque shall be to National Electrical Testing Association's (NETA) Standards.

3.04 REMOVAL OF RUBBISH

A. Contractor shall remove his rubbish from building site at intervals and shall maintain the spaces allotted him in an orderly manner. On completing his work, and prior to submission of final estimate, he shall remove all tools, appliances, material and rubbish from the grounds.

3.05 GROUND RESISTANCE MEASUREMENTS

A. Ground resistance measurements of each ground rod shall be taken and certified by the Contractor to the Engineer. No part of the electrical distribution system shall be energized prior to the resistance testing of that system's ground rods and grounding system and submission of test results to the Engineer. Test reports shall indicate the location of the ground rod and grounding system and the resistance and the soil conditions at the time the test was performed. When the building water service is used as a ground of part of the grounding system, ground-resistance measurements shall also be made of this connection. Ground resistance measurements shall be made in normally dry weather, not less than 48 hours after rainfall, and with the ground under test isolated from other grounds. The resistance to ground shall be measured using the fall-of-potential method described in IEEE No. 142. Submit test reports with Operation and Maintenance Manuals.

3.06 MECHANICAL OPERATION TESTS

A. All electrical equipment, such as switches, circuit breakers, etc., shall be tested by operating the device to verify that the mechanical portions of the device are functioning.

3.07 ROTATIONAL TESTS

A. The Contractor shall assist Division 15 in performing rotational tests on all motors. If rotational tests determine that conductors must be transposed to change direction of rotation, the conductors shall be changed at the make-up box on the motor; or if the change is made elsewhere, then the conductor's color coding shall be changed.

3.08 INSTRUCTING OWNER'S REPRESENTATIVE

A. The Contractor shall instruct representatives of the Owner in the proper operation and maintenance of all elements of the Electrical system.

B. Contractor shall spend not less than one (1) day in such formal instruction to fully prepare the Owner's representative to operate and maintain the Electrical systems.

3.09 UL LISTINGS

A. The Contractor shall bear all responsibility for any work, which he

performs, that voids any UL listings of any equipment.

3.10 OWNER OCCUPIED BUILDINGS

A. Holes cut in Owner occupied buildings shall be done with drills with vacuum attachments that vacuum cuttings as the drill cuts.

B. All drilling, hammering, or other loud construction activities shall be done after Owner's normal working hours.

C. Conduit cutting will be done outside.

D. Contractor shall clean work area at the end of each day.

3.11 OBJECTIONABLE NOISE AND/OR HARMONICS

A. If after installation of the electrical system, it is found that objectionable noise or harmonics exists on the electrical system, the manufacturer of the equipment which is producing the objectionable noise or harmonics shall install the proper electrical equipment to prevent the noise and/or harmonics from emitting onto the building's electrical system and shall be contained within the offending equipment.

3.12 VOLTAGE MEASUREMENTS

A. Contractor shall measure and record voltage at service equipment with as much load on the system as possible. Contractor shall measure and record phase-to-phase, phase-to-neutral, and phase-to-equipment ground voltages for each phase. Where harmonic cancellation transformers are installed, contractor shall also measure and record phase-to-phase, phase-to-neutral and phase-to-equipment ground voltages for each phase on the secondary side of the transformers. Contractor shall submit records of these voltages with the Operation and Maintenance Manuals.

3.13 REMOVAL OF PAINT AND OTHER FINISHES

A. The contractor shall remove all paint and other non-factory finishes applied inadvertently by other subcontractors to all electrical equipment.

3.14 TEMPORARY CONSTRUCTION POWER AND LIGHTING

A. The contractor shall provide all necessary temporary construction power and lighting to accomplish the work.

B. After the construction is completed, the contractor shall remove all temporary construction power and lighting.

3.15 PROJECT PHASING

A. The contractor shall become familiar with the project phasing prior to his bidding the project and shall include in his bid, the amount of money required by him to provide the necessary labor, materials, adjustments, programming, reprogramming, and accessories to provide the project in the phases shown within the general conditions of the contract documents.

END OF SECTION

SECTION 26 0501

ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified in this section.

1.02 REGULATORY REQUIREMENTS

A. Conform to the requirements of NFPA 70 - National Electrical Code.

1.03 DESCRIPTION OF WORK

A. The extent of general building demolition work is shown on drawings. Coordinate the required electrical work with the general demolition.

B. Demolition includes removal and disposal of demolished materials, as shown on drawings and herein specified.

C. Interior demolition includes work in crawl spaces, work above ceilings, finishes, and removal and disposal of demolished materials, as shown on drawings and herein specified.

D. The Owner shall have the option of retaining any items removed. The Contractor shall dispose of all material off site, unless directed otherwise by Owner.

1.04 JOB CONDITIONS

A. Condition of Structures: The Owner assumes no responsibility for actual condition of structures to be demolished.

1. Conditions of the structure existing at time of inspection for bidding purposes will be maintained by Owner in so far as practicable. However, variations within structure may occur by Owner's removal and salvage operations prior to start of demolition work. The drawings are schematic and provided as an aid in bidding. The contractor shall visit the site and determine the actual conditions prior to bidding.

B. Partial Removal: Items of salvable value to Contractor may be removed from structure as work progresses. Salvaged items must be transported from site as they are removed.
   1. Storage or sale of removed items on site will not be permitted.

C. Traffic: Conduct demolition operations and removal of debris to ensure minimum interference with roads, streets, walks, occupied areas, and other adjacent occupied or used facilities.

D. Protections: Ensure safe passage of persons around or through area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons.
   1. Install temporary electrical services, lighting, etc. as required by the Owner or authorities having jurisdiction.

E. Damages: Promptly repair damages caused to adjacent facilities by demolition operations at no cost to Owner.

F. Utility Services: Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations. Allow no interruption in service unless coordinated with Owner at least 24 hours in advance.
   1. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing fire utilities, as acceptable to governing authorities.
   2. Contractor will disconnect and seal utilities serving each structure to be demolished, or interior area to be demolished, prior to start of demolition work.

G. If Contractor is required to disconnect utility services or other services to an occupied area the Contractor shall provide temporary or alternative services to that area.

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

3.01 DEMOLITION

A. Remove all branch and feeder conduit and wire back to panelboards.

1. Where walls, ceilings, or floors are to remain, remove all devices, and wire where indicated. Provide blank cover plate at outlet box or patch wall to match existing finish as directed by the issued documents and/or the Architect/Engineer.
2. All items shown to remain active shall be furnished with necessary accessible junction boxes and all conduit and wire as required to maintain circuit continuity.
3. All outlet boxes which must be removed due to demolition but which must remain active in order to maintain circuit continuity shall be relocated into ceilings or walls and shall be accessible.
4. All material, fixtures, and equipment to be reused shall be removed and stored on site. Before reinstallation all items are to be cleaned, tested, and prepared for re-use. Fixtures shall be re-lamped and new ballasts installed.
5. Correct existing directories of load centers, panelboards, and switchboards where circuits are removed and/or added. Corrections to existing directories of load centers and panelboards shall be neatly handwritten. Nameplates are required at switchboards.
6. Conduit in a concrete slab or that is not shown to be reused, may be abandoned provided as follows:
    a. Conduits in slab shall be cut off at top of slab.
    b. Underground conduits shall be removed to 12 inches below grade before being abandoned.
7. Fire seal all holes in fire and/or smoke walls and floors where conduits are removed.

B. Remove all accessible low-voltage cables that are not to be reused.
1. This includes data, telephone, television, audio/visual, intercom, fire alarm, security, access control, public address, and temperature control cables.
2. Fire seal holes where these cables penetrated fire and/or smoke walls and floors.

3.02 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Remove from site debris, rubbish, and other materials resulting from demolition operations. Pay all fees related to removal and dumping.
1. Remove and dispose of interior demolition debris only.
2. Burning of removed materials from demolished structures will not be permitted on site.

B. Removal:

1. Transport materials removed from demolished structures and dispose of off site.

C. Store items that Owner wishes to retain as directed by the Owner.

3.03 OUTAGES

A. The Contractor shall schedule all outages with the Owner at least two weeks in advance. Owner has the right to approve or disapprove any scheduled outages. Contractor will schedule the outage at the Owner's convenience. Contractor shall pay all costs, including overtime, necessary for the outage work schedule.

B. Refrigerators and freezers shall not be turned off for more than 1 hour. If the Contractor needs more than 1 hour, he shall install a temporary feeder to the equipment and/or rent an emergency generator to power the equipment. Contractor shall pay all costs of the generator and/or temporary feeders at no additional cost to the Owner.

END OF SECTION

SECTION 26 0502

EQUIPMENT WIRING SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to elevator, plumbing, appliances, and mechanical equipment specified under other sections or Owner furnished equipment.

1.02 RELATED SECTIONS

A. Section 26 0533 – Raceway and Boxes for Electrical Systems.

B. Section 26 0519 – Low-Voltage Electrical Power Connectors and Cable.

C. Section 26 0529 – Hangers and Supports for Electrical Systems.

D. Section 26 2816 - Enclosed Switches and Circuit Breakers.

E. Section 26 2913 - Enclosed Motor Controllers.

1.03 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. NEMA WD 1 - General Purpose Wiring Devices.

C. NEMA WD 6 - Wiring Device Configurations.

D. NFPA 72 - National Fire Alarm Code.

E. UL 498 - Attachment Plugs and Receptacles.

F. UL 1010 - Receptacle Plug Combinations for Use in Hazardous (Classified) Locations.

1.04 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 0500.

B. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

C. Conform to requirements of the Arkansas State Fire Protection Code.

1.06 COORDINATION

A. Obtain and review shop drawings, product data, and manufacturer's instructions for equipment furnished under other sections. Verify voltage, ampere, and phase ratings before beginning any of the work. Notify Engineer immediately of any discrepancies found. Any work installed that has to be replaced because of the contractor’s failure to verify these ratings will not be reimbursed. Verify that equipment furnished under other sections has disconnects and starters, if so specified in other sections.

B. Determine connection locations and requirements.

C. Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.

D. Sequence electrical connections to coordinate with start-up schedule for equipment.

PART 2 - PRODUCTS

2.01 CORDS AND CAPS

A. Manufacturers:
1. Hubbell.

2. Pass & Seymour.
3. Arrow-Hart.

B. Attachment Plug Construction: Conform to NEMA WD 1.

C. Configuration: NEMA WD-6; match receptacle configuration at outlet provided for equipment.

D. Cord Construction: ANSI/NFPA 70, Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

E. Size: Suitable for connected load of equipment, length of cord, and rating at branch circuit overcurrent protection.

2.02 BOILER SAFETY SHUTDOWN EQUIPMENT FOR BOILERS RATED 400,000 BTUH AND HIGHER

A. Normally closed pushbutton(s) shall be equal to Square D #SK9RD5H13 with additional KA1 contacts for additional boilers.

B. Power Relay shall be equal to Square D Class 8501 Type CO-7 in a NEMA 1 enclosure.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using liquidtight flexible conduit with watertight connectors.

C. Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment.

D. Provide receptacle outlet where connection with attachment plug is

indicated. Provide cord and cap where field-supplied attachment plug is indicated.

E. Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

F. Install disconnect switches, controllers, control stations, and control devices as indicated and as required by applicable codes.

G. Provide interconnecting conduit and wiring between devices and equipment where indicated.

H. All flexible conduit to pumps, chillers, air handling units, outdoor equipment, and water heaters shall be liquidtight.

I. Ground all metal equipment. Ensure that bonding breaks through paint to bare metallic surface of all painted metallic equipment.

J. The contractor shall check overload settings, wire sizes, fuse/circuit breaker sizes & disconnect sizes of equipment provided by others for compliance with the National Electrical Code and shall:
   1. Adjust settings where possible.
   2. Advise the Engineer of non-compliance where remedy will require more than just adjustments.

END OF SECTION

SECTION 26 0519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Building wire and cable.

B. Wiring connectors and connections.

1.02 RELATED SECTIONS

A. Section 26 0529 – Hangers and Supports for Electrical Systems.

B. Section 26 0533 – Raceway and Boxes for Electrical Systems.

C. Section 26 0553 – Identification for Electrical Systems.

1.03 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. NETA – National Electrical Testing Association.

C. UL 83 - Thermoplastic Insulated Wires and Cables.

D. UL 486 A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.

E. UL 486 C - Splicing Wire Connectors.

F. UL 1581 - Reference Standard for Electrical Wires, Cables and Flexible Cords.

1.04 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 0500.

B. Product Data: Provide for each wire and cable type.

C. Manufacturer's Installation Instructions: Indicate application conditions

and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.07 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Conductors shall be copper.

C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.

D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.08 COORDINATION

A. Determine required separation between cable and other work.

B. Determine cable routing to avoid interference with other work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS - BUILDING WIRE AND CABLE

A. Triangle.

B. American.

C. Engineer Approved.

2.02 BUILDING WIRE AND CABLE

A. Description: Single conductor insulated wire.

B. Conductor: Copper.

C. Insulation Voltage Rating: 600 volts.

D. Insulation: ANSI/NFPA 70, Type THW (feeder circuits) and THHN/THWN (branch circuits).

2.03 WIRING CONNECTORS/LUGS

A. All cable and wire terminals, lugs, taps, and splices shall be made secure with compression type connectors, approved for the service. Connections shall be installed with approved tools and dies to assure a permanent secure joint. Compression joints shall be cleaned and made smooth with insulating compound. Connectors in dry locations shall be wrapped with varnish cambric and insulated with approved electrical grade plastic tape. Where conductors are to be connected to metallic surfaces, the coated surfaces of the metal shall be polished before installing the connector. Lacquer coating of conduits shall be removed where ground clamps are to be installed. Provide all necessary hangers, racks, cleats, and supports required to make a neat installation. Wire connectors shall conform to UL 486.

B. Connectors in wet or damp locations shall be covered with heat shrinkable products equal to Scotch #ITCSN Series.

C. Contractor shall provide and install all connectors, taps, lugs, and splices as required to connect all wires and cables provided under the contract. Contractor shall torque all bolted connections to manufacturer's specifications. If manufacturer's specifications do not apply, use NETA specifications.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation verify that interior of building has been protected from weather.

B. Prior to installation verify that mechanical work likely to damage wire and cable has been completed.

3.02 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.03 WIRING METHODS

A. Interior Locations: Use only building wire, Type THW or use THHN/THWN insulation, in raceway unless otherwise indicated on the Drawings.

B. Wet or Damp Interior Locations: Use only building wire, Type THW or THHN/THWN in raceway or liquidtight flexible conduit.

C. Exterior Locations: Use only building wire, Type THW or THHN/THWN insulation in raceway.

D. Underground Installations: Use only building wire, Type THW or USE insulation in raceway.

E. Use wiring methods indicated on Drawings.

F. On the load side of GFIC circuit breaker, use only Type XHHW conductors.

3.04 INSTALLATION

A. Install products in accordance with manufacturers instructions.

B. Use solid conductors for feeders and branch circuits No 10 AWG and smaller, except branch circuits to motors shall be stranded copper for flexibility. Stranded conductors may be used if tapped to solid conductors before terminating to wiring devices.

C. Use stranded conductors for control circuits 24 volts and below. Minimum size shall be No. 16 AWG.

D. Use conductors not smaller than No. 12 AWG for power and lighting circuits and 120 volt control circuits.

E. Use No. 10 AWG conductors for 20 ampere, 120 volt branch circuits

longer than 100 feet or where the distance to the first outlet exceeds 50 feet.

F. Use No. 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet.

G. Pull all conductors into raceway at same time.

H. Use suitable wire pulling lubricant for building wire No. 4 AWG and larger.

I. Protect exposed cable from damage.

J. Support cables above accessible ceiling, using spring metal clips to support cables from structure. Do not rest cable on ceiling panels.

K. Use suitable cable fittings and connectors.

L. Neatly train and lace wiring inside boxes, equipment, and panelboards.

M. Clean conductor surfaces before installing lugs and connectors.

N. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise. Split bolt connectors are not allowed.

O. Use sleeve compression connectors for copper conductor splices and taps, No. 6 AWG and larger. Insulated uninsulated conductors and connector with heat shrink insulation rated 600 volts.

P. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, No. 8 AWG and smaller.

Q. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, No. 10 AWG and smaller.

R. Route circuits at own discretion; however, circuit numbers shall be according to Drawings.

S. Do not share neutral or ground on computer circuits. Each circuit shall be run in a separate raceway.

T. On three phase, four wire systems do not use a common neutral for

more than 3 circuits.

U. On single phase, three wire systems do not use a common neutral for more than 2 circuits.

V. Where a common neutral is run for 2 or 3 homerun circuits, connect phase conductors to breakers in panel, which are attached to separate phase legs in order that the neutral conductors will carry only the unbalanced current. Neutral conductors shall be of same size as phase conductors unless specifically noted otherwise.

W. Run conductors of same circuit in same conduit.

X. Run conductors of different voltage system in separate conduits.

Y. Color-code conductors as follows:

	208Y120 Volts	Switchlegs
Phase A	Black	Violet
Phase B	Red	Pink
Phase C	Blue	
Ground	Green	
Neutral	White	
Isolated Ground	Green with Yellow Stripe	

Z. Contractor shall not install more than three (3) current-carrying conductors in one conduit without derating the conductors per NEC Table 310-15(b)(2)(a).

AA. Where cables not in conduit pass through floors, cables shall be enclosed in conduit extending at least 6 inches above the floor.

BB. Cables shall be protected from physical damage where necessary by conduit.

CC. All cable splices shall be made in boxes.

DD. The radius of bends in cables shall not be less than five times the diameter of the cable.

EE. Cables shall be secured by staples, straps, j-hooks, or similar fittings every 4-1/2 feet and within 12 inches of every cabinet, box and fitting.

FF. Do not pull cable sheaths back more than necessary to separate

conductors.

GG. Do not score conductors when peeling back conductor insulation. Scored conductors will be replaced.

HH. Do not cut off strands from stranded conductors at terminations. Conductors with strands missing shall be replaced.

II. Kinked, torn, or twisted cable sheaths are unacceptable and shall be replaced.

JJ. Install wire and cables to avoid chemicals, cold temperature bending, and different lengths of conductors of same circuit.

KK. Make sure conduits are properly terminated, reamed and brushed before installation of wire and cables.

LL. Cable sheaths shall be held in place by strain relief fittings.

MM. Verify proper conductor location at each termination before energizing.

NN. All parallel conductors shall be of the same length, type, size and shall have the same connector pressures.

OO. Do not splice service entrance or feeder conductors.

PP. Maintain 18 inch clearance from all wires and cables to hot water pipes, steam pipes, and flues.

QQ. Route all cables parallel and perpendicular to walls. This includes cables installed above ceilings, in attics, and in crawl spaces.

3.05 INTERFACE WITH OTHER PRODUCTS

A. Identify wire and cable under provisions of 26 0553 – Identification for Electrical Systems.

B. Identify each conductor with its circuit number or other designation indicated on Drawings in each junction box, switch, switchboard, control panel, and in each panelboard.

3.06 FIELD QUALITY CONTROL

A. Perform field inspection and testing.

B. Inspect wire and cable for physical damage and proper connection.

C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values, if applicable. If not applicable, use NETA’s recommended values.

D. Verify continuity of each branch circuit conductor.

E. Check tightness of all connections.

3.07 USE OF THE FOLLOWING IS PROHIBITED

A. Aluminum conductors.

B. Wire nuts in damp or wet locations.

C. Copper-clad aluminum conductors.

END OF SECTION

SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Grounding electrodes and conductors.

B. Equipment grounding conductors.

C. Bonding.

D. Chemicals.

E. Conduit.

1.02 RELATED SECTIONS

A. Section 26 0533 – Raceway and Boxes for Electrical Systems.

B. Section 26 0519 – Low Voltage Electrical Power Conductors and Cables.

1.03 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. UL 467 - Grounding and Bonding Equipment.

1.04 GROUNDING ELECTRODE SYSTEM

A. Metal underground water pipe, if any.

B. Metal frame of the building, if any.

C. Electrode.

D. Rod electrode.

E. GEM encased in direct contact with earth.

1.05 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: No greater than 5 ohms.

1.06 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 0500.

B. Product Data: Provide data for grounding electrodes and connections.

C. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

D. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of exothermic connectors.

1.07 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1.

B. Accurately record actual locations of grounding electrodes.

1.08 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years documented experience.

1.09 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc.

PART 2 - PRODUCTS

2.01 ROD ELECTRODE

A. Material: Copper clad steel.

B. Diameter: 3/4 inch.

C. Length: 10 feet.

2.02 WIRE

A. Material: Stranded or solid copper.

B. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

C. Wire shall conform to Section 26 0519.

2.03 EXOTHERMIC CONNECTIONS

A. Cadweld.

B. Approved Equal.

2.04 CHEMICALS

A. Ground enhancement materials (50 lbs. minimum per rod).

B. Cadweld "GEM" system, or approved equal.

2.05 CONDUIT

A. Conduit shall conform to Section 26 0533.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that final backfill and compaction has been completed around area where chemical ground is to be installed.

3.02 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.

B. Auger a 3 inch diameter hole to a depth of 9-1/2 feet.

C. Install rod electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground. Drive rod 1 foot into ground. Make Cadweld connection. Pour chemicals around rod. Tamp around rod. Pour water in augered hole. Remove excess water from hole. Fill remainder of augered hole with soil. Tamp soil.

D. Provide grounding well pipe with cover at each rod location. Install well

pipe top flush with finished grade.

E. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus or bushing.

F. Size and type of green equipment ground conductors and method of securing then to obtain electrical continuity and effective grounding as per National Electrical Code, Article 250. Conduit shall not be used for grounding.

G. Neutrals shall be grounded in accordance with the National Electrical Code.

H. All metal raceway system, including cabinets, conduit and boxes, shall be grounded in accordance with the National Electrical Code.

I. An equipment ground conductor shall be installed in all conduits.

J. Install a grounding electrode and grounding electrode conductor at the service equipment, meter, current transformer cabinet, and at each dry type transformer.

K. The grounding electrode shall be connected to the metal structure of all buildings with metal structures and to a 1-1/2 inch or larger cold-water pipe, if metallic. The ground connection to the metal structure shall be exothermic.

L. Install isolated ground conductors all the way back to the service equipment ground for 240- and 208-volt services.

M. All unburied grounding conductors shall be installed in conduit.

N. Provide grounding of pad-mounted transformer as required by the Utility.

O. Connect equipment ground conductor of branch circuits serving gas appliances to metallic gas lines. Do not use metallic gas lines as a grounding electrode of the electrical system.

P. Ground all metal non-current carrying equipment. Ensure that bonding breaks through paint to bare metallic surface of all painted metallic equipment.

3.03 FIELD QUALITY CONTROL

A. Inspect equipment grounding conductors and connections for tightness and proper installation.

B. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

END OF SECTION

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SECTION 26 0529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Conduit, cable and equipment supports.

B. Anchors and fasteners.

1.02 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. NECA - National Electrical Contractors Association.

C. UL 514B - Fittings for Conduit and Outlet Boxes.

1.03 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 0500.

B. Product Data: Provide manufacturer's catalog data for fastening systems.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 PRODUCT REQUIREMENTS

A. Materials and Finishes: Provide adequate corrosion resistance.

B. Provide materials, sizes, and types of anchors, fasteners, and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

C. Perforated strap iron will not be acceptable as hanger or fastening material.

D. Plastic tie wraps will not be acceptable as support materials, except:
   1. Inside enclosures to neatly train cables and wires.

E. Channels shall be galvanized and not painted.

F. All hardware shall be galvanized.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".

C. Do not fasten supports to pipes, ducts, mechanical equipment, and other conduit.

D. Obtain permission from the Engineer before using powder-actuated anchors.

E. Obtain permission from the Engineer before drilling or cutting structural members.

F. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

G. Install surface-mounted cabinets with minimum of four anchors. Provide blocks between studs to support anchors.

H. In wet and damp locations use steel channel supports to stand cabinets one inch off wall.

I. All conduits, both horizontal and vertical, shall be accurately supported. Each hanger shall be properly sized to fit supported conduit.

J. Where lines are supported under concrete construction, hanger rods shall be secured with concrete inserts.

K. All hangers shall be so located as to properly grade and support horizontal conduits without appreciable sagging of these lines.

L. Where multiple conduits are run horizontally at the same elevation and grade, they may be supported on trapezes of channels suspended on rods. Trapeze numbers, including suspension rods, shall be properly sized for number, size, and loaded weight of conduits to be supported.

M. Conduit supports shall be installed within 3 feet of each coupling, connector, and box.

N. Electrical contractor shall install his own supports for his equipment.

O. All 2 inch and larger conduits shall have a swivel hanger support equal to B-Line #B446 or #B446C.

END OF SECTION

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SECTION 26 0533

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Rigid steel conduit.

B. Flexible metal conduit.

C. Liquidtight flexible metal conduit.

D. Electrical metallic tubing.

E. Surface mounted raceway.

F. PVC conduit.

G. Fittings and conduit bodies.

H. Wall and ceiling outlet boxes.

I. Floor boxes.

J. Pull and junction boxes.

1.02 RELATED SECTIONS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 – Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems.

D. Section 26 2726 - Wiring Devices.

E. Section 26 0502 - Equipment Wiring Systems.

1.03 REFERENCES

A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.

B. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

C. ANSI/NFPA 70 - National Electrical Code.

D. NECA "Standard of Installation".

E. NEMA TC 3 - PVC Fittings to Use with Rigid PVC Conduit and Tubing.

F. UL 1 - Flexible Metal Conduit.

G. UL 5 - Surface Metal Raceways and Fittings

H. UL 6 - Rigid Metal Conduit.

I. UL 360 - Liquid-tight Flexible Steel Conduit.

J. UL 652 - Schedule 40 and 80 Rigid PVC Conduit.

K. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

L. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

M. UL 38 - Boxes for Use with Fire-Protection Signaling Systems, Manually Actuated Signaling.

N. UL 50 - Cabinets and Boxes.

O. UL 514A - Metallic Outlet Boxes.

P. UL 514B - Fittings for Conduit and Outlet Boxes.

Q. UL 996 - Electrical Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.

R. UL 1241 - Junctions Boxes for Swimming Pool Lighting Fixtures.

S. UL 1773 - Termination Boxes.

T. UL 65 - Wired Cabinets.

1.04 DESIGN REQUIREMENTS

A. Conduit Size: ANSI/NFPA 70.

1.05 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 0500.

B. Product Data: Provide for metallic conduit, flexible metal conduit, liquidtight flexible metal conduit, metallic tubing, non-metallic conduit, fittings, and conduit bodies.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.06 PROJECT RECORD DOCUMENTS

A. Accurately record actual routing of conduits larger than 2 inches.

B. Submit under provisions of Division 1.

C. Accurately record actual locations and mounting heights of outlet, pull, and junction boxes.

1.07 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site.

B. Inspect all conduit for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

1.09 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of conduit and openings prior to rough-in.

C. Route conduit as shown on Drawings in approximate locations unless specifically dimensioned. Route as required to complete wiring system.

D. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose. The exact location of all electrical boxes shall be as approved by Engineer who reserves the right to change any outlet for a distance of 6 feet in any direction from position shown on plans, before work is roughed-in, without extra charge.

PART 2 - PRODUCTS

2.01 CONDUIT REQUIREMENTS

A. Minimum Size: 3/4 inch unless otherwise specified.

B. Underground Installations:
   1. Conduit installed below grade shall be Schedule 80 PVC. All elbows and riser up thru floor slabs shall be galvanized rigid steel conduit (RSC).
   2. All conduit not installed under the floor slab shall be 24 inches below grade unless otherwise noted.

C. Outdoor Locations, Above Grade, and On Roofs: Use galvanized rigid steel conduit. On roofs install 4 inch by 4 inch square treated wooden blocks on roof to support rigid steel conduit within 3'-0" of each coupling and box and to support liquidtight flexible conduit every 3'-0".

D. Dry Locations:
   1. Concealed: Use electric metallic tubing.
   2. Exposed:
      a. Use galvanized rigid steel conduit in unfinished areas only (Electric Room, Mechanical Room) unless noted otherwise.
      b. Use surface metal raceway where specifically indicated in finished areas of existing buildings where it is impossible to fish flexible metallic conduit down inside of existing walls.

E. Mechanical and Electrical Rooms:
   1. Use 6'-0" maximum length liquidtight flexible conduit for final connections to mechanical equipment and dry type transformers. Support all flexible conduit every 3'-0".
   2. Use galvanized rigid steel conduit where exposed.

F. In Slabs Above Grade: Use galvanized steel only. Conduits shall not cross each other. Refer to Drawings for specific notes for conduit in slab locations.

G. Electrical metallic tubing (EMT) is to be used for all HVAC equipment control wiring. The conduit system for HVAC temperature controls is to be furnished and installed by Division 15 in accordance with the requirements specified herein. Line voltage control work not specifically shown on the electrical drawings shall be furnished and installed by Division 15 with all line voltage work and all conduit work performed by licensed electricians.

H. Use surface metal raceway only in existing facilities where conduit cannot be fished down walls or across finished ceilings. Surface metal raceway shall not be used in new buildings, unless noted on the Drawings.

2.02 RIGID STEEL CONDUIT

A. Manufacturers:
   1. Allied.
   2. Triangle.
   3. Engineer Approved.

B. Rigid Steel Conduit: ANSI 80.1

C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit.

2.03 FLEXIBLE METAL CONDUIT

A. Manufacturers:
   1. Allied.
   2. Triangle.
   3. Engineer Approved.

B. Description: Interlocked steel construction.

C. Fittings: ANSI/NEMA FB 1.

D. Maximum Length: 6'-0".

2.04 LIQUIDTIGHT METAL CONDUIT

A. Manufacturers:
1. Allied.
2. Triangle.
3. Engineer Approved.

B. Description: Interlocked steel construction with PVC jacket.

C. Fittings: ANSI/NEMA FB 1.

D. Maximum Length: 6'-0".

2.05 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
1. Allied.
2. Triangle.
3. Engineer Approved.

B. Description: ANSI C80.3; galvanized tubing.

C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; die-cast compression type.

2.06 SURFACE METAL RACEWAY

A. Manufacturers:
1. Wiremold.
2. Engineer Approved.

B. Description: Surface metal raceway with hidden supports.

C. Fittings, Boxes, and Conduit Bodies: As manufactured by surface metal raceway manufacturer.

2.07 NONMETALLIC CONDUIT

A. Manufacturers:

1. Carlon.
2. Engineer Approved.

B. Description: NEMA TC 3; Schedule 80 PVC.

C. Fittings and Conduit Bodies: NEMA TC 3.

2.08 OUTLET BOXES

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized steel.
1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported, include 1/2 inch male fixture studs where required.
2. Concrete Ceiling Boxes: Concrete type.
3. Receptacle, single switch, and 2 gang switch boxes for wood studs shall be Raco #194 or #235 with plaster ring of proper depth.
4. Receptacle, single switch, and 2 gang switch boxes for metal studs shall be Raco #196 or #235 with plaster ring for proper depth.
5. Gang switches of 3 or more devices for wood or metal studs and exposed work shall be Raco #950 Series, appropriate gang box and raised cover.
6. Lighting fixture outlet boxes for wood or metal studs, masonry walls, and furred ceilings shall be Raco #166, #167, or Raco #194 or #235 with plaster ring.
7. Junction boxes for wood or metal studs, masonry walls, furred ceilings and interior exposed work shall be Raco #231, #232, #233, or #235.
8. Receptacle boxes for masonry walls shall be Raco #695 or #191 with #785 device cover.
9. Switches in 6 inch and wider masonry walls shall be 3-1/2-inch-deep masonry boxes of gang required. Masonry boxes in 4-inch walls shall be 2-1/2 inches deep.
10. Television outlet boxes shall be Raco #246, 4-1/16 inch box with #836 device cover ring. Telephone outlet boxes shall be Raco #256.
11. Outlet boxes for interior exposed work in unfinished areas shall be Raco #191, #192, #231, or #232 boxes with 1/2 inch raised, 4 inch square cover of appropriate configuration.
12. Boxes, for interior exposed work on existing walls and ceilings in finished areas in existing buildings, where it is impossible to fish conduit down walls or above ceilings, shall be boxes as

manufactured by the surface metal raceway manufacturer for the intended purpose.

B. Cast Boxes: NEMA FB 1, Type FD, aluminum. Provide gasketed cover by box manufacturer.

C. Boxes shall be oversized when required by Table 370-16(a) of the National Electrical Code.

D. Specialty A/V floor boxes shall be as scheduled on the drawing, "FSR" or equal

2.09 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. Surface-Mounted Cast Metal Box: NEMA 250, Type as required; flat-flanged, surface-mounted junction box.
1. Material: Galvanized steel.

C. Cover: Furnish with ground flange, neoprene gasket, and stainless-steel cover screws.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install conduit in accordance with NECA "Standard of Installation".

B. Install surface metal raceway in accordance with manufacturer's directions.

C. Arrange supports to prevent misalignment during wiring installation.

D. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers. Supports shall be installed within 3 feet of every outlet box, junction box, panel, or other conduit terminations. Fastening of unbroken lengths shall be permitted to be increased to a distance of 5 feet where structural members do not readily permit fastening within 3 feet. Do not space supports further than 10 feet apart.

E. Group related conduits; support using conduit rack. Construct rack using steel channel.

F. Fasten conduit supports to building structure and surfaces under provisions of Section 26 0529.

G. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

H. Do not attach conduit to ceiling support wires.

I. Arrange conduit to maintain headroom and present neat appearance.

J. Route all conduit parallel and perpendicular to walls. This includes conduit installed above ceilings, in attics, on roofs, and in crawl spaces.

K. Install insulated bushings or approved equivalent on each end of all conduit.

L. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.

M. Cut conduit square using saw or pipe cutter; de-burr cut ends.

N. Bring conduit to shoulder of fittings; fasten securely.

O. Install no more than equivalent of four 90-degree bends between boxes. Use factory elbows for all 90 degree bends in conduits 1" and larger.

P. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

Q. Provide suitable fittings to accommodate expansion and deflection where conduit crosses expansion joints.

R. Use suitable caps to protect installed conduit against entrance of dirt and moisture during construction.

S. Ground and bond conduit under provisions of Section 26 0526.

T. Identify conduit under provisions of Section 26 0553.

U. Provide suitable pull boxes in all conduit runs as required by the National Electrical Code and as required to facilitate wire installation.

V. Holes for passage of conduits through all one-hour and two-hour

drywall partitions shall be neatly cut to the required size. If holes are cut larger than necessary, they shall be covered with two (2) additional pieces of 5/8 inch type X gypsum wallboard, each 8 inches by 16 inches with a half circular cutout of the proper size, one (1) layer on one-hour partitions, and two (2) layers on two-hour partitions.

W. Holes for passage of conduits through one-hour, two-hour, and four-hour masonry walls shall be fireproofed. Fireproofing materials shall be as follows:
   1. Cellular Glass Insulation: Pittsburgh Corning Corp. Foamglas "Regular" or UL rated or UNI-JAC UL rated pipe insulation, or approved equal.
   2. Fire Retardant Putty: IPC Flamesafe Type FAS500 or FST600 Series, or improved equal, for one-hour and two-hour walls.
   3. IPC/KB5 Mortar Seal, or approved equal (full depth of wall) for four-hour walls.

X. Holes for passage of conduits through masonry floors shall be fireproofed. Fireproofing material shall be Firestop Compound - IPC Flamesafe Type 500/FST 600, or approved equal, filled to full depth of slab. Minimum annular space around conduit shall be 3/16 inch.

Y. Refer to Architectural drawings for locations of fire-rated walls, ceilings, and floors.

Z. Support 2-1/2 inch and larger conduit in accordance with Section 16880.

AA. All flexible conduit in Mechanical Rooms and outside shall be liquidtight flexible conduit.

BB. All conduits that enter a building's basement wall below grade shall have a fitting equal to OZ Type CSBI installed inside the conduit and shall be watertight sealed between outer conduit wall and basement opening.

CC. Conduits, which enter refrigerated areas, such as walk-in coolers and wall-in freezers, shall have a seal-off installed on the non-refrigerated side of the conduit where the conduit exits or enters the refrigerated area.

DD. Make sure conduits are properly terminated, reamed, and brushed before installation of wire or cable.

EE. Install bushings on all conduits.

FF. Structural Engineer shall approve placement of conduits in all concrete slabs, beams, and columns. See Structural Drawings for structural engineer's name and address.

GG. Conduits which pass from an air-conditioned space to a non-air conditioned space shall have sealoffs installed on non-air conditioned side near wall.

HH. Ground metallic conduits.

II. Install gasketed conduit hubs on all conduits exiting the top or sides of NEMA 3R enclosures.

JJ. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements.

KK. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

LL. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

MM. Install boxes to preserve fire resistance rating of partitions and other elements.

NN. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.

OO. Use flush mounting outlet boxes in finished areas, unless noted otherwise on the Drawings.

PP. Do not install flush mounting boxes back-to-back in walls; provide minimum 6 inch separation. Provide minimum 24 inch separation in acoustic rated walls. See Architectural floor plans for acoustic rated wall locations.

QQ. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

RR. Use stamped steel bridges to fasten flush mounting outlet box between studs.

SS. Install flush mounting box without damaging wall insulation or reducing the effectiveness.

TT. Use adjustable steel channel fasteners for hung ceiling outlet box.

UU. Do not fasten boxes to ceiling support wires.

VV. Support boxes independently of conduit.

WW. Use gang box where more than one device is mounted together. Do not use sectional box.

XX. In other than masonry, use 4-inch square by 1-1/2 inch minimum box with plaster ring for single devices.

YY. Use cast outlet box in exterior locations exposed to the weather and wet locations.

ZZ. Use cast floor boxes for installations in slab on grade. See plans for specialty A/V floor boxes equal to FSR. Coordinate cover trim with floor covering thickness and type.

AAA. Set floor boxes level.

BBB. Large Pull Boxes: Boxes larger than 100 cubic inches in volume or 12 inches in any dimension.
1. Interior Dry Locations: Use hinged enclosure.
2. Other Locations: Use surface-mounted cast metal box.

CCC. Locate boxes so outlets are not obstructed by pipes, ducts, or other items.

DDD. Boxes for light switches shall generally be located within 6 inches of door jamb.

EEE. Pullboxes shall be provided at points shown on plans or required to overcome mechanical difficulties due to arrangement of runs or the fixed characteristics of the building construction. No runs of over 100 feet shall be made without use of pullbox.

FFF. All boxes shall have covers. All boxes installed above a ceiling and installed in unfinished spaces (Mechanical and Electrical Rooms, etc.) shall have the covers clearly and legibly marked with the circuits contained within them.

GGG. All flush-mounted boxes shall come within 1/4 inch of finished non-combustible surfaces and shall be flush with finished combustible surfaces. Install box extensions, if after rough-in and wall construction, the boxes do not come out far enough.

HHH. Fireproof all poke-through devices in accordance with manufacturer's directions.

III. Ground all boxes. Ensure that bonding breaks through paint to bare metallic surface.

JJJ. Grind ears off of 2-gang boxes with isolated ground receptacles in each box. Grinding shall be done in a machine shop.

3.02 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance of partitions and other elements.

B. Pullboxes shall be provided at points shown on the plans or required to overcome mechanical difficulties due to arrangement of runs or the fixed characteristics of the building construction.

C. All threaded conduit shall be secured to boxes, cabinets, panels, switches, etc. by means of a threaded bushing on the inside and locknutted on the box exterior and interior.

D. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

E. Coordinate mounting heights and locations of outlets mounted above counters, branches, and backsplashes with Architect prior to rough-in.

F. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

3.03 THE FOLLOWING ARE PROHIBITED

A. EMT crimp-on, tap-on, indenter type fittings.

B. EMT set- screw fittings. Set-screw fittings on ends of flexible conduit are allowed.

C. PVC inside buildings, or above grade.

D. All thread nipples in other than dry locations.

E. Wooden plugs inserted in concrete or masonry units as bases for fastening conduits, tubing, boxes, cabinets, or other equipment.

F. Installation of conduit or tubing which has been crushed or deformed.

G. Where conductors #8AWG or larger are inside, the following fittings shall not be used:
   1. 90° threaded hubs.
   2. Pulling elbows.
   3. Bushed elbows.
   4. Short box connectors.
   5. 90° connectors.
   6. Entrance elbows.
   7. Types LB, LL, LR, T, L, TA, TB, X, LBD, or LBDN conduit bodies.
   8. Short elbows.

H. Type ENT tubing.

I. Armored cable.

J. Metal-clad cable.

K. EMT on roof, exposed, outside, in concrete, or underground.

L. Flexible or liquidtight flexible conduits concealed in walls or floors.

M. PVC elbows.

N. Storage of PVC in sunlight.

O. The use of heat to bend PVC conduit.

P. Surface non-metal raceway.

Q. Surface metal raceway in new buildings.

R. Surface metal raceway in damp or wet locations.

S. Flexible or liquidtight flexible conduits in lengths exceeding 6'-0".

T. The use of external coverclips on surface metal raceway.

U. All steel EMT fittings.

V. Flexible conduit connectors on which the flexible conduit is threaded.

W. Plastic boxes.

X. Fiberglass boxes.

END OF SECTION

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SECTION 26 0553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Nameplates and labels.

B. Wire and cable markers.

C. Trench tape.

1.02 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

1.03 RELATED SECTIONS

A. Section 09 900 - Painting: Boxes.

1.04 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 0500.

B. Product Data: Provide catalog data for nameplates, labels, and markers.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 NAMEPLATES AND LABELS

A. Nameplates: Engraved three-layer laminated plastic, white letters on black background.

B. Locations:
   1. Each electrical distribution equipment (switchboards, panelboards, enclosed circuit breakers, motor control centers, transformers) and control equipment enclosure (starters, disconnect switches, etc.).

C. Letter Size:
   1. Use 1/2 inch letters for identifying equipment designation and voltage.

D. Provide typewritten directory in each panelboard of circuit designations in clear/transparent protective envelope attached to inside of panelboard door.

E. Provide typewritten zone directory in each conventional fire alarm control panel in clear/transparent, protective envelope attached to inside of central panel door.

F. Provide nameplate on inside of each panelboard and main indicating color code scheme for the voltage of that panelboard and main, nameplates to be red with white characters.

2.02 WIRE MARKERS

A. Description: Tape or tubing type wire markers.

B. Locations: Each conductor at panelboard gutters switchboard gutters, motor control center gutters, pull boxes, outlet and junction boxes, disconnect switches, motor starters, and at each load connection.

C. Legend:
   1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.

2.03 TRENCH TAPE

A. Tape shall be detectable aluminum foil polyethylene laminate.

B. Tape shall be the following color and have the following wording:

Application	Color	Caution Wording
Cable TV	Orange	“Caution – Cable TV Line Buried Below”
Electrical	Red	“Caution – Electric Line Buried Below”
Telephone	Orange	“Caution – Telephone Line Buried Below:
Fiber Optic	Orange	“Caution – Buried Fiber Optic Cable”

C. Tape shall be equal to Panduit Type HTDU with width to match trench width.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.02 APPLICATION

A. Install nameplate and label parallel to equipment lines.

B. Secure nameplate to equipment front using No. 4 round heat cadmium plated, steel self-tapping screws or nickel-plated brass plates.

C. Identify underground conduits using underground warning tape. Install one tape per trench at 6 inches below finished grade.

D. All fire alarm junction boxes and pullboxes shall be painted red where concealed or exposed in mechanical or electrical rooms.

E. Both ends of pullwires shall be identified by means of labels or tags, reading "PULLWIRE" and shall be numbered to refer to same pullwire.

F. Install nameplates at each circuit breaker on all switchboards and large panelboards.

G. Install wire markers on wires in each junction box, panelboard, switchboard, control panel, etc.

H. Install typewritten ”COMPUTER” with black letters and clear background on each coverplate of receptacles adjacent to information outlets

I. Install nameplates at each device within motor control centers.

J. Install directory of addresses and corresponding devices and locations in each addressable fire alarm and security control panels.

K. All security junction boxes and pullboxes shall be painted yellow where concealed or exposed in mechanical or electrical rooms.

L. Install labels on all telephone and computer cables.

M. All telephone junction boxes and pullboxes shall be painted white where concealed or exposed in mechanical or electrical rooms.

N. Paint all data junction boxes and pullboxes blue where concealed or exposed in mechanical or electrical rooms.

O. Paint all public address junction boxes and pullboxes dark gray where concealed or exposed in mechanical or electrical rooms.

P. Paint all television cable junction boxes or pullboxes black where concealed or exposed in mechanical or electrical rooms.

END OF SECTION

SECTION 26 0573

ARC FLASH HAZARD ANALYSIS/SHORT/CIRCUIT/COORDINATION STUDY

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The contractor shall furnish short-circuit and protective device coordination studies as prepared by Square D Engineering Services, Cutler Hammer Engineering Services or Siemens Engineering Services.

B. The contractor shall furnish an Arc Flash Hazard Analysis Study per the requirements set forth in the current version of NFPA 70E - *Standard for Electrical Safety in the Workplace*. The arc flash hazard analysis shall be performed according to the IEEE Standard 1584 – 2002, the IEEE *Guide for Performing Arc-Flash Calculations.*

1.02 REFERENCES

A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
   2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
   3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis
   4. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings
   5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
   6. IEEE 1584 -Guide for Performing Arc-Flash Hazard Calculations

B. American National Standards Institute (ANSI):
   1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
   2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
   3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
   4. ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

C. The National Fire Protection Association (NFPA)
   1. NFPA 70 -National Electrical Code, latest edition
   2. NFPA 70E – Standard for Electrical Safety in the Workplace

1.03 SUBMITTALS

A. The studies shall be submitted to the design engineer prior to

receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the study may cause delays in equipment shipments, approval from the Engineer may be obtained for a preliminary submittal of data to ensure that the selection of device ratings and characteristics will be satisfactory to properly select the distribution equipment. The formal study will be provided to verify preliminary findings.

1.04 SUBMITTALS FOR CONSTRUCTION

A. The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. A minimum of five (5) bound copies of the complete final report shall be submitted. For large system studies, submittals requiring more than five (5) copies of the report will be provided without the section containing the computer printout of the short-circuit input and output data. Electronic PDF copies of the report shall be provided upon request.

B. The report shall include the following sections:
   1. Executive Summary including Introduction, Scope of Work and Results/Recommendations.
   2. Short-Circuit Methodology Analysis Results and Recommendations
   3. Short-Circuit Device Evaluation Table
   4. Protective Device Coordination Methodology Analysis Results and Recommendations
   5. Protective Device Settings Table
   6. Time-Current Coordination Graphs and Recommendations
   7. Arc Flash Hazard Methodology Analysis Results and Recommendations including the details of the incident energy and flash protection boundary calculations, along with Arc Flash boundary distances, working distances, Incident Energy levels and Personal Protection Equipment levels.
   8. Arc Flash Labeling section showing types of labels to be provided. Section will contain descriptive information as well as typical label images.
   9. One-line system diagram that shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location, device numbers used in the time-current coordination analysis, and other information pertinent to the computer analysis.

1.05 QUALIFICATIONS

A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the responsible charge and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.

B. The Registered Professional Electrical Engineer shall be an employee of the equipment manufacturer or an approved engineering firm.

C. The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies.

D. The approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual arc flash hazard analyses it has performed in the past year.

E. The engineering firm shall have a minimum of ten (10) years experience in performing power system studies.

1.07 COMPUTER ANALYSIS SOFTWARE

A. The studies shall be performed using SKM Systems Analysis Power*Tools for Windows (PTW) software program or an engineer approved equivalent.

PART 2 - PRODUCTS

2.01 STUDIES

A. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E -Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D. This study shall also include short-circuit and protective device coordination studies. All studies to be prepared by Square D Engineering Services.

2.02 DATA

A. Contractor shall furnish all data as required for the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

B. Source combination may include present and future motors and generators.

C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner, or Contractor.

D. If applicable, include fault contribution of existing motors in the study. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

2.03 SHORT-CIRCUIT ANALYSIS

A. Transformer design impedances shall be used when test impedances are not available.

B. Provide the following:
   1. Calculation methods and assumptions
   2. Selected base per unit quantities

3. One-line diagram of the system being evaluated that clearly identifies individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location and other information pertinent to the computer analysis
4. The study shall include input circuit data including electric utility system characteristics, source impedance data, conductor lengths, number of conductors per phase, conductor impedance values, insulation types, transformer impedances and X/R ratios, motor contributions, and other circuit information as related to the short-circuit calculations.
5. Tabulations of calculated quantities including short-circuit currents, X/R ratios, equipment short-circuit interrupting or withstand current ratings and notes regarding adequacy or inadequacy of the equipment rating.
6. Results, conclusions, and recommendations. A comprehensive discussion section evaluating the adequacy or inadequacy of the equipment must be provided and include recommendations as appropriate for improvements to the system.

C. For solidly-grounded systems, provide a bolted line-to-ground fault current study for applicable buses as determined by the engineer performing the study.

D. Protective Device Evaluation:
1. Evaluate equipment and protective devices and compare to short circuit ratings
2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses
3. Square D shall notify Owner in writing, of any circuit protective devices improperly rated for the calculated available fault current.

2.04 PROTECTIVE DEVICE TIME-CURRENT COORDINATION ANALYSIS

A. Protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.

B. Include on each TCC graph, a complete title with descriptive device names.

C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.

D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

E. Plot the following characteristics on the TCC graphs, where applicable:
1. Electric utility's overcurrent protective device
2. Medium voltage equipment overcurrent relays
3. Medium and low voltage fuses including manufacturer's

minimum melt, total clearing, tolerance, and damage bands
4. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
5. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves
6. Medium voltage conductor damage curves
7. Ground fault protective devices, as applicable
8. Pertinent motor starting characteristics and motor damage points, where applicable
9. Pertinent generator short-circuit decrement curve and generator damage point
10. The largest feeder circuit breaker in each motor control center and applicable panelboard.

F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

G. Provide the following:
1. A One-line diagram shall be provided which clearly identifies individual equipment buses, bus numbers, device identification numbers and the maximum available short-circuit current at each bus when known.
2. A sufficient number of log-log plots shall be provided to indicate the degree of system protection and coordination by displaying the time-current characteristics of series connected overcurrent devices and other pertinent system parameters.
3. Computer printouts shall accompany the log-log plots and will contain descriptions for each of the devices shown, settings of the adjustable devices, and device identification numbers to aid in locating the devices on the log-log plots and the system one-line diagram.
4. The study shall include a separate, tabular printout containing the recommended settings of all adjustable overcurrent protective devices, the equipment designation where the device is located, and the device number corresponding to the device on the system one-line diagram
5. A discussion section which evaluates the degree of system protection and service continuity with overcurrent devices, along with recommendations as required for addressing system protection or device coordination deficiencies.

2.05 ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D. The arc flash hazard analysis shall be performed in conjunction with the short-circuit analysis (Section 2.03) and the protective device time-current coordination analysis (Section 2.04)

B. The flash protection boundary and the incident energy shall be calculated at significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.

C. Circuits 240V or less where available bolted short circuit current is less than 10 kA may be omitted from the computer model and will be assumed to have a hazard risk category 0 per NFPA 70E Table 130.7(C)(9)(a), including footnote 3.

D. Circuits 240V or less fed by transformers 112.5 kVA or less may be omitted from the computer model and will be assumed to have a hazard risk category 0 per IEEE 1584.

E. Working distances shall be based on IEEE 1584. The calculated arc flash protection boundary shall be determined using those working distances.

F. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations

G. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location in a single table. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum. Conversely, the maximum calculation will assume a maximum contribution from the utility. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable as well as any stand-by generator applications.

   The Arc-Flash Hazard Analysis shall be performed utilizing mutually agreed upon facility operational conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.

H. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors should be decremented as follows:
   1. Fault contribution from induction motors should not be considered beyond 5 cycles.

I. For each piece of ANSI rated equipment with an enclosed main device, two calculations shall be made. A calculation shall be made for the main cubicle, sides, or rear; and shall be based on a device located upstream of the equipment to clear the arcing fault. A second calculation shall be made for the front cubicles and shall be based on the equipment's main device to clear the arcing fault. For all other non-ANSI rated equipment, only one calculation shall be required and it shall be based on a device located upstream of the equipment to clear the arcing fault.

J. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

K. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

L. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. A maximum clearing time of 2 seconds will be used based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

M. Provide the following:
1. Results of the Arc-Flash Hazard Analysis shall be submitted in tabular form, and shall include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, working distances, personal-protective equipment classes and AFIE (Arc Flash Incident Energy) levels.
2. The Arc-Flash Hazard Analysis shall report incident energy values based on recommended device settings for equipment within the scope of the study.
3. The Arc-Flash Hazard Analysis may include recommendations to reduce AFIE levels and enhance worker safety.

PART 3 - EXECUTION

3.01 FIELD ADJUSTMENT

A. Contractor shall adjust relay and protective device settings according to the recommended settings table provided by the coordination study.

Field adjustments to be completed by switchgear manufacturer services under the separate Startup and Acceptance Testing contract portion of project specifications.

B. Contractor shall make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

3.02 ARC FLASH LABELS Square D Engineering Services shall provide a 4.0 in. x 4.0 in. Brady thermal transfer type label of high adhesion polyester for each work location analyzed.

A. The labels shall be designed according to the following standards:
1. UL969 – Standard for Marking and Labeling Systems
2. ANSI Z535.4 – Product Safety Signs and Labels
3. NFPA 70 (National Electric Code) – Article 110.16

B. The label shall include the following information:
1. System Voltage
2. Flash Protection Boundary

3. Personal Protective Equipment Category
4. Arc Flash Incident Energy Value (cal/cm^2)
5. Limited, Restricted, and Prohibited - Approach Boundaries
6. Study report number and issue date

C. Labels shall be printed by a thermal transfer type printer, with no field markings.

D. Arc flash labels shall be provided for equipment as identified in the study and the respective equipment access areas per the following:
1. Floor Standing Equipment - Labels shall be provided on the front of each individual section. Equipment requiring rear and/or side access shall have labels provided on each individual section access area. Equipment line-ups containing sections with multiple incident energy and flash protection boundaries shall be labeled as identified in the Arc Flash Analysis table.
2. Wall Mounted Equipment – Labels shall be provided on the front cover or a nearby adjacent surface, depending upon equipment configuration.
3. General Use Safety labels shall be installed on equipment in coordination with the Arc Flash labels. The General Use Safety labels shall warn of general electrical hazards associated with shock, arc flash, and explosions, and instruct workers to turn off power prior to work.

Label Installation

E. Labels shall be field installed by Square D Services. The technician providing the installation shall have completed an 8-Hour instructor led Electrical Safety Training Course with includes NFPA 70E material including the selection of personal protective equipment.

3.03 ARC FLASH TRAINING

A. The vendor supplying the Arc Flash Hazard Analysis shall train the owner's qualified electrical personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours). The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET) or equivalent. The trainer shall be an authorized OSHA Outreach instructor.

B. The vendor supplying the Arc Flash Hazard Analysis shall offer instructor led and online NFPA 70E training classes.

END OF SECTION

SECTION 26 2213

LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.02 DESCRIPTION OF WORK

A. Extent of transformer work is indicated by drawings and schedules.

B. Types of transformers in this section include the following:

1. Dry-type transformers.

C. Electrical wiring connections for transformers are specified in applicable Division-26 sections.

1.03 RELATED SECTIONS

A. Section 03 300 - Cast-In-Place Concrete.

B. Section 09 900 - Painting: Touchup.

C. Section 26 0553 - Identification for Electrical Systems: Engraved nameplates.

D. Section 26 0548 – Vibration and Seismic Controls for Electrical Equipment.

1.04 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of power/distribution transformers of types and ratings required, whose products have been in satisfactory use in similar service for not less than 2 years.

B. Installer: Qualified with at least 5 years of successful installation experience on products with electric power/distribution transformer work similar to that required for this project.

C. NEC Compliance: Comply with NEC as applicable to installation and construction of electrical power/distribution transformers.

D. NEMA Compliance: Comply with applicable portions of NEMA Std Pub Nos. TP 1, TP2 and ST 20 pertaining to power/distribution transformers.

E. ANSI/IEEE Compliance: Comply with applicable ANSI/IEEE standards pertaining to power/distribution transformers.

F. ANSI/NEMA Compliance: Comply with NEMA Std. ST 20; "Dry-Type Transformers for General Applications".

G. UL Compliance: Comply with applicable portions of UL 1561.

1.05 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 0500.

B. Product Data: Submit manufacturer's data on power/distribution transformers, including certification of transformer performance efficiency at indicated loads, percentage regulation at 100% and 80% power factor, no-load and full-load losses in watts, 5 % impedance at 75 degrees C, hot-spot and average temperature rise above 40 degrees C ambient, sound level in decibels, and standard published data.

C. Shop Drawings: Submit dimensioned drawings of transformer installations, showing layout, mountings and supports, spatial relationship to associated equipment and panelboards, and transformer connections to electrical equipment.

D. Maintenance Data: Submit maintenance instructions and spare parts lists. Include this data in maintenance manuals.

1.06 REGULATORY REQUIREMENTS

A. Conform to the requirements of NFPA 70 - National Electrical Code.

B. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Power/Distribution Transformers:

1. Manufacturer: Subject to compliance with requirements, provide products of one of the following (for each type of transformer):
   a. Sorgel Electric Div./Square D Co.
   b. General Electric.
   c. Siemens ITE.
   d. Cutler Hammer.

2.02 POWER/DISTRIBUTION TRANSFORMERS

A. General: Except as otherwise indicated, provide manufacturer's standard materials and components as indicated by published Product information, designed and constructed as recommended by manufacturer, and as required for complete installation.

B. Dry-Type Distribution Transformers: Provide factory-assembled, general-purpose, air-cooled, dry-type distribution transformers where shown; of sizes, characteristics, and rated capacities indicated; 30 KV BIL, 4.0% impedance, 150 degrees C rise. Provide primary winding with 2 taps; both 5% increments below full-rated voltage for de-energized tap-changing operation. Insulate with Class 220 insulation and rate for continuous operation at rated KVA. Limit transformer surface temperature rise to maximum of 50 degrees C. Provide terminal enclosure, with cover, to accommodate primary and secondary coil wiring connections and electrical supply raceway terminal connector. Equip terminal leads with connectors installed. Provide wiring connectors suitable for copper wiring. Cushion-mount transformers with external vibration isolation supports; sound-level ratings not to exceed, 64 dB as determined in accordance with ANSI/NEMA standards. Electrically ground core and coils to transformer enclosure by means of flexible metal grounding strap. Provide transformers with fully-enclosed sheet steel enclosures. Apply manufacturer's standard light gray indoor enamel over cleaned and phosphatized steel enclosure. Provide transformers suitable for floor mounting with vibration isolators. Transformers shall be low loss type with minimum efficiencies per NEMA TP-1 when operated at 35 percent of full load capacity. Efficiency shall be tested in accordance with NEMA TP-2.

C. All transformers shall be provided with removable covers that may be removed by qualified personnel without removing transformer from service.

PART 3 - EXECUTION

3.01 INSTALLATION OF TRANSFORMERS

A. Install transformers as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA and IEEE standards, and in accordance with recognized industry practices and ensure that products fulfill requirements.

B. Coordinate transformer installation work with electrical raceway and wire/cable work, as necessary for proper interface.

C. Install units on vibration mounts and a 4 inch housekeeping pad as indicated. Comply with Manufacturer's indicated installation method.

D. Connect transformer units to electrical wiring system; comply with requirements of other Division-26 sections. Wiring connections to be in strict conformity with N.E.C.

E. Install housekeeping pad for transformer.

F. Bolt transformer to pad in accordance with Section 26 0548.

G. Make final connections to dry type transformers using 3'-0" length of liquidtight flexible conduit

H. Do not install conduits out the top of the transformer.

I. Ground transformer enclosure to the equipment-grounding conductor in transformer high voltage feeder.

J. Ground transformer's secondary neutral.

K. Level transformer.

L Install nameplate with transformer designation.

M. Touchup scratched or marred surfaces to match original finish.

N. Neatly form wires inside transformer enclosure.

3.02 GROUNDING

A. Provide tightly fastened equipment grounding and bonding connections for transformers as indicated.

B. Bond neutral and ground at transformer.

C. Install grounding electrode conductor to building structural steel (where building structure is steel), to 1-1/2 inch or larger metallic cold water pipe (where one exists) and to chemical ground.

D. Ground shield of harmonic cancellation transformers.

3.03 FILED QUALITY CONTROL

A. Upon completion of installation of transformers, energize primary circuit at rated voltage and frequency from normal power source and test transformers, including, but not limited to, audible sound levels, to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

B. Check tightness of conductor lugs using calibrated torque wrench.

END OF SECTION

SECTION 26 2416

PANELBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Branch circuit panelboards.

B. Distribution panelboards.

1.02 RELATED SECTIONS

A. Section 09 900 - Painting: Touchup.

B. Section 26 0529 – Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Engraved nameplates.

D. Section 26 0548 – Vibration and Seismic Controls for Electrical Systems.

1.03 REFERENCES

A. NECA (National Electrical Contractors Association) "Standard of Installation."

B. NEMA AB 1 - Molded Case Circuit Breakers.

C. NEMA PB 1 - Panelboards.

D. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or less.

E. NFPA 70 - National Electrical Code.

F. UL 67 - Panelboards.

1.04 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 0500.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker arrangement and sizes.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.05 RECORD DOCUMENTS

A. Record actual locations of Products; indicate actual branch circuit arrangement.

1.06 OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.07 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

1.08 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.09 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.10 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.11 MAINTENANCE MATERIALS

A. Provide two of each panelboard key.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Square D.

B. General Electric.

C. Siemens/ITE.

D. Cutler-Hammer.

2.02 PANELBOARDS

A. Panelboards: NEMA PB1, circuit breaker type.

B. Panelboard Bus: Tin-plated copper, ratings as indicated. Provide copper ground bus in each panelboard; provide insulated ground bus where scheduled.

C. Minimum short circuit rating, shall be as indicated on the Drawings. Panelboards shall have a fully rated interrupting rating. Series-rated equipment will not be accepted.

D. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

E. Enclosure: NEMA PB 1, Type 1, or 3R as indicated on the Drawings.

F. Cabinet box: 6 inches deep; width: 20 inches for 240 volt and less panelboards.

G. Cabinet Front: Surface cabinet front with concealed trim clamps, concealed hinge, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

2.03 MODIFICATIONS TO EXISTING PANELBOARDS

A. Provide and install all bus extensions, bus stabs, enclosures, etc. to install circuit breakers in existing panelboards.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1.

B. Install panelboards plumb. Provide supports in accordance with Section 26 2416.

C. Install panelboards with middle at 48 inches, if less than 6'-6" tall. If panelboard is taller than 6'-6 inches, install with top at 7'-6".

D. Provide filler plates for unused spaces in panelboards.

E. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

F. Provide engraved plastic nameplates under the provisions of Section 26 0553.

G. Provide a minimum of four (4) spare 20A/1P circuit breakers in each branch circuit panelboard or as indicated on the drawings.

H. Install all screws and bolts in coverplates.

I. Install knockout plugs in all unused openings in enclosure.

J. Install nameplates on all circuit breakers of large panelboards.

K. Bolt panelboards to mounting surface in accordance with Section 26 0548.

L. Panelboards installed on basement walls or outside on exterior walls shall be installed on 1-1/2 inch channel.

M. The first section of multi-section panelboards shall have feed-through lugs. Contractor shall install conductors with ampacities equal to the bus rating of the panelboards, from the feed-through lugs to the main lugs only of Section #2 panelboard.

N. Touchup scratched or marred surfaces to match original finish.

O. Neatly form wire inside of panelboard.

3.02 FIELD QUALITY CONTROL

A. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections using calibrated torque wrench for circuit breakers, bus stabs, and busses.

END OF SECTION

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SECTION 26 2600

LOW-VOLTAGE ELECTRICAL DISTRIBUTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Arrangement with Utility Company for permanent and temporary electric services, including payment of Utility Company charges for service.

B. Underground service entrance.

C. Metering equipment.

1.02 RELATED SECTIONS

A. Section 31 2100 – Earth Moving.

B. Section 31 2323 - Backfilling.

C. Section 31 2316 - Trenching.

D. Section 03 300 - Cast-In-Place Concrete for pad mounted transformers and/or free-standing C.T. cabinets.

E. Section 26 0533 – Raceway and Boxes for Electrical Systems.

F. Section 26 0526 - Grounding and Bonding for Electrical Systems.

G. Section 26 0529 – Hangers and Supports for Electrical Systems.

1.03 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. NETA – National Electrical Testing Association.

1.04 SYSTEM DESCRIPTION

A. Utility Company: Entergy of Arkansas.

B. System Characteristics: 208 volts, three phase, four- wire, 60 Hertz.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with Utility Company written requirements.

B. Maintain one copy of each document on site.

1.06 REGULATORY REQUIREMENTS

A. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

B. Conform to the requirements of NFPA 70 - National Electrical Code, ANSI/IEEE C2 - National Electrical Safety Code, and Arkansas Public Service Commission rules and regulations.

1.07 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on Utility Company drawings.

PART 2 - PRODUCTS

2.01 UTILITY METERS

A. Meters will be furnished and installed by Utility Company.

2.02 UTILITY METER BASES

A. Meter bases will be purchased by Contractor from Utility Company and installed by the Contractor.

2.03 UTILITY CURRENT TRANSFORMER CABINET

A. Current transformer cabinet shall be purchased by Contractor from Utility Company and shall be installed by Contractor per directions from Utility Company.

2.04 TRANSFORMER PAD

A. Description: Concrete transformer pad with cable pit sized as

indicated on Drawings.

2.05 GROUND GRID

A. Stranded copper conductors, exothermic connections, and copper clad steel ground rods as directed by Utility Company.

2.06 LUGS

A. Contractor shall provide lugs to the Utility to connect underground service conductors to pad-mounted transformer secondary terminals.

2.07 CONDUITS

A. Above ground conduit shall be threaded rigid steel.

B. Underground conduit shall be Schedule 80 with IMC elbows.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that service equipment is ready to be connected and energized.

3.02 PREPARATION

A. Make arrangements with Utility Company to obtain permanent and temporary electric services to the Project.

B. Coordinate location of Utility Company's facilities to ensure proper access is available.

C. Pay all fees for electrical service to Utility Company.

3.03 INSTALLATION

A. Install service entrance conduits and conductors from Utility Company's transformer to building service entrance equipment.

B. Provide cast-in-place concrete pad and ground grid for Utility Company transformer and/or free-standing C.T. cabinet, under the provisions of Section 03 300.

C. Provide buried PVC conduit from primary compartment of transformer pad to Utility Company's pole as directed by Utility Company.

D. Install meter and current transformer cabinet as directed by Utility Company.

E. Provide and install secondary lugs at transformer and lugs at current transformer cabinet.

F. Level concrete pads.

G. Dress up areas of excavation.

H. Ground enclosures, current transformers, and meter.

I. Install conduit hubs when exiting the top or sides of a NEMA 3R enclosure.

J. Install weatherheads on ends of conduits for overhead services.

K. Install meters, current transformer cabinets, and outdoor service equipment on 1-1/2 inch channels.

3.04 FIELD QUALITY CONTROL

A. Torque lugs to NETA specifications.

END OF SECTION

SECTION 26 2726

WIRING DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Occupancy Sensors.

D. Device plates.

1.02 RELATED SECTIONS

A. Section 26 0533 - Boxes.

B. Section 26 0553 - Electrical Identification: Labels on computer outlets.

1.03 REFERENCES

A. NEMA WD 1 - General Purpose Wiring Devices.

B. NEMA WD 6 - Wiring Device Configurations.

C. UL 20 - General Use Snap Switches.

D. UL 498 - Attachment Plugs and Receptacles.

E. UL 894 - Switches for Use in Hazardous (Classified) Locations.

F. UL 1010 - Receptacle Plug Combinations for Use in Hazardous (Classified) Locations.

1.04 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 0500.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Manufacturer's Instructions:
   1. Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements.
   2. Include instructions for storage, handling, protection, examination, preparation, operation, and installation of product.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.06 EXTRA MATERIALS

A. Provide protective rings and split nozzles as required and as specified.

PART 2 - PRODUCTS (NO SUBSTITUTIONS)

2.01 WALL SWITCHES

A. Single Pole Switch:
   1. Hubbell #1221.
   2. Pass & Seymour #20AC1.
   3. Cooper Wiring Devices #2221.
   4. Leviton #1221.

B. Double Pole Switch:
   1. Hubbell #1222.
   2. Pass & Seymour #20AC2.
   3. Cooper Wiring Devices #2222.
   4. Leviton #1222.

C. Three-way Switch:
   1. Hubbell #1223.
   2. Pass & Seymour #20AC3.
   3. Cooper Wiring Devices #2223.
   4. Leviton #1223.

D. Four-way Switch:
   1. Hubbell #1224.

2. Pass & Seymour #20AC4.
3. Cooper Wiring Devices #2224.
4. Leviton #1224.

2.02 RECEPTACLES

A. Single Convenience Receptacle:
1. Hubbell #5361.
2. Pass & Seymour #5361.
3. Cooper Wiring Devices #5361.
4. Leviton #5361.

B. Duplex Convenience Receptacle:
1. Hubbell #5362.
2. Pass & Seymour #5362.
3. Cooper Wiring Devices #5362.
4. Leviton #5362.

C. GFCI Receptacle:
1. Hubbell #GF5352.
2. Pass & Seymour #2091.
3. Cooper Wiring Devices #XGF20.
4. Leviton #GF5352.

D. Isolated Ground Duplex Receptacle:
1. Hubbell #IG5362.
2. Pass & Seymour #IG6300.
3. Cooper Wiring Devices #IG5362.
4. Leviton #IG5362.

E. Special Purpose Receptacle:
1. Type, NEMA configuration and voltage as specified on Drawings as manufactured by:
   a. Hubbell.
   b. Pass & Seymour.
   c. Cooper Wiring Devices.
   d. Leviton.

F. Color of devices as selected by Architect/Engineer.

2.03 OCCUPANCY SENSORS

A. APPROVED MANUFACTURES
   1. Hubbell
   2. WattStopper
   3. Engineer approved

B. TYPE: Sensors shall be “Dual Technology” unless otherwise noted on plans

C. INSTALLATION
   1. The Occupancy Sensor system shall sense the presence of human activity within the desired space and fully control the “On” / “Off” function of the lights.
   2. Time Delay settings shall be set at 10 minutes. This delay selection is based on lamp life vs. energy savings and sensor performance. Corridors and Bathroom time delay shall be set for 30 minutes to provide safety in such areas.
   3. Contractor shall adjust sensor sensitivity so the device will operate properly.
   4. Manufacture specified on drawings is specific to design. If an alternate manufacture is selected, the contractor is responsible for additional sensors, power pack, and additional equipment to meet the design needs. Also, contractor is to provide manufactures drawings with sensor coverage located on drawings. The revised drawing shall be included with the shop drawings. Alternate plan will only be approved once the engineer has reviewed this information.

2.04 WALL PLATES

A. Cover Plates: Stainless steel.

B. Weatherproof Enclosures:
   1. Receptacles in wet locations shall be installed with an outlet enclosure clearly marked "Suitable for Wet Locations While in Use”. There shall be a gasket between the enclosure and the mounting surface, and between the cover and the base to assure proper seal.
   2. The enclosure must employ stainless steel mounting hardware and be constructed of impact resistant polycarbonate. The outlet enclosure shall be UL listed and shall be as manufactured by TayMac Corporation, or approved equal.

C. Isolated Ground Receptacle/Computer Receptacle: Cover plates shall be

have "Computer" with black letters on clear background written from typewriter equal to Thomas & Betts at top or coverplate.

D. Wall-mounted Occupancy Sensors: Coverplates shall be suitable for sensor type and shape.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify conditions.

B. Verify outlet boxes are installed at proper height.

C. Verify wall openings are neatly cut and will be completely covered by wall plates.

D. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

E. Verify color of all devices and coverplates.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean debris from outlet boxes.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install devices plumb and level.

C. Install single and double pole switches with OFF position down.

D. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

E. Install plates on switch, receptacle, and blank outlets in all areas.

F. Connect wiring devices by wrapping conductor around screw terminal in clockwise direction and tightening screw. Where wiring device has

two (2) plates tightened by a screw, this method may be used. However, other back-connected wiring devices, which depend upon a metal spring action, are not allowed.

G. Use jumbo size plates for outlets installed in masonry walls.

H. Install galvanized steel plates on outlet boxes and junction boxes above accessible ceilings, and on surface mounted outlets.

I. All plates shall be secured by means of screws with heads matching plates.

J. Vertically mounted receptacles shall be installed with equipment grounds down, unless local codes require otherwise. Horizontally mounted receptacles shall be installed with equipment grounds to the right, unless local codes require otherwise. Regardless, all receptacles, including GFCI receptacles, shall be installed in the same way with the ground, turned in the same direction.

K. Install labels on computer outlets.

3.04 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 0533 to obtain mounting heights specified and indicated on Drawings.

B. Install wall switches 48 inches above finished floor to the center of the box.

C. Install convenience receptacle 18 (vertically oriented) inches above finished floor unless noted otherwise on Drawings.

D. Install convenience receptacle 6 (horizontally oriented) inches above finished counter.

3.05 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

F. Check tightness of all conductor connections.

3.06 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

END OF SECTION

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SECTION 26 2816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fusible switches.

B. Non-fusible switches.

C. Fuses.

D. Enclosed circuit breakers.

1.02 REFERENCES

A. ASME A17.1 - Safety Code for Elevators and Escalators.

B. NECA (National Electrical Contractors Association) “Standard of Installation”.

C. NEMA AB 1 - Molded-Case Circuit Breakers.

D. NEMA KS 1 - Enclosed Switches.

E. NFPA 70 - National Electrical Code.

F. UL 50 - Enclosures for Electrical Equipment.

G. UL 98 - Enclosed and Dead-Front Switches.

H. UL 198C - High Interrupting Capacity Fuses; Current Limiting Type.

I. UL 198E - Class R fuses.

J. UL 363 - Knife Switches.

K. UL 489 - Molded-Case Circuit Breakers and Circuit Breaker Enclosures.

L. UL 1066 - Low Voltage AC and DC Power Circuit Breakers Used in Enclosures.

M. UL 1332 - Organic Coatings for Steel for Outdoor-Use Electrical Equipment Enclosure.

1.03 RELATED SECTIONS

A. Section 09 900 - Painting: Touchup.

B. Section 26 0529 – Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems.

D. Section 26 0548 – Vibration and Seismic Controls for Electrical Systems.

1.04 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 0500.

B. Product Data: Provide switch ratings and enclosure dimensions.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

1.06 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Disconnect switches shall be heavy duty, as manufactured by,
1. Square D

2. General Electric
3. Siemens ITE
4. Cutler-Hammer

2.02 ENCLOSED SWITCHES

A. Fusible Switch Assemblies: NEMA KS 1, Type HD load interrupter enclosed knife switch, with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Designed to accommodate Class R fuses.

B. Non-fusible Switch Assemblies: NEMA KS 1, Type HD load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

C. Enclosures: NEMA KS 1.
1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R.

2.03 ENCLOSED CIRCUIT BREAKERS

A. Enclosures: NEMA KS 1.
1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R, lockable.

B. Minimum integrated short circuit rating as indicated on the Drawings shall be fully rated rating. Series-Rated equipment will not be accepted.

C. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

D. Cabinet: Finish in manufacturer's standard gray enamel.

E. 480Y277 volt main circuit breakers rated 1000 amperes or more shall have ground fault protection.

2.04 FUSES

A. Manufacturers:
   1. Bussman.
   2. Gould-Shawmut.
   3. Little.

B. Description: Dual element, current limiting, time delay, one-time fuse, 600 volt, UL 198E, Class RK 1.

C. Interrupting Rating: 200,000 rms amperes.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install the electrical device where indicated.

B. Install fuses in fusible disconnect switches.

C. Install equipment ground bus in enclosed circuit breaker / switch.

D. Provide adhesive label on inside door of each switch indicating UL fuse class and size for replacement.

E. Provide label on outside cover as directed by Section 26 0553 - Identification for Electrical Systems.

F. Provide three (3) spare fuses of each type utilized.

G. Bolt enclosed circuit breaker / switch to mounting surface in accordance with Section 26 0529.

H. Where wall-mounted circuit breaker / switches are mounted to be operated from floor or grade, install switch with middle of switch at 48 inches, if switch is less than 6'-6" tall. If switch is taller than 6'-6" tall, install switch with top of switch at 7'-6".

I. When the electrical devices are installed on exterior basement walls or outside, the switches shall be mounted on 1-1/2 inch channels.

J. Enclosed switches for wall-mounted exhaust fans installed higher than 8’ from the floor, shall be installed high on the wall next to the exhaust

fan.

K. Install nameplate on disconnect switch with designation of equipment being served by switch. If main switch, install "Main Disconnect" nameplate.

L. Touchup scratched or marred surfaces to match original finish.

M. Connect elevator battery lowering device to auxiliary contact of elevator disconnect switch.

N. Neatly form wires inside switches.

3.02 FIELD QUALITY CONTROL

A. Check tightness of conductor lugs using calibrated torque wrench.

END OF SECTION

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SECTION 26 2913

ENCLOSED MOTOR CONTROLLERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Manual motor starters.

B. Magnetic motor starters.

1.02 RELATED SECTIONS

A. Section 03 300 - Cast-In-Place Concrete for free standing enclosures.

B. Section 09 900 - Painting: Touchup.

C. Section 26 0529 – Hangers and Supports for Electrical Systems.

D. Section 26 0553 - Identification for Electrical Systems.

E. Section 26 0548 – Vibration and Seismic Controls for Electrical Systems.

1.03 REFERENCES

A. NECA "Standard of Installation," published by National Electrical Contractors Association.

B. NEMA AB 1 - Molded Case Circuit Breakers.

C. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.

D. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.

E. NEMA KS 1 - Enclosed Switches.

F. NFPA 70 - National Electrical Code.

G. UL 198C - High-interrupting Capacity Fuses; Current Limiting Type.

H. UL 508 - Industrial Control Equipment.

1.04 SUBMITTALS

A. Submit under provisions of Section 26 0500 and Division 1.

B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protection devices, short circuit ratings, dimensions and enclosure details.

C. Test Reports: Indicate field test and inspection procedures and test results.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation and starting of Product.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.07 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters' Laboratories, Inc. as suitable for purpose specified and indicated.

1.08 EXTRA MATERIALS

A. Provide three (3) of each size and type fuse installed.

B. Provide three (3) of each size and type of overload heater elements installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Square D.

B. General Electric.

C. Siemens - ITE.

D. Cutler-Hammer.

2.02 MANUAL CONTROLLERS

A. Manual Motor Controller: NEMA ICS 2, AC general-purpose Class A manually operated, full voltage controller with overload element, red pilot light, 1 N.O. and 1 N.C. contact and pushbutton operator.

B. Fractional Horsepower Manual Controller: NEMA ICS 2, AC general-purpose Class A manually operated, full voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light, and toggle switch.

C. Enclosure: NEMA ICS 6, Type 1.

2.03 AUTOMATIC CONTROLLERS

A. Magnetic Motor Controllers: NEMA ICS 2, AC general purpose, Class A magnetic controller for induction motors rated in horsepower, full voltage, non-reversing type. Reduced voltage auto-transformer (65% tap), closed transition type for 460 volt motors 25 HP and larger, and 208/240 volt motors 15 HP and larger.

B. Two Speed Controllers: Include integral time delay transition between FAST and SLOW speeds.

C. Coil Operating Voltage: As indicated on Drawings.

D. Overload Relay: NEMA ICS; melting alloy.

E. Enclosure: NEMA ICS 6, Type 1 or 3R as indicated on Drawings, sized for all housed pilot protective devices and control power transformer.

F. Phase Failure and Undervoltage Protection Relay: UL listed, connected to de-energize controller coil circuit upon any of the following abnormalities:
   1. Phase Loss.
   2. Phase Unbalance (10 percent or greater).
   3. Phase Reversal.
   4. Undervoltage (adjustable from 75 percent to 100 percent of

normal voltage),

5. Relay to be equipped with LED indicating relay has been energized. Relay to be track mounted within the controller enclosure. Relay to be equal to Square D Class 8430, Type MPD.

2.04 PRODUCT OPTIONS AND FEATURES TO BE PROVIDED AS INDICATED

A. Auxiliary Contacts: NEMA ICS 2, 2 each normally open, closed, field convertible contacts in addition to seal-in contact. (Provide with all automatic controllers).

B. Cover Mounted Pilot Devices: NEMA ICS 2, standard duty type. (As applicable.)

C. Pilot Device Contacts: NEMA ICS 2, Form Z, rated A150. (As applicable.)

D. Pushbuttons: Unguarded type. (When directed by controls contractor.)

E. Indicating Lights: LED type. (Provide with all automatic controllers.)

F. Selector Switches: Rotary type (H-O-A). (Provide with all automatic controllers.)

G. Relays: NEMA ICS 2. (When directed by controls contractor.)

H. Control Power Transformers: 120 volt secondary, 100 va minimum extra capacity, in each motor starter or as scheduled. Provide fused primary and secondary, and bond unfused leg of secondary to enclosure. (Provide with all automatic controllers.)

2.05 DISCONNECTS

A. Combination Controllers: Combine motor controllers with non-fusible switch or fusible switch, disconnect in common enclosure as scheduled.

B. Non-fusible Switch Assemblies: NEMA KS 1, enclosed knife switch with externally operable handle.

C. Fusible Switch Assemblies: NEMA KS 1, enclosed knife-switch with externally operable handle. Fuse clips: Designed to accommodate Class R fuses.

2.06 FUSES

A. Manufacturers:
   1. Bussman.
   2. Gould-Shawmut.
   3. Little Fuse.

B. Description: Dual element, current limiting, one-time fuse, 600 volt, UL 198E, Class RK.

C. Interrupting Rating: 200,000 RMS amperes.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install enclosed controllers where indicated, in accordance with manufacturer's instructions.

B. Install enclosed controllers plumb. Provide supports in accordance with Section 26 0529.

C. If enclosure is less than 6'-6" tall, install enclosure with middle of enclosure at 48 inches. If enclosure is taller than 6'-6", install enclosure with top of enclosure at 7'-6".

D. Install fuses in fusible switches.

E. Select and install overload heater elements in motor controllers to match installed motor characteristics.

F. Provide and install engraved plastic nameplates under the provisions of Section 26 0553.

G. Provide neatly typed label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

H. Provide and install all product options and control accessories as directed by mechanical and/or controls contractor(s).

I. Install housekeeping pad for freestanding enclosures.

J. Bolt freestanding enclosures to floor in accordance with Section 26 0548.

K. Bolt surface mounted enclosures to mounting surface in accordance with Section 26 0548.

L. Level enclosure.

M. Ground enclosure with equipment grounding conductor in controller branch circuit.

N. Adjust doors so that doors open easily without dragging on doorframe.

O. Where enclosed motor controllers are installed on exterior basement walls or outside, controllers shall be installed on 1-1/2 inch channels.

P. Touchup scratched or marred surfaces to match original finish.

Q. Neatly form wires inside motor controller enclosures.

3.02 FIELD QUALITY CONTROL

A. Inspect and test each enclosed controller to NEMA ICS 2.

B. Verify that each overload relay is the proper size for the motor.

C. All motor circuits shall be coordinated with the approved Division 23 shop drawings and any required changes shall be recorded on the record drawings.

D. Check tightness of conductor connections using calibrated torque wrench.

END OF SECTION

SECTION 26 3213

ENGINE GENERATORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes packaged engine-generator sets for standby power supply with the following features:
   1. Natural gas engine.
   2. Unit-mounted cooling system.
   3. Unit-mounted control and monitoring.
   4. Performance requirements for sensitive loads.
   5. Load banks.
   6. Outdoor enclosure.

B. Related Sections include the following: List below only products and equipment that the reader might expect to find in this Section but are specified elsewhere.
   1. Section 26 36 23 “Enclosed Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.03 DEFINITIONS

A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

B. LP: Liquid petroleum.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
   1. Thermal damage curve for generator.
   2. Time-current characteristic curves for generator protective device.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.

2. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
3. Vibration Isolation Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
4. Wiring Diagrams: Power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Submit certification that engine-generator set, batteries, battery racks, accessories, and components will withstand seismic forces defined in Section 26 0548 "Vibration and Seismic Controls for Electrical Systems." Include the following:
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Qualification Data: For installer, manufacturer and testing agency.

C. Source quality-control test reports.
1. Certified summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
5. Report of sound generation.

6. Report of exhaust emissions showing compliance with applicable regulations.
7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

D. Field quality-control test reports.

E. Warranty: Special warranty specified in this Section.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Manual: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 26 05 00 "Operation and Maintenance Manuals," include the following:
1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

1.07 MAINTENANCE MATERIAL SUBMITTALS

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. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

C. 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.

D. Comply with ASME B15.1.

E. Comply with NFPA 37.

F. Comply with NFPA 70.

G. Comply with NFPA 99.

H. Comply with NFPA 110 requirements for Level 2 emergency power supply system.

I. Comply with UL 2200.

J. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

K. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.09 PROJECT CONDITIONS

A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
   1. Ambient Temperature: 5 to 40 deg C.
   2. Relative Humidity: 0 to 95 percent.
   3. Altitude: Sea level to 1000 feet (300 m).

1.10 COORDINATION

A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 5 years from date of Substantial Completion.

1.12 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work limited to, the following:
   1. Caterpillar; Engine Div.
   2. Kohler Co.; Generator Division.
   3. Onan/Cummins Power Generation; Industrial Business Group.

2.02 ENGINE-GENERATOR SET

A. Factory-assembled and -tested, engine-generator set.

B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
   1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

C. Capacities and Characteristics:
   1. Power Output Ratings: Electrical output power rating for Standby operation of not less than (see plans) kW, at 80 percent lagging power factor, 480/277, Parallel Wye, 3-phase, 4 -wire, 60 hertz.
   2. Alternator shall be capable of accepting maximum 663.0 kVA in a single step and be capable of recovering to a minimum of 90% of rated no load voltage. Following the application of the specified kVA load at near zero power factor applied to the generator set.
   3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of components.

D. Generator-Set Performance:
   1. Steady-State Voltage Operational Bandwidth: 1 percent of rated output voltage from no load to full load.
   2. Transient Voltage Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
   3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
   4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
   5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
   6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence

factor, determined according to NEMA MG 1, shall not exceed 50 percent.

7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 8 seconds without damage to generator system components. For a 1-phase, bolted short circuit at system output terminals, system shall regulate both voltage and current to prevent over-voltage conditions on the non-faulted phases.
8. Start Time: Comply with NFPA 110, Type 10, system requirements.
9. Ambient Condition Performance: Engine generator shall be designed to allow operation at full rated load in an ambient temperature under site conditions, based on highest ambient condition. Ambient temperature shall be as measured at the air inlet to the engine generator for enclosed units, and at the control of the engine generator for machines installed in equipment rooms.

2.03 ENGINE

A. Fuel: Natural Gas

B. Lubrication System: The following items are mounted on engine or skid:
   1. Filter and Strainer: Provided by the engine manufacturer of record to provide adequate filtration for the prime mover to be used.
   2. Lube oil pump: shall be positive displacement, mechanical, full pressure pump.
   3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

C. Engine Fuel System:
   1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
   2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

D. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 2 equipment for heater capacity.

E. Governor: Adjustable isochronous, with speed sensing.

F. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.
   1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.

2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
    a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and non-collapsible under vacuum.
    b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

G. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
1. Minimum sound attenuation of 25 dB at 500 Hz.
2. Sound level measured at a distance of 10 feet (3 m) from exhaust discharge after installation is complete shall be 85 dBA or less.

H. Air-Intake Filter: Standard-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

I. Starting System: 12 or 24-V electric, with negative ground.
1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: 60 seconds.
4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least twice without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in Part 1 "Project Conditions" Article. Include accessories required to support and fasten batteries in place.
7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:

a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.04 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

C. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.

D. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 2 system, and the following:
   1. AC voltmeter (3-phase, line to line and line to neutral values).
   2. AC ammeter (3-phases).
   3. AC frequency meter.
   4. AC kVA output (total and for each phase). Display shall indicate power flow direction.
   5. Ammeter-voltmeter displays shall simultaneously display conditions for all three phases.
   6. Emergency Stop Switch: Switch shall be a red "mushroom head" pushbutton device complete with lock-out/tag-out provisions. Depressing switch shall cause the generator set to immediately stop the generator set and prevent it from operating.
   7. Fault Reset Switch: Supply a dedicated control switch to reset/clear fault conditions.
   8. DC voltmeter (alternator battery charging).
   9. Engine-coolant temperature gage.
   10. Engine lubricating-oil pressure gage.
   11. Running-time meter.
   12. Retain subparagraph below for units with "generator-protector" feature. Generator-voltage and frequency digital raise/lower switches. Rheostats for these functions are not acceptable. The control shall adjustment of these parameters in a range of plus or minus 5% of the voltage and frequency operating set point (not nominal voltage and frequency values.)
   13. AC Protective Equipment: The control system shall include over/under voltage, over current, short circuit, loss of voltage reference, and over excitation shut down protection. There shall be an overload warning, and overcurrent warning alarm.
   14. Status LED indicating lamps to indicate remote start signal present at the control, existing alarm condition, not in auto, and generator set running.
   15. A graphical display panel with appropriate navigation devices shall be provided to view all information noted above, as well as all engine status and alarm/shutdown conditions (including those from an integrated engine emission control system). The display shall also include integrated provisions for adjustment of the gain and stability settings for the governing and voltage regulation systems.
   16. Panel lighting system to allow viewing and operation of the control when the generator room or enclosure is not lighted.

17. DC control Power Monitoring: The control system shall continuously monitor DC power supply to the control, and annunciate low or high voltage conditions. It shall also provide an alarm indicating imminent failure of the battery bank based on degraded voltage recover on loading (engine cranking).

E. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

F. Connection to Data Link: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication is reserved for connections for data-link transmission of indications to remote data terminals.

G. Common Remote Audible Alarm: Signal the occurrence of any events listed below without differentiating between event types. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset.
1. Engine high-temperature shutdown.
2. Lube-oil, low-pressure shutdown.
3. Overspeed shutdown.
4. Remote emergency-stop shutdown.
5. Engine high-temperature pre-alarm.
6. Lube-oil, low-pressure pre-alarm.
7. Fuel tank, low-fuel level.
8. Low coolant level.

H. Remote Alarm Annunciator: Comply with NFPA 99. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

2.05 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.
1. Tripping Characteristic: Designed specifically for generator protection.
2. Trip Rating: Matched to generator rating.
3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
4. Mounting: Adjacent to or integrated with control and monitoring panel.

B. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground-fault. Integrate ground-fault alarm indication with other generator-set alarm indications.

2.06 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Permanent Magnet Generator (PMG) shall provide excitation power for optimum motor starting and short circuit performance.

G. Enclosure: Drip-proof.

H. Instrument Transformers: Mounted within generator enclosure.

I. Voltage Regulator: SCR type, separate from exciter, providing performance as specified. The voltage regulation system shall be microprocessor-controlled, full wave rectified, and provide a pulse-width modulated signal to the exciter. No exceptions or deviations to these requirements will be permitted.

J. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

K. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

L. Sub-transient Reactance: 15 percent maximum, based on the rating of the engine generator set.

2.07 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description: Sound Attenuated Steel housing. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Instruments, control, and battery system shall be mounted within enclosure.

B. Construction:

1. Hinged Doors: With padlocking provisions. Restraint/Hold back hardware to prevent door to keep door open at 180 degrees during maintenance. Rain lips over all doors.
2. Exhaust System: Muffler located within enclosure.
3. Hardware: All hardware and hinges shall be stainless steel.
4. Mounting Base: Suitable for mounting on sub-base fuel tank or housekeeping pad.
5. A weather protective enclosure shall be provided which allows the generator set to operate at full rated load with a static pressure drop equal to or less than 0.5 inches of water.

C. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.

D. Sound Performance: Reduce the sound level of the engine generator while operating at full rated load to a maximum of 75 dBA measured at any location 23 ft from the engine generator in a free field environment.

E. Convenience Outlets: Factory wired, GFCI. Arrange for external electrical connection.

2.08 VIBRATION ISOLATION DEVICES

A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
1. Material: Standard neoprene.

2.09 FINISHES

A. Indoor and Outdoor Enclosures and Components: Powder-coated and baked over corrosion-resistant pretreatment and compatible primer. Manufacturer's standard color or as directed on the drawings.

2.10 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
   1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
   2. Full load run.
   3. Maximum power.
   4. Voltage regulation.
   5. Transient and steady-state governing.
   6. Single-step load pickup.
   7. Safety shutdown.
   8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
   9. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

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

3.02 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

C. Install packaged engine generator with elastomeric isolator pads having a minimum deflection of 1 inch (25 mm) on 4-inch- (100-mm-) high concrete base. Secure sets to anchor bolts installed in concrete bases. Concrete base construction is specified in Section 26 0548 "Vibration and Seismic Controls for Electrical Systems."

D. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.03 CONNECTIONS

A. Connect engine exhaust pipe to engine with flexible connector.

B. Ground equipment according to Section 26 0526 "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

3.04 IDENTIFICATION

A. Identify system components according to Section 23 0553 "Identification for HVAC Piping and Equipment" and Section 26 0553 "Identification for Electrical Systems."

3.05 FIELD QUALITY CONTROL

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

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

C. Perform tests and inspections and prepare test reports.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection (except those indicated to be optional) for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
3. Provide a 4hr load bank test. Provide results to Engineer.
4. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
    a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
    c. Verify acceptance of charge for each element of the battery after discharge.
    d. Verify that measurements are within manufacturer's specifications.
5. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.

6. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
7. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.

E. Coordinate tests with tests for transfer switches and run them concurrently.

F. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.

G. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

H. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

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

J. Remove and replace malfunctioning units and reinspect as specified above.

K. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

L. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

M. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each power wiring termination and each bus connection. Remove all access panels so terminations and connections are accessible to portable scanner.
1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION

SECTION 26 3623

ENCLOSED TRANSFER SWITCH
SERVICE ENTRANCE RATED NEMA 3R

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Automatic transfer switch.

1.02 RELATED SECTIONS

A. Section 26 05 48 – Vibration and Seismic Controls for Electrical Systems.

B. Section 26 05 53 – Identification for Electrical Systems.

C. Section 26 32 13 – Engine Generators.

1.03 REFERENCES

A. NEMA ICS 1 - General Standards for Industrial Control and Systems.

B. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers, and Assemblies.

C. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.

D. NFPA 70 - National Electrical Code.

E. UL 1008 - Automatic Transfer Switch.

1.04 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 05 00.

B. Product Data: Provide catalog sheets showing voltage, switch size, ratings and size of switching and overcurrent protective devices, operating logic, short circuit ratings, dimensions, and enclosure details.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.05 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 1 and Section 26 05 00.

B. Operation Data: Include instructions for operating equipment. Include instructions for operating equipment under emergency conditions when engine generator is running.

C. Maintenance Data: Include routine preventative maintenance and lubrication schedule. List special tools, maintenance materials, and replacement parts.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with experience.

B. Supplier: Authorized distributor of specified manufacturer with minimum three years documented experience.

1.07 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 1 and Section 26 05 00.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to internal components, enclosure and finish.

1.09 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated.

1.10 MAINTENANCE SERVICE

A. Furnish service and maintenance of transfer switch for one year from Date of Substantial Completion.

1.11 MAINTENANCE MATERIALS

A. Provide maintenance materials under provisions of Division 1.

B. Provide two of each special tool required for maintenance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Automatic Switch Company, service entrance rated.

B. Kohler.

C. Onan Electric, Inc.

D. Generac.

2.02 AUTOMATIC TRANSFER SWITCH

A. Description: NEMA ICS 2, automatic transfer switch.
B. Configuration: Electrically operated, mechanically held transfer switch.
C. Service Entrance Rated
D. NEMA 3R

2.03 SERVICE CONDITIONS

A. Service Conditions: NEMA ICS 1.

2.04 RATINGS

A. Voltage: 480/277 volts, three phase, four-wire, 60 Hz.

B. Switched Poles: 3.

C. Load Inrush Rating: Combination load.

D. Continuous Rating: See Drawings.

E. Interrupting Capacity: 600 percent of continuous rating.

F. Withstand Current Rating: 50,000 rms symmetrical amperes, when used with Class L current limiting fuse.

2.05 PRODUCT OPTIONS AND FEATURES

A. Indicating Lights: Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE, ALTERNATE SOURCE AVAILABLE, SWITCH POSITION.

B. Test Switch: Mount in cover of enclosure to simulate failure of normal source.

C. Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate to normal source.

D. Transfer Switch Auxiliary Contacts: 2 normally open; 2 normally closed.

E. Normal Source Monitor: Monitor each line of normal source voltage and frequency; initiate transfer when voltage drops below 85 percent or frequency varies more than 3 percent from rated nominal value.

F. Alternate Source Monitor: Monitor alternate source voltage and frequency; inhibit transfer when voltage is below 85 percent or frequency varies more than 3 percent from rated nominal value.

G. In-Phase Monitor: Inhibit transfer until source and load are within 5

electrical degrees.

H. Switched Neutral: Overlapping contacts. Required for four pole only.

2.06 AUTOMATIC SEQUENCE OF OPERATION

A. Initiate Time Delay to Start Alternate Source Engine Generator: Upon initiation by normal source monitor.

B. Time Delay to Start Alternate Source Engine Generator: 0 to 60 seconds, adjustable.

C. Initiate Transfer Load to Alternate Source: Upon initiation by normal source monitor and permission by alternate source monitor.

D. Time Delay Before Transfer to Alternate Power Source: 0 to 60 seconds, adjustable.

E. Initiate Time Delay, Retransfer Load to Normal Source: Upon permission by normal source monitor.

F. Time Delay Before Transfer to Normal Power: 0 to 180 seconds, adjustable; bypass time delay in event of alternate source failure.

G. Time Delay Before Engine Shut Down: 0 to 300 minutes, adjustable, of unloaded operation.

H. Engine Exerciser: Start engine every 7 days; run for 30 minutes before shutting down. Bypass exerciser control if normal source fails during exercising period.

I. Alternate System Exerciser: Transfer load to alternate source during engine exercising period.

2.07 ENCLOSURE

A. Enclosure: 3R Located outside.

B. Finish: Manufacturer's standard enamel.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify conditions.

B. Verify that surface is suitable for transfer switch installation.

3.02 INSTALLATION

A. Install transfer switches in accordance with manufacturer's instructions.

B. Provide engraved plastic nameplates under the provisions of Section 26 05 53

C. Install all screws and bolts in coverplates.

D. Bolt surface-mounted enclosures to mounting surface in accordance with Section 26 05 48.

E. Install 4-inch housekeeping pad for freestanding enclosures.

F. Bolt freestanding enclosures to floor in accordance with Section 26 05 48.

G. Level switch.

H. Ground switch with equipment grounding conductors in both emergency and normal power feeders.

I. Adjust doors so that they open easily and do not drag on doorframe.

J. Install engine start wires to emergency generator.

K. Install wall-mounted switches with middle of switch at 48 inches if switch is less than 6'-6" tall. Install switches taller than 6'-6" with top of switch at 7'-6".

L. Where switches are mounted on exterior basement walls or outdoors, install switch on 1-1/2-inch channels.

M. Neatly form wires in transfer switch enclosure.

N. Touchup scratched or marred surfaces to match original finish.

3.03 FIELD QUALITY CONTROL

A. Check tightness of all conductor connections with calibrated torque wrench.

3.04 DEMONSTRATION

A. Provide systems demonstration.

B. Demonstrate operation of transfer switch in normal and emergency modes.

END OF SECTION

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SECTION 26 4300

TRANSIENT VOLTAGE SURGE SUPPRESSION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Main Distribution Panel.

B. Low Voltage Electronic Grade Panel.

1.02 RELATED SECTIONS

A. Section 09 900 - Painting: Touchup.

B. Section 26 0533 – Raceway and Boxes for Electrical Systems.

C. Section 26 0519 – Low-Voltage Electrical Power Connectors and Cable.

D. Section 26 0553 - Identification for Electrical Systems: Engraved nameplates.

E. Section 26 0548 – Vibration and Seismic Controls for Electrical Systems.

1.03 REFERENCES

A. American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.41-1991 and C62.45-1987)

B. Canadian Standards Association (CSA)

C. Federal Information Processing Standards Publication 94 (FIPS PUB 94)

D. National Electrical Manufacturers Association (NEMA)

E. National Fire Protection Association (NFPA 70 (NEC), 75 and 78).

F. Underwriters' Laboratories - UL1449, 2nd Edition and UL1283.

1.04 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 0500.

B. UL 1449 Suppression Ratings - Documentation of unit's UL 1449 suppression rating shall be included as required product data submittal information. Manufacturer shall make available upon request certified documentation of applicable Location Category C Testing in full compliance

with ANSI/IEEE C62.41-1991 and ANSI/IEEE C62.45-1987 Guidelines.

1.05 REGULATORY REQUIREMENTS

A. Conform to NFPA 70, 75 and 78.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.06 OPERATION AND MAINTENANCE DATA

A. Equipment Manual - The manufacturer shall furnish an equipment manual with installation, operation and maintenance for the specified unit.

B. Drawings - Electrical and mechanical drawings shall be provided by the manufacturer which show unit dimensions, weights, mounting provisions, connection details and layout diagram of the unit.

C. Spare Parts - A list of customer-replaceable spare parts shall be included in the unit's installation, operation and maintenance instructions. All spare parts shall be quickly and easily field-replaceable.

1.07 QUALIFICATIONS, TESTING & WARRANTY

A. Warranty - The manufacturer shall provide an Unlimited Replacement Five Year Warranty from date of shipment on the entire electronic grade panel (suppression filter system unit, breakers and other panel components) against failure when installed in compliance with applicable national/local electrical codes and the manufacturer's installation, operation and maintenance instructions.

B. Quality Assurance - The unit shall be thoroughly factory-tested before shipment. Testing of each unit shall include, but shall not be limited to, quality assurance checks, MCOV, and clamping voltage verification tests.

C. MCOV Testing - The unit shall be factory tested and burned in at the applicable MCOV for a minimum of one (1) hour.

D. Start-Up Testing - Upon request by the engineer, and after completion of installation, a factory-certified local service technician shall perform testing services. The following tests shall be performed: (a) voltage measurements from L-G, L-N, L-L and N-G at the time of the testing procedure, (b) impulse injection to verify the system suppression voltage tolerances for all suppression paths. Test results shall be recorded, compared to factory benchmark test parameters supplied with each individual unit. A copy of the start-up test results shall be supplied to the engineer for confirmation of proper suppression filter system function. In addition, the integrity of the N-G

bond shall be verified through testing.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Current Technology.

B. Liebert.

C. Cutler Hammer

2.02 GENERAL PERFORMANCE CRITERIA

A. Maximum Continuous Operating Voltage (MCOV) - The maximum continuous operating valve (MCOV) of all suppression components utilized in the unit shall not be less than 125 percent of the facility's nominal operating voltage for 120 volt nominal systems and not less than 115 percent of the facility's nominal operating voltage for 220, 240, 277, 347, 480, 575, and 600 volt nominal systems.

B. High Frequency Extended Range Tracking Filter - The unit shall include a UL 1283 high -frequency, error producing transients and electrical line noise to harmless levels, thus eliminating disturbances, which may lead to system upset. The filter shall provide minimum insertion loss as follows:

Attenuation Frequency	100 kHz	1 MHZ	10 MHZ	100 MHZ
Insertion Loss (dB)	41	31	35	53

NOTE: Standardized insertion loss data obtained utilizing MIL-STD-E220A 50 ohm insertion loss methodology.

C. Performance Ratings - The unit's published performance ratings shall be the UL1449 Listed suppression ratings. The UL1449 Suppression Rating shall be, for each mode of protection, as follows:

VOLTAGE	L-L	L-N	L-G	N-G
120/240	800	400	400	400
120/208	800	400	400	400
277/480	1500	800	800	800
347/600	2000	1000	1000	1000

D. Operating Frequency - The operating frequency range of the unit shall be 47 to 63 Hertz.

E. Protection Modes - The unit's primary mode of protection shall be line-to-line (delta-configured systems) or line-to-neutral (wye-configured systems). The secondary modes of protection shall be line-to-ground and neutral-to-ground (wye configured systems) or line-to-ground (delta-configured systems).

2.03 MAIN DISTRIBUTION PANEL PROTECTION

A. Tested Single Pulse Surge Current Capacity - Based on ANSI/IEEE C 62.41-1991's standard 8 by 20 microsecond current waveform, the single pulse surge current capacity, in amperes, of the unit (not individual module) shall be no less than as follows:

Mode of Protection	L-L	L-N	L-G	N-G
Tested Single Pulse Surge Current Capacity Per Protection Mode	100,000	100,000	100,000	100,000

In compliance with NEMA LS 1-1992, the suppression filter unit shall be single pulse tested in all modes up to 150% of the product design rating by an industry-recognized independent test laboratory.

B. Life Expectancy Testing - The unit shall be capable of protecting against and surviving at least 2,500 ANSI/IEEE C62.41-1991 Category C3 surges without failing or degrading the UL 1449 Surge Suppression Rating by more than 10 percent. The unit shall be able to survive a steady state voltage swell in excess of 125% of nominal voltage for 60 seconds without damage to the unit.

C. Integral Disconnect Switch - The unit shall include an integral fused and safety interlocked disconnect switch located in the unit enclosure with an externally mounted manual operator. The switch shall disconnect all ungrounded circuit conductors from the distribution system to enable testing and maintenance without interruption of power to the facility's distribution system. The switch shall be rated for 600 VAC.

D. Filter System - Each suppression filter system element (selenium cell, MOV, polypropene capacitor) shall be individually fused with 200 KAIC rated fuse links recognized under UL 248 in order to provide maximum fault current protection. The unit must be tested to full rated surge current without failure of any component (including fuse links).

E. Diagnostic Monitoring Option - The unit shall be provided with the following features: Dual Form "C" dry contacts, battery powered audible alarm with disable switch, phase indicator lights, LED status indicator, transient voltage

surge counter and test switch.

F. Internal Connections - All internal wiring associated with the suppression/filter system and subject to surge currents shall utilize low impedance copper bus bar and/or #1/0 AWG copper conductor or larger. All internal connections associated with the suppression/filter system and subject to surge currents shall be made with compression solderless-type lugs and shall be bolted to the bus bars in order to reduce overall system impedance.

G. Field Connections - The unit shall include mechanical lugs for each phase, neutral and ground, if applicable. The lugs shall accommodate up to #2 AWG copper conductor with integral fused disconnect switch.

H. Field Installation - The unit shall be installed as close as practical to the facility's wiring system in accordance with applicable national/local electrical codes and the manufacturer's recommended installation instructions. Connection shall be with #2 AWG copper conductor or larger and not be any longer than necessary, avoiding unnecessary bends.

I. Enclosure - Standard surface-mounted units shall be provided in a NEMA 4 metallic type enclosure. Dimensions shall not be greater than 22 inches wide by 38 inches high by 14.25 inches deep. Weight of standard surface-mounted units shall not exceed 125 lbs (maximum).

2.04 ELECTRONIC GRADE PANELBOARD

A. Unit Operating Voltage - The nominal unit operating voltage and configuration shall be as indicated on the Drawings.

B. High Performance Suppression System - The unit shall include an engineered solid-state high-performance suppression system, utilizing arrays of fused non-linear voltage dependent metal oxide varistors with similar operating characteristics. The suppression system's components shall optimally share surge currents in a seamless, loss-stress manner assuring maximum performance and proven reliability. The suppression system shall not utilize gas tubes, spark gaps, silicon avalanche diodes or other components which might short or crowbar the line, thus leading to interruption of normal power flow to or system upset of connected loads. The suppression system shall not incorporate any other components, which may degrade performance or reliability of the suppression system.

C. Tested Single Pulse Surge Current Capacity - Based on ANSI/IEEE C62.41-1991's standard 8 x 20 microsecond current waveform, the tested single pulse surge current capacity, in amperes, of the unit shall be no less than as follows:

Mode of Protection	L-L	L-N	L-G	N-G
Tested Single Pulse Surge Current Capacity Per Protection Mode	80,000	80,000	80,000	80,000

D. Life Expectancy Testing - The unit shall be capable of protecting against and surviving at least 2,500 ANSI/IEEE C62.41-1991 Category C3 surges without failing or degrading the UL 1449 Surge Suppression Rating by more than 10 percent.

E. Trim - The unit shall be constructed with surface-mounted gray baked enamel sheet metal trim and shall be top- or bottom- fed as indicated on the drawings. A directory cardholder shall be mounted on the inside of the hinged door that includes flush-type latch/lock assembly. Multi-sectional panelboards shall be as indicated on the drawings and shall be configured with feed-through lugs in either two (2) or three (3) section configurations.

F. Boxes - The unit's box shall be formed of galvanized metal and chemically cleansed, and all breaks in galvanizing shall be painted with metallic paint. Minimum size shall be 20 inches wide by 5.75 inches deep, unless otherwise indicated on the drawings. The unit's box shall not be less than 9 inches longer than standard panelboards.

G. Interiors - The unit shall have a removable interior as manufactured by General Electric, Square D, Siemens, or approved equal. The interior shall be so arranged that individual branch circuit breakers may be installed or removed without disturbing adjacent units, bus structure, or insulation.

H. Copper Main Bus - The unit shall include an all-copper main bus of the ampacity and arrangement as indicated on the drawings.

I. Circuit Breakers - The unit shall include bolt-on main, branch or sub-feed circuit breakers with frame size, poles, trip rating, and minimum interrupting rating as indicated on the drawings. Circuit breakers shall have a minimum 10,000 amperes interrupting range for 120/240, and 120/208 volt circuits, and 14,000 amperes for 277/480 and 347/600 volt circuits, or as indicated on the drawings. Circuit breakers shall be single handle, common trip for two and three pole units.

J. 200 Percent Rated Copper Neutral Bus - The unit shall include a 200 percent rated, all copper neutral bus, designed for the peculiar current demands associated with non-linear loads. The neutral bus shall include AL/CU rated mechanical solderless-type lugs in sufficient quantity and capacity as indicated on the drawings.

K. Safety Ground Bus - The unit shall include a safety ground bus with

connection points equal to the number of branch breaker positions. The safety ground bus shall include AL/CU rated mechanical solderless-type lugs in sufficient quantity and capacity as indicated on the drawings.

L. Field Connections - The unit shall include mechanical solderless-type connection points and labels for each phase, neutral, safety ground, as indicated on the drawings.

M. Integral Circuit Breaker for Suppression/Filter System - The unit shall require an integral circuit breaker as a means of disconnecting the suppression/filter system for maintenance and/or test purposes without interruption of power to the facility's distribution system. The breaker shall be 2 pole for single phase (120/240 VAC) and 3-pole for three phase (120/208, 277/480, or 347/600 VAC) applications.

N. Suppression/Filter System Connections - All internal wiring associated with the suppression/filter system and subject to surge currents shall utilize low-impedance copper bus bar and/or #8 AWG copper conductor or larger. All internal connections associated with the suppression/filter system sand subject to surge currents shall be made with compression solderless type lugs and shall be bolted to the bus bars in order to reduce overall system impedance.

O. Diagnostic Monitoring Option - Unit shall be provided with the following features: Form "C" contact, audible alarm silence/test, status indicator lights, transient voltage surge counter and external test capability

PART 3 - EXECUTION

3.01 INSTALLATION

A. Field Installation - The unit shall be installed in accordance with applicable national/local electrical codes and the manufacturer's recommended installation instructions.

B. Each individual circuit shall be clearly numbered on the face of the panelboard and a typewritten directory for circuit identification shall be provided by the contractor.

C. Bolt surface-mounted enclosures to mounting surface in accordance with Section 26 0548.

D. Bolt freestanding enclosures to floor in accordance with Section 26 0548.

E. Level enclosure.

F. Ground enclosure with equipment grounding conductor with TVSS feeder.

G. Adjust doors so that they open easily without dragging.

H. If enclosure is less than 6'-6" tall, install enclosure with middle of enclosure at 48 inches. If enclosure is taller than 6'-6", install enclosure with top of enclosure at 7'-6".

I. Install engraved nameplate on panels.

J. Neatly form wires in panelboards or other enclosures.

K. Touchup scratched or marred surfaces to match original finish.

3.02 FIELD QUALITY CONTROL

A. Check tightness of all conductor connections with calibrated torque wrench.

END OF SECTION

SECTION 26 5000

LIGHTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. General

B. LED luminaires

C. Exit signs.

D. Emergency lighting units.

E. Inverters

1.02 RELATED SECTIONS

A. Section 26 5000 – Common Work Results for Electrical

B. Section 09 900 - Painting: Touchup.

C. Section 26 0533 – Raceway and Boxes for Electrical Systems.

D. Section 26 0529 – Hangers and Supports for Electrical Systems.

E. Section 26 0548 – Vibration and Seismic Controls for Electrical Systems.

1.03 REFERENCES

A. ANSI/NFPA 70 – National Electrical Code.

B. ANSI/NFPA 101 – Life Safety Code.

C. UL 1598 – Luminaires.

D. UL 844 – Electric Lighting Fixtures for Use in Hazardous (Classified) Locations.

E. UL 924 – Emergency Lighting and Power Equipment.

F. UL 8570 – Light Emitting Diode (LED) Equipment for Use in Lighting

Products

G. NEMA SSL 1-2010 – Electronic Drivers for LED Devices, Arrays, or Systems

H. IES LM-79 – Electrical and Photometric Measurements of Solid-State Lighting Products

I. IES LM-80 – Measuring Lumen Maintenance of LED Light Sources

J. IES TM-21 – Projecting Long Term Lumen Maintenance of LED Light Sources

1.04 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 0500.

B. Product Data: For each type of luminaire, arranged in order of luminaire designation. Include data on features, accessories, finishes, and the following:
   1. Descriptive cutsheets indicating fixture catalog number selections, highlight and/or clearly mark which part numbers are used to build the complete fixture catalog number.
   2. Material and physical description of luminaire including dimensions.
   3. Emergency lighting units including battery and charger.
   4. Life, output (lumens, CCT, and CRI), and energy efficiency data.
   5. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps, drivers, and accessories identical to those indicated for the luminaire as applied in this Project.
      a. Testing Agency Certified Data: For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer. LM-79 and LM-80 data for solid state lighting.
      b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
   6. Low voltage transformers/power supplies.

C. Shop Drawings: For nonstandard or custom luminaires.
   1. Include plans, elevations, sections, and mounting and attachment details.
   2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. For custom luminaires, modified luminaires or linear luminaires mounted in continuous rows, submit scaled drawings prepared by the manufacturer showing all details of construction, lengths in runs, pendant or power feed locations, accessories, finishes and lists of materials.
   4. This Contractor shall provide the manufacturer with accurate field dimensions where required.
   5. Include wiring diagrams, power and control wiring.

D. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of each luminaire.

1.06 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 1 and Section 26 0500.

B. Maintenance Data: Instructions for each product including information on replacement parts.

1.07 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Conform to requirements of NFPA 101.

C. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 – PRODUCTS

2.01 GENERAL

A. Descriptions, type letters, manufacturers' names and general characteristics are shown on the drawings. Manufacturers' names noted are for defining quality of construction only and do not limit other manufacturers' products, unless noted “No Substitutions”.

B. The lighting system shall consist of the type and manufacturer as shown on the drawings or approved equal. If other than fixture shown in submitted complete illumination calculations are required to show equality.

C. Special Adapters, Plates, Brackets, and Anchors: Provide where required by constructions features of the building to suitably mount lighting fixtures. All such appurtenances and mounting methods shall be approved by the Architect/Engineer prior to fabrication and installation.

D. Lighting fixtures in hazardous areas shall be suitable for installation in Class and Division areas as defined in NFPA 70.

E. Fixtures shall be Design Lights Consortium (DLC) or Energy Star certified.

2.02 LED LUMINAIRES

A. Furnish products as specified on drawings.

B. Color Temperature of 3500K for interior luminaires as listed in the fixture schedule on the plans, unless otherwise noted. The color temperature of exterior LED luminaires shall not exceed 4100K (nominal), unless otherwise noted.

C. Luminaire Color Rendering Index (CRI) shall be a minimum of 80 for interior luminaires, and a minimum of 70 for exterior luminaires, unless otherwise noted.

D. Luminaire shall maintain 70% lumen output for a minimum of 50,000 hours.

E. Driver shall have a rated life of 50,000 hours, minimum.

F. Lumen output shall not depreciate more than 20% after 10,000 hours of use.

G. LED luminaires shall dim to (20%, 15%, 10%, 5%, 1% or 0.1%) as specified in the fixture schedule on the plans without visible flicker or

"popcorn effect". "Popcorn effect" is defined as the luminaire being on a pre-set dimmed level (less than 100%), and going to 100% prior to returning to the pre-set level when power is returned to the luminaire.

H. The LED luminaire shall carry a limited 5-year warranty minimum (not pro-rated) for LED light engine(s)/board array, driver(s), and LED components from date of substantial completion of the project. This warranty to cover all product defects, performance criteria, and parts.

I. LED driver shall be UL certified for use in a dry, damp, or wet location as specified on drawings.

2.03 EXIT SIGNS

A. Manufacturers: As indicated on drawings.

B. Description: Self-contained exit sign fixture.

C. Housing: High impact thermoplastic unless indicated otherwise on drawings.

D. Face: As indicated on drawings.

E. Directional Arrows: As indicated on drawings.

F. Mounting: For ceiling, back, end mounting or recessed as indicated on drawings. Subcontractor is cautioned to coordinate exit sign locations with Architectural details. Mounting height, in general, up 90 inches or one inch above door casing where mounted over doors; verify all exit sign locations with Architect/Engineer prior to installation of outlet boxes.

G. Battery: Nickel-cadmium/Lithium with sufficient capacity to operate lights for 90 minutes with self-diagnostics.

H. Battery Charger: Dual-rate type, with sufficient capacity to recharge discharged battery to full charge within twelve hours.

I. Lamps: LED, Red color unless indicated otherwise on drawings.

J. Input Voltage: 120/277 volts.

2.04 EMERGENCY LIGHTING UNITS

A. Manufacturers: As indicated on the drawings.

B. Description: Self-contained emergency lighting units.

C. Housing: High impact thermoplastic unless indicated otherwise on drawings.

D. Mounting: As indicated on the drawings.

E. Battery: Nickel-cadmium/lithium sealed maintenance fee, capable of operating lights for 90 minutes with self-diagnostics.

F. Battery Charger: Dual-rate type, with sufficient capacity to recharge battery to full charge within 12 hours.

G. Lamps: LED.

H. Input Voltage: 120/277 volts.

I. Test Circuit: "Push-to-test" batteries and diodes.

2.05 INVERTERS

A. Inverter Manufacturers:
   1. Bodine
   2. Dual-Lite
   3. Evenlite
   4. IOTA

B. Emergency Inverters shall be sine-wave type, or have written confirmation from the luminaire manufacturer that the luminaire will function with a square-wave inverter.

C. To comply with UL Listing to Standard 924 (Emergency Lighting), batteries shall be designed to provide a minimum 90 minutes rated output voltage to the connected load in emergency mode without dropping below 87.5% of nominal battery voltage

D. Manual and automatic test modes shall be provided.

   1. Manual user-initiated system test at any time
   2. Automatic weekly, monthly, and annual self-diagnostic test
   3. Automatic recording of the last twenty events in a Test Results log

E. The system shall be guaranteed, under normal and proper use, against defects in workmanship and materials for a period of one year from the date of substantial completion. Batteries supplied as part of the systems shall be covered under a separate pro-rata warranty as described below.
   1. Sealed Lead Calcium VRLA, 10-year life expectancy (Type S) – One-year full replacement warranty plus an additional nine years pro-rata.
   2. Sealed Lead Calcium, 20-year life expectancy (Type G) – One-year full replacement warranty plus an additional fourteen years pro-rata.
   3. Wet Cell Nickel Cadmium, 25-year life expectancy (Type N) – One-year full replacement warranty plus an additional fourteen years pro-rata.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrate and supporting grids for luminaires.

B. Examine each luminaire to determine suitability for lamps specified.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Fixture Location: Locations shown are approximate only. Install at locations shown on architectural drawings and as required to coordinate with tile patterns, architectural features, and mechanical work. In mechanical rooms, locate to clear mechanical installations.

C. In seismic design category D, E, & F, fixtures installed in lay-in ceiling grid shall be supported as follows in addition of being securely fastened to the ceiling grid. Refer to specification section 26 0548 for additional fixture support information.
   1. Less than 10lbs: one 12-gauge safety wire connected to structure.
   2. More than 10lbs but less than 56lbs: two 12-gauge safety wires connected to structure.
   3. More than 56lbs: shall be supported directly from structure independent of the ceiling grid

D. Locate recessed ceiling luminaires as indicated on Architectural reflected ceiling plan.

E. Install surface mounted luminaires and exit signs level, plumb, square and adjust to align with building lines and with each other. Secure to prohibit movement.

F. Exposed Grid Ceilings: Fasten surface mounted luminaires to ceiling T using bolts, screws, rivets, or suitable clips. On non-fire rated lay-in ceilings, Contractor shall install surface-mounted light fixtures on 1-1/2 inch spacers.

G. Install recessed luminaires to permit removal from below. Final connections to lay-in light fixtures shall be made with 6'-0" flexible conduit from junction box to light fixture. Flexible conduit shall not go from light fixture to another light fixture.

H. Install recessed luminaires using accessories and fire stopping materials to meet regulatory requirements for fire rating at ceiling.

I. Provide and install insulation barriers for all light fixtures that may contact insulation if the fixture is not IC Rated.

J. Install clips to secure recessed grid-supported luminaires in place.

K. Install wall mounted luminaires, emergency lighting units and exit signs at height as indicated on drawings.

L. Install all accessories furnished with each luminaire or as required for a complete installation as indicated.

M. Connect luminaires, emergency lighting units and exit signs to branch circuit outlets provided under Section 26 0533 using flexible conduit or as indicated on the drawings.

N. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

O. Bond products and metal accessories to branch circuit equipment grounding conductor.

P. All fixtures shall be guaranteed for a period of one year after final acceptance and any defects in material or workmanship during this period shall be replaced or repaired to the Engineer's satisfaction without extra cost.

Q. All supports, safety chains, swivels, etc. shall be furnished as required

for a complete installation.

R. Securely fasten all exit signs and emergency lighting units to surface to which they are mounted.

S. Replace all broken or cracked lens.

T. Replace all scratched or bent reflectors and doorframes.

U. Light fixtures shall not be supported from conduits, duct or piping.

V. All recessed light fixtures shall have seismic clips firmly situated over tops of ceiling grid tees or plaster rings.

W. 2 by 2 light fixtures shall have louvers and lamps oriented in the same direction.

X. Touchup scratched or marred surfaces to match original finish.

Y. Surface-mounted light fixtures shall be mounted at least 80 inches above the floor to the bottom of the light fixtures.

3.03 FIELD QUALITY CONTROL

A. Perform the following test and inspections:
   1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation. Inspect for proper connection and operation.
   2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to emergency power (i.e., Battery power) and retransfer to normal.

B. Prepare test and inspection reports.

3.04 ADJUSTING

A. Aim and adjust luminaires as indicated on drawings or as directed.

B. Adjust exit sign directional arrows as indicated.

C. If Owner complains of glare from light fixtures; add glare control, adjust light fixtures, or relocate light fixture as required to remove

SECTION 31 10 00

CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Clearing, grubbing, removal and disposal of vegetation, rocks, roots and debris within the limits of the work except objects designated on the drawings to remain.

B. Preserve from injury or defacement all vegetation and objects to remain.

1.02 RELATED WORK

A. Section 31 20 00: Site Grading and Filling

1.03 LIMITS OF WORK

A. Rights-of-way area established by Engineer.

B. Construction area including the area bounded by lines five feet outside the construction lines established by Engineer.

C. Approved borrow pit areas.

D. Designated stockpiles of construction material other than borrow material.

1.04 PROTECTION

A. Protect living trees not marked for removal and outside the construction area. Treat cut or scarred surfaces of trees or shrubs with a paint prepared especially for tree surgery.

B. Protect benchmarks and existing structures, roads, sidewalks, paving and curbs against damage from vehicular or foot traffic.

C. Maintain designated temporary roadways, walkways, and detours, for vehicular and pedestrian traffic.

PART 2 - PRODUCTS

(Not applicable)

PART 3 – EXECUTION

3.01 PREPARATION

A. Maintain benchmarks, monuments and other reference points. Re-establish if disturbed or destroyed at no cost to Owner.

3.02 CLEARING AND GRUBBING

A. Clear rights-of-way, borrow pit and other stockpile areas of objectionable material to the ground surface except for trees and stumps.

B. Cut trees and stumps outside the construction area marked for removal by the Engineer to within six inches of the ground surface.

C. Remove low hanging, unsound or unsightly branches on trees or shrubs designated to remain.

D. Grub construction area of protruding obstructions except sound undisturbed stumps and roots six inches or less above the ground which will be a minimum of 5' below subgrade or embankment slope provided undercutting, topsoil stripping or other corrective measures are not stipulated.

E. Grub borrow pit and stockpile areas of all objectionable material. Strip overburden over the material to be obtained in stockpile areas.

F. Perform clearing and grubbing well in advance of construction or material removal activities.

3.03 BACKFILLING AND SURFACE PREPARATION

A. Backfill and compact all depressions resulting from clearing and grubbing with suitable materials in accordance with Section 02210.

1. Backfill embankment areas to natural ground elevation.
2. Backfill excavation areas below finished subgrade to finished subgrade.

B. Perform backfilling a satisfactory distance ahead of construction operations.

C. Prepare areas designated on the drawings to receive erosion control matting to smooth surfaces that have been shaped, fertilized, and seeded.

3.04 DEBRIS REMOVAL

A. Promptly remove cleared debris from site.

B. Obtain permission from applicable regulatory authority for disposal of debris to waste disposal site.

END OF SECTION

SECTION 31 20 00

SITE GRADING AND FILLING

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02 06 14: Geotechnical Data

B. Section 01 45 23: Testing Laboratory Services

1.02 QUALITY ASSURANCE

A. Testing Laboratory and Soils Engineer:

1. Soils compaction testing of in-place soil and filled and compacted areas will be performed by Testing Laboratory in accordance with those standards listed herein.

1.03 PROTECTION

A. Protect excavations and grounds from water ponding and water damage. Construct and maintain temporary drainage. Pump, if required to keep excavations free of water. Maintain site in well drained condition at all times.

B. Protect, maintain, and restore benchmarks, monuments, and other reference points affected by this work. If bench marks, monuments or other permanent reference points are displaced or destroyed, points shall be re-established, and markers reset under supervision of a licensed surveyor who shall furnish Owner's Representative with certification of his work.

C. Protect utilities and other construction designated to remain to place.

D. Protect trees to remain in place.

1.04 LINES AND GRADES

A. It is imperative that lines and grades established on drawings, except for allowance for installation of fill aggregate, concrete, and topsoil established below, be met when this work is completed.

1.05 SUBMITTALS TO DESIGN PROFESSIONAL AND/OR OWNERS REPRESENTATIVE

A. Submit one copy of permits and notices obtained from local jurisdiction before commencing work.

B. Obtain and submit certification of adequacy of site grading and filling from Testing Laboratory, signed and sealed by a qualified Soils Engineer, stating that work is in accordance with Contract Documents, and that soils are capable of supporting the structure to be constructed under the Contract.

C. If benchmarks and other permanent reference points are displaced, obtain, and submit certification, signed and sealed by a licensed surveyor, of proper re- establishment of benchmarks and reference points.

PART 2 - PRODUCTS

2.01 GRANULAR FILL

A. (Under structural slabs only) Natural gravel or crushed stone not more than 3/4 inch in its largest dimension and ranging down, but with less than 5 percent passing a No. 200 sieve.

2.02 EARTH FILL

A. Clean earth (free from organic material, cinders, ice and rocks over 2 inches in their longest dimension) consisting of either low plasticity clay having a plasticity index of less than 20, or a cohesionless soil with less than 15 percent passing a No. 200 sieve.

B. On-site earth removed during cutting operations may be used if it meets the above requirements.

PART 3 - EXECUTION

3.01 REMOVAL OF OBSTRUCTIONS (If required)

A. Clean out cellars, wells, cisterns, septic tanks and drain fields, cesspools, catch basins, manholes, and similar items to solid subgrade and break up masonry and/or concrete bottoms so that no pieces remain which are over 12 inches in their largest dimension. Break out masonry and concrete sides of such construction to a depth of at least 2'-0" below bottoms of footings to be installed as part of this project or subgrade, as applicable.

B. Fill basements, cellars, walls and other items enumerated above with specified granular fill and compact to 95 percent Standard Proctor Density.

3.02 DISPOSITION OF ABANDONED UTILITIES

A. If abandoned underground utility lines and electric conduit are uncovered in the course of grading, then that part uncovered shall be removed and capped off at points of removal as well as at property lines.

3.03 REMOVAL AND STORAGE OF TOPSOIL

A. Remove sufficient topsoil from areas to be covered by construction, excavated, filled or graded to provide the amount required in topsoil replacement.

B. Remove topsoil to entire depth.

C. Mow grass, weeds and other annual-type growth, and brush close to ground.

D. Scrape or rake area to remove brush, roots, loose grass, weeds and rocks before stripping topsoil.

E. Topsoil to be stored for reuse shall meet requirements established above.

F. Store topsoil in area designated by Engineer. Store so as to prevent erosion and mixture with debris and other materials.

3.04 SITE EXCAVATION AND PROOF-ROLLING

A. After this stripping is done, proof-roll these areas with a loaded rubber-tired dump truck having a single axle load of approximately 40,000

pounds. Operate the truck at a normal walking speed so that the Soils Engineer may observe the ground while walking beside the truck.

B. The Soils Engineer will inspect the areas for soft spots.

3.05 REMEDIAL WORK

A. During the course of proof-rolling and inspection, as the Soils Engineer finds soft spots, he will direct cutting out of soft spots and backfilling with specified, compacted earth fill.

3.06 GENERAL SITEWORK

A. Fill and grade to attain elevations indicated +/- 0.1' less allowances for placement of aggregate, concrete, walks, drives and parking areas, and topsoil.

B. Inside of building lines, fill with specified earth fill and allow for placement of indicated depth of granular fill and indicated thickness of concrete, unless noted otherwise on the Contract Drawings.

C. Outside of building, in areas designated to receive topsoil, grade, or fill and compact specified earth, to bring areas to finished grade +/- less 6" for placing topsoil.

D. Where exterior walks are indicated, allow for placement of 4" of granular fill and 4" of concrete and finish +/- 0.1'.

E. Where drives are indicated to join the building, allow for placement of concrete or aggregate base/asphalt section as shown on the Drawings.

3.07 GRADING

A. Grade to uniform levels and slopes, without abrupt changes. Make transitions from levels to slopes with roundings of large radius.

B. Finish areas to a reasonably true and even plane at required elevations, less allowances for items specified above.

C. Along the lines indicating the limits of work, taper finish grade to the existing grade at a slope matching the natural contour. Perform all of this work within the limit lines.

3.08 FILLING

A. When excavation is complete, place granular fill base for concrete slabs. Roll and tamp granular fill to thoroughly compact it. Coordinate this work with concrete trade so that concrete can be placed before rain, if a sand base is used.

B. Outside of building in areas to be paved or covered by construction, fill as specified above for fill within building lines.

C. Outside of building in areas where no construction or paving will be placed, place specified earth fill in loose lifts of 12" and thoroughly compact.

3.09 COMPACTION DENSITIES

A. For all compaction, except those areas where there will be no construction or pavement:

1. Compact to a density of 95 percent at optimum moisture content (ASTM D 1557, Modified Proctor Method).

B. For areas where no construction will be placed, compact to a density of 90 percent at optimum moisture content (ASTM D 1557, Modified Proctor Method).

3.10 COMPACTION TESTING

A. While filling and compacting operations are in progress, Soils Engineer will make density tests at random depths and at random locations to determine adequacy of compaction. If compaction tests do not meet specified densities, take action to compact to required densities and pay for retesting to prove compaction densities.

3.11 PLACING OF TOPSOIL

A. Place topsoil in areas disturbed by construction and not covered by paving, buildings and other hard-surfaced materials.

B. When directed by Owner's Representative, scarify sub-grade to a depth of 3" and spread topsoil uniformly to bring finished grade to elevations indicated after topsoil has been lightly compacted with roller. Topsoil shall be 6" thick.

C. Level and slope topsoil as indicated so that finished grades are +/- 0.1' elevations indicated.

3.12 SITE DRAINAGE

A. The work in this section consists of furnishing all materials, accessories, equipment, tools, transportation, service and performance of all operations required to execute the construction of the complete system of site drainage as shown, and including all excavation, backfill structures and catch basins, grading, pipe and connections and all other items shown are required.

B. All storm drainage pipe shall be reinforced concrete pipe, unless noted as otherwise on plans, and conforming to the following:

1. Reinforced Concrete Pipe: shall conform to ASTM C76 for the specified diameters and strength classes. Horizontal and vertical elliptical pipe shall conform to ASTM C507. Arch pipe shall conform to ASTM C506.
2. Precast reinforced concrete end sections shall conform to the cited specifications to the extent to which they apply.

C. Joints for concrete pipe shall be rubber gasket joints.

D. Rubber Gasket Joints - Rubber gaskets shall conform to ASTM Specifications C443, and shall be continuous rubber rings fitting snugly into the annular space between the parallel surfaces of the tongue and groove ends of the pipe to form a flexible and watertight seal under all conditions of service. Make rubber gasket joints as recommended by the

gasket manufacturer and generally as follows: Prior to installing the pipe and when recommended by the gasket manufacturer, the gasket shall be cemented to the tongue end of the pipe with a special rubber cement furnished by the manufacturer of the gasket. When placing gasket, the pipe tongue surface shall be dry and clean. Affix gasket to the pipe not more than 24 hours prior to installation. Before installing pipe, the entire interior of the groove shall be cleaned and lubricated, as well as the gasket over which the groove is fitted. All pipe shall be aligned with the previously installed pipe and the joint pulled together tightly. If the gasket becomes loose or displaced, the pipe section shall be removed and the joint remade satisfactorily. All joints shall be inspected both inside and outside for gasket faulting or displacement.

E. The sizes of pipe shall be identified by the nominal inside diameter. The pipe shall be of the sizes stipulated in the contract, shown on the plans, or established by the Project Engineer.

3.13 CLEANUP

A. After all other work of this section is completed, leave area clean and free of any debris

END OF SECTION

SECTION 31 23 00

FOUNDATION EXCAVATING AND BACKFILLING

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 45 23: Testing Laboratory Services

B. The Contractor shall follow project requirements in the Geotechnical Exploration AGFC Charlie Craig Hatchery Improvement Blytheville, Arkansas: Geotechnology, LLC Memphis Tennessee Dated April 17, 2023 Geotechnology Project Number: J037472.01

1.02 QUALITY ASSURANCE

A. A Soils Engineer will be utilized by the Contractor to inspect foundation bottoms and compensated as noted in Section 01410 - Testing Laboratory Services.

B. The Contractor shall pay for any retesting required as a result of work not meeting project specifications.

1.03 PROTECTION

A. Protect utilities and other items of physical property to remain in place.

B. Protect excavations and grounds from water ponding and water damage. Pump as required to remove water.

1.04 VERIFYING

A. Lay out lines and verify grades. Prior to construction, building location must be staked and certified by a registered Land Surveyor acceptable to the Owner's Representative. If discrepancies exist between actual lines and elevations and those indicated on drawings, notify Owner's Representative and obtain a decision before starting work.

1.05 COORDINATION

A. Coordinate with other trades whose work will be affected by this work. Especially coordinate with plumbing trade for pipes required to pass below foundations.

PART 2 - PRODUCTS

2.01 EARTH FILL

A. Clean earth (free from organic material, cinders, ice and rocks over 2 inches in their longest dimension) consisting of either low plasticity clay having a plasticity index of less than 30, or a cohesionless soil with less than 15 percent passing a No. 200 sieve unless noted otherwise in the Geotechnical Report.

B. On-site earth removed during cutting operations may be used if it meets the above requirements

2.02 AGGREGATE BACKFILL

A. Uniform clean crushed limestone or river gravel with none passing the No. 4 sieve size and 100% passing the 2-inch size unless noted otherwise in the Geotechnical Report.

PART 3 - EXECUTION

3.01 INSPECTION

A. Soils Engineer shall inspect all foundation excavations prior to placement of concrete.

3.02 EXCAVATING

A. Excavate to depths indicated. If forms are required, provide sufficient space to permit erection of forms, shoring, construction and inspection.

B. Do not excavate to full depth when there is probability of frost forming or ground freezing in excavations before concrete is placed.

C. Level bottoms of trenches and excavations. Where elevation changes are required, bench excavation.

D. Foundation trenches may be cut to true size where earth is firm enough to permit it, so that concrete can be placed without forms, unless unknown conditions prohibit it.

E. Keep excavations dry by sloping ground away from holes and trenches. Furnish pumps to keep spaces clear of water, where necessary.

F. When excavation reaches full depth, Soils Engineer will inspect for adequacy of bearing. If Soils Engineer directs, excavate to a greater depth and backfill with specified concrete. In this case, keep accurate records of materials removed and concrete placed.

3.03 BACKFILL AND COMPACTING OF BELOW GRADE WALLS

A. Do not perform this work until all testing has been performed and the Owner's Representative has approved foundations, walls below grade, and other construction to be covered up.

B. Before depositing backfill, remove vegetation and other unsuitable material. Do not place backfill on subgrade that is muddy or is frozen.

C. Use caution to protect walls from unbalanced loads.

D. Backfill with gravel or other suitable material indicated in Section 02210 unless noted otherwise. Place and compact in 8" (max.) lifts to achieve indicated compaction to levels of adjacent grades.

E. Sand backfill shall extend from two feet (min.) off the outside corner of the foundation slab to the finished grade elevation, less allowance for topsoil, at an angle not more than 30 degrees above the horizontal.

F. Backfill shall be all earth fill or topsoil compacted to 95 percent at optimum moisture content (ASTM D-698, Standard Proctor).

G. Remove excess excavated materials from job site and when work is completed, leave site in a clean condition.

END OF SECTION

SECTION 31 23 33

TRENCHING, BACKFILLING, AND COMPACTION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Excavation for piped utility material.

B. Provide necessary sheeting, shoring and bracing.

C. Prepare trench bottom with appropriate materials.

D. Dewater excavation as required.

E. Place and compact granular beds, as required, and backfill.

1.02 RELATED WORK

None

1.03 PRECAUTIONS

A. Notify utility companies when necessary to disturb existing facilities and abide by their requirements for repairing and replacing.

B. Protect all vegetation and other features to remain.

C. Protect all benchmarks and survey points.

PART 2 - PRODUCTS

2.01 BEDDING AND BACKFILL MATERIALS

A. Class I Material: Angular, 1/4 to 1 inch graded stone including a number of fill materials that have regional significance such as crushed stone, cinders, slag, and crushed shells.

B. Class II Material: Coarse sands and gravels with a maximum particle dimension of 1-1/2 inch including variously graded sands and gravels

containing small percentages of fines, generally granular and non-cohesive, either wet or dry.

C. Class III Material: Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures.

D. Class IV Material: Silt, silty clays, and clays, including inorganic clays and silts of medium to high plasticity and liquid limits.

E. Class V Material: Organic soils, as well as, soil containing frozen earth, debris, rocks larger than 1-1/2 inches and other foreign material. Whenever encountered in the trench Class V Material shall be removed and disposed of as excess excavation. Class V Material shall not be used for pipe bedding or backfill.

F. Class A Material: Continuous concrete cradle constructed in conformity with details shown on drawings, consisting of Class "B" concrete, 3000 psi minimum comprehensive strength at 28 days.

G. Class B Material: Sand or a natural sandy soil, all passing a 3/8" sieve with not more than 10% passing a No. 200 sieve; or stone, gravel, chert or slag.

H. Class C Material: Natural ground or compacted embankment at a depth of at least 10% of the outside vertical pipe diameter.

PART 3 - EXECUTION

3.01 PREPARATION

A. Install barriers and other devices to protect areas adjacent to construction.

B. Protect and maintain all benchmarks and other survey points.

3.02 EXCAVATION TRENCHES

A. Perform in such a manner as to form a suitable trench in which to place the pipe and so as to cause the least inconvenience to the public.

B. Maximum width, for water pipe, at the crown of the pipe - 2'-0" plus the nominal diameter of the pipe unless approved by the Engineer

C. Cut pavement along neat, straight lines with a pavement saw.

D. Trench depth: for force mains - as shown on the plans.

E. Align trench as shown on the plans unless a change is necessary to miss an unforeseen obstruction.

F. For force mains, shape the bottom of the trench to provide uniform bearing of the pipe on undisturbed earth throughout its entire length. Dig bell holes to aid in securing uniform support of the pipe.

G. For sewer pipe, fill the bottom of the trench with granular material as specified herein.

H. When unstable soil is encountered at the trench bottom, remove it to a depth required to assure support of the pipeline and backfill to the proper grade with crushed limestone aggregate, Size No. 67.

I. No more than 50 feet of trench will be excavated ahead of backfilling operations unless otherwise permitted by the Designer.

3.03 SHEETING SHORING, AND BRACING

A. When necessary or when required by local, State or Federal safety requirements, furnish, put in place, and maintain such sheeting, bracing, etc., as may be required to support the sides of the excavation and to prevent movement which can in any way damage adjacent pavement or other structures, damage or delay the work or construction or endanger life or health.

B. Take care to prevent voids outside the sheeting.

C. If voids are formed, immediately fill and ram to the satisfaction of the Designer.

D. Devise plans for performing this work subject to the approval of the Designer.

E. Unless adjacent facilities will be injured, remove all sheeting, shoring and bracing after backfill has been placed to a depth of 18 inches over the pipeline.

F. Cut shoring off at the top of the pipe and leave the lower section in the trench.

3.04 DISPOSAL OF EXCAVATED MATERIAL

A. Satisfactorily dispose of all excess excavated material that cannot be used or is not suitable for embankments.

3.05 UNAUTHORIZED EXCAVATION

A. All excavation outside or below the proposed lines and grades shown on the plans or directed by the Designer.

B. Backfill areas of unauthorized excavation with the type material necessary (earth, rock or concrete) to insure the stability of the structure of construction involved.

C. Unauthorized excavation or backfill to replace same shall be at Contractor's expense.

3.06 REMOVAL OF WATER

A. Keep excavated areas free of water while work is in progress.

B. Dewatering shall be performed if required by ground conditions and paid for by the Contractor.

C. Take particular precautions to prevent the displacement of structures or pipelines as a result of accumulated water.

3.07 OBSTRUCTIONS

A. Obstructions shown on the plans are for information only and do not guarantee their exact locations nor that other obstructions are not present.

B. When utilities or obstructions are not shown on the plans but are present off the roadway at the location of the proposed pipeline route, the Contractor may request to relocate the pipeline in the roadway if necessary to avoid disturbing the utility or obstructions.

C. Exercise due care in excavating adjacent to existing obstructions and do not disturb same unless absolutely necessary.

D. In the event obstructions are disturbed, repair or replace as quickly as possible to the condition existing prior to their disturbance.

E. If required by the utility company, pay for the repair or replacement work performed by the forces of the utility company or other appropriate party.

F. If replacement or repair of disturbed obstructions is not performed after a reasonable period of time, the Owner may have the necessary work done and deduct the cost of same from payments to the Contractor.

3.08 GRAVITY SEWER BEDDING

A. Always maintain proper grade and alignment during the bedding and tamping process.

1. Any pipe dislodged during this process shall be replaced by the Contractor at his expense.
2. Dig bell holes to assure uniform support of the pipe.

B. Bedding for PVC, Closed Profile PVC, Open Profile PVC, DI, and RCP Sewers:

1. Bed all pipe regardless of size in compacted Class I angular material from 6" below the pipe to 6” above the top of the pipe, with minimum 9” side bedding.

3.09 BEDDING FOR FORCEMAINS

A. Bed in a trench cut in natural ground.

B. Dig bell holes to assure uniform support throughout the entire length of pipe.

C. Excavate the trench in such a manner as to form a suitable bed in which to place the pipe.

3.10 INITIAL BACKFILLING

A. Do not begin backfilling before the Designer has inspected the grade and alignment of the pipe, the bedding of the pipe, and the joints between the pipe. If backfill material is placed over the pipe before an inspection is made, reopen the trench in order for an inspection to be made.

3.11 FINAL BACKFILLING

A. After the backfill has reached a point 18" or more above the top of the pipe, perform final backfilling depending on the location of the work and danger from subsequent settlement.

B. Backfilling in Unimproved Areas:

1. Dispose of and replace all soft or yielding material which is unsuitable for trench backfill with suitable material.
2. Deposit backfill to the surface of the ground by dragline, bulldozer, or other suitable equipment in such a manner so as not to disturb the pipe.
3. Backfill not under streets and driveways shall be compacted to 90% Standard Proctor in a maximum of 12-inch deep lifts.
4. Neatly round sufficient surplus excavated material over the trench to compensate for after settlement.
5. Dispose of all surplus excavated material.
6. Prior to final acceptance, remove all mounds to the elevation of the surrounding terrain.
7. Contractor shall maintain backfilled trench until warrantee period of project is expired.

C. Backfilling Beneath Driveways and Streets where Non-Rigid and Rigid Type Surfacing is to be Replaced:

1. Backfill entire trench from top of pipe bedding to within thirteen inches (13") of final grade with Class A II Material commonly designated as “pea gravel”.
2. Backfill next ten inches (10”) with compacted Class “II” crushed limestone with fines.
3. Replace asphaltic concrete surface with two inches (2”) of ArDOT Item No. 406 and the final one-and-one-half inch (1.5”) surface with ArDOT Item No.407 mix (or equivalent Arkansas DOT products).

D. Backfilling of Shoulders Along Streets and Highways:

1. Backfilling methods and materials for shoulders along streets and highways shall be in accordance with the requirements of

governing local, county, or state departments maintaining the particular roadway or highway.

2. Replace with similar materials, all shoulders which may be damaged or destroyed as a result of pipe trenching.
3. Backfill shall be compacted to at least 95% standard proctor, ASTM D 698.

E. Crushed Stone for Pavement Maintenance and Shoulder Replacement:

1. Where possible, salvage and reuse all base material that is removed during construction.
2. Wet and thoroughly compact crushed stone and blade to tie into the existing surface prior to final acceptance.

F. Flowable Fill:

1. This item shall consist of the furnishing, mixing, and placing a flowable mixture of Portland cement, fly ash, sand, and water for backfilling pipe culverts or other uses approved by the Engineer.

2. The mix design will be prepared by the Contractor. The mixture will be proportioned to produce a flowable mixture without segregation.

3. Material for one cubic yard, absolute volume, shall be as follows:

Cement	80-100lbs.
Fly ash	220-300lbs.
Sand	Variable to equal one cubic yard
Water	Approximately 65 gallons

4. The minimum flow of the mixture shall be 8". The unit weight shall be a minimum of 110 lbs./cubic foot.

END OF SECTION

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SECTION 31 25 00

EROSION CONTROL

PART I - GENERAL

1.01 DESCRIPTION

A. This work shall consist of temporary erosion control measures as shown on the plans or where field conditions warrant or as directed by the Owner's Representative to be coordinated with the permanent erosion control features, to assure economical, effective, and continuous erosion control throughout the construction and post construction period.

1.02 MATERIALS

A. Baled Hay

1. Baled hay shall be either hay or straw containing five (5) cubic feet or more of material.

2. Baled hay or straw shall be used where the existing ground slopes toward or away from the roadway along the toe of slopes, in ditches, or other areas where siltation, erosion or water run-off is a problem.

B. Temporary Silt Fences

1. Silt fences shall utilize woven wire or other approved material attached to posts with filter cloth composed of burlap, plastic filter fabric, etc. attached to the upstream side of the fence to retain the suspended silt particles in the run-off water.

C. Baled hay and silt fences shall be constructed together and placed at all locations where erosion is a problem or as directed by the Owner's Representative.

1.03 EQUIPMENT

A. All equipment necessary for the satisfactory performance of this work

shall be on the project and approved, before work will be permitted to begin.

PART II - CONSTRUCTION PROCEDURES

2.01 BALED HAY WITH SILT FENCE

A. Baled hay or straw with silt fence shall be embedded in the ground 4 to 6 inches to prevent water flowing under them. The bales shall also be anchored securely to the ground by wooden stakes driven through the bales into the ground. The Contractor shall keep the bales in good condition by replacing broken or damaged bales immediately after damage occurs. Normal debris clean-out will be considered routine maintenance. Baled hay or straw with silt fences shall be placed on the natural ground, at the bottom of fill slopes, in ditches, or other areas where siltation is a problem.

B. The Contractor shall be required to maintain the baled hay or straw with silt fence in a satisfactory condition for the duration of the project or until its removal is requested by the Owner's Representative. The silt accumulation at the fence may be left in place and seeded, removed, etc. as directed by the Owner's Representative. The baled hay or straw with silt fence becomes the property of the Contractor whenever it is removed.

C. The temporary erosion control features installed by the Contractor shall be acceptably maintained by the Contractor until no longer needed or permanent erosion control methods are installed. Any materials removed shall become the property of the Contractor.

D. In the event that temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as part of the work as scheduled, and are ordered by the Owner's Representative, such work shall be performed by the Contractor at his own expense.

E. In case of repeated failure on the part of the Contractor to control erosion, pollution and siltation, the Owner's Representative reserves the right to employ outside assistance or to use his own forces to provide the necessary corrective measures. Such incurred direct costs plus project engineering costs will be charged to the Contractor and

appropriate deductions made from the Contractor's monthly progress estimate.

F. Temporary pollution control shall include construction work outside the rights-of-way where such work is necessary as a result of construction such as; borrow pit operations, haul roads and equipment storage sites. Bid price in such cases shall include all necessary clearing and grubbing, construction incidentals, maintenance, and site restoration when no longer needed.

2.02 BALED HAY OR STRAW

A. Baled hay or straw will be placed around all inlets and in swales where necessary to help prevent erosion.

END OF SECTION

SECTION 31 37 00

RIP-RAP

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Preparation of Foundation.

B. Placing of stone rip-rap.

PART 2 - PRODUCTS

2.01 STONE

A. Stone shall be sound, dense and durable, free from cracks, pyrite intrusions and other structural defects and have a density of not less that 150 pounds per solid cubic foot. When tested by the Los Angeles method, the percent of wear shall not exceed 60.

When the stone is subjected to five alternations of the sodium sulfate soundness test, the weighted percentage of loss shall be not more than 15.

Stone shall conform to one of the following graduations and shall be approximately rectangular in shape:

RIP-RAP GRADATIONS

GRADE B
1,200 pound maximum weight

Weight			Percent
750 lbs.	to	1,200 lbs.	27%
400 lbs.	to	749 lbs.	25%
200 lbs.	to	399 lbs.	25%
50 lbs.	to	199 lbs.	15%
10 lbs.	to	49 lbs.	5%
less than 10 lbs.			3%

GRADE C
400 pound maximum weight

Weight			Percent
250 lbs.	to	400 lbs.	30%
50 lbs.	to	249 lbs.	20%
30 lbs.	to	49 lbs.	25%
10 lbs.	to	29 lbs.	20%
less than 10 lbs.			5%

GRADE D
125 pound maximum weight

Weight			Percent
90 lbs.	to	125 lbs.	25%
25 lbs.	to	89 lbs.	50%
10 lbs.	to	24 lbs.	15%
under 10 lbs.			10%

2.02 FILTER FABRIC AND FASTENERS

The filter cloth material used as a base for rip-rap shall be pervious sheets of strong, rot-proof non-woven plastic fabric meeting the following specifications:

Physical Property	Test Method	Acceptable Test Results
Tensile Strength, wet, lbs	ASTM D-1682	200 (min)
Elongation, wet, %	ASTM D-1682	40 (min)
Coefficient of Water Permeability, cm/scc	Constant Head	.03 (min)
Puncture Strength, lbs	ASTM D-751	100 (min)
Pore Size – EOS U.S. Standard Sieve	Corps of Engineers CW-02215	40 (max)

Unless noted differently above, the Filter Fabric shall meet or exceed the minimum requirements for Class A erosion control fabric as specified in AASHTO M288-92.

The Contractor shall furnish a certified laboratory test report from an approved testing laboratory with each shipment of materials. Laboratory test reports

shall include actual numerical test data obtained on this product.

Pins may be any commercially available pin 6 inches in length capable of retaining a washer. Washers may be any commercially available washer 2 inches in diameter and compatible with the pin. The pins and washers shall be manufactured from corrosion resistant metal material.

PART 3 - EXECUTION

3.01 SUBGRADE PREPARATION

A. The area to be occupied by the rip-rap stabilization shall be cleared of all trees, roots, vegetation, and similar material. Immediately prior to the placement of rip-rap, the slopes or ground surface shall be trimmed in conformity to the lines and grades indicated on the Plans or as directed by the Engineer and shall be thoroughly compacted by the use of hand or mechanical tamps. Unless otherwise specified herein make all fill with suitable materials excavated from site. All fills in dry areas shall be compacted to a maximum density of 95 percent as determined by ASTM D 698 (Standard Proctor). On slopes, the bottom of the rip-rap shall be placed at least 2 feet below the natural ground surface, unless otherwise directed or shown on the Plans.

Surplus excavated material shall be removed from the site and disposed of as shown on the plans or as directed by the Owner's Representative. Spoil material shall not be disposed of in a watercourse or on the banks of a watercourse.

3.02 FILTER FABRIC

Unless otherwise specified, filter fabric shall be placed on the prepared and compacted subgrade within the limits shown on the Plans for stone and/or sacked sand cement rip-rap. The filter fabric shall be laid loosely without wrinkles or crease. When more than one width or length of filter fabric is necessary, the joints shall be overlapped a minimum of 24 inches. Securing pins with washers shall be inserted through both strips of overlapped material and into the material beneath, until the washer bears against the fabric and secures it firmly to the base material. These securing pins shall be inserted through the overlapped fabric at not greater than 2-foot intervals along a line through the midpoint of the overlap. If the fabric is torn or damaged, a patch overlapping the edges of the damaged area by 2 feet shall be sewn securely to

the fabric with a continuous, monofilament, rot-proof material.

3.03 STONE RIP-RAP

A. Stone rip-rap shall be constructed upon the prepared foundation by hand placing, so that the stones shall be as close together as is practicable in order to reduce the voids to a minimum.

When rip-rap is constructed in more than one layer, it shall be so placed that it will be thoroughly tied together with the larger stones protruding from one layer into the other.

Each stone shall be placed so that the depth will be perpendicular to the surface upon which it is set. The length shall be placed as directed by the Owner's Representative and each main stone shall be placed so that it will be against the adjoining stones. The stones shall be placed in such a manner as to stagger all joints as far as it is possible and practicable.

The main stones shall be thoroughly "chinked" and filled with the smaller stones by throwing them over the surface in any manner that is practicable for the smaller stones to fill the voids. This work shall continue with the progress of the construction. Tamping of the stones will not be required if the stones have been placed in a reasonable and satisfactory manner.

Knapping of the stones will not be required, except individual stones protruding more than 4 inches above the specified grade, in which case, these stones shall be broken down to come within 4 inches of the specified grade.

END OF SECTION

objectionable glare.

3.05 CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.

B. Remove dirt and debris from enclosure.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

E. Clean lighting control elements, lamps, fixture interiors and exposed exterior surfaces thoroughly before requesting final inspection.

END OF SECTION

SECTION 31 31 16
TERMITE CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Chemical soil treatment.

1.02 REFERENCE STANDARDS

A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; 2019.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.

C. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements.

D. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.

E. Certificate of compliance from authority having jurisdiction indicating approval of toxicants.

F. Manufacturer's Instructions: Indicate caution requirement.

G. Maintenance Data: Indicate re-treatment schedule and ____.

H. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing this type of work and:
   1. Approved by manufacturer of treatment materials.
   2. Licensed in the State in which the Project is located.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year installer's warranty against damage to building caused by termites.
   1. Include coverage for repairs to building and to contents damaged due to building damage. Repair damage and, if required, re-treat.
   2. Inspect annually and report in writing to Owner. Provide inspection service for _____ years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 CHEMICAL SOIL TREATMENT

A. Toxicant Chemical: EPA Title 7, United States Code, 136 through 136y approved; synthetically color dyed to permit visual identification of treated soil.

B. Diluent: Recommended by toxicant manufacturer.

C. Mixes: Mix toxicant to manufacturer's instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.

B. Verify final grading is complete.

3.02 APPLICATION - CHEMICAL TREATMENT

A. Comply with requirements of U.S. EPA and applicable state and local codes.

B. Spray apply toxicant in accordance with manufacturer's instructions.

C. Apply toxicant at following locations:
   1. Under Slabs-on-Grade.
   2. In Crawl Spaces.
   3. At Both Sides of Foundation Surface.

D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.

E. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.

F. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.

G. Re-treat disturbed treated soil with same toxicant as original treatment.

H. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 INSTALLATION - SITE-APPLIED TERMITICIDE

A. Comply with manufacturer's written instructions.

3.04 PROTECTION

A. Do not permit soil grading over treated work.

B. Protect sheet materials from damage after completed installation. Repair damage with manufacturer's recommended products and according to the manufacturer's written instructions.

END OF SECTION

SECTION 32 01 17

ASPHALT PAVEMENT REPAIR

PART 1 - GENERAL

1.1 SUMMARY

A. Repair asphaltic concrete pavement disturbed during construction in accordance with this Section and details shown on the Drawings.

B. Contractor shall comply with all requirements of county or city in which the work is being done and the Arkansas State Highway and Transportation Department.

C. Contractor shall secure permits and inspections, post necessary bonds, and pay necessary fees.

D. Where asphalt streets, driveways, or parking areas are disturbed during trench excavation, the surface shall be replaced as soon as practical after completion of backfilling so as to restore it to the original condition.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials, 444 North Capitol Street North West, Suite 249, Washington, DC 20001.

1. AASHTO M82 - Standard Specification for Cut-Back Asphalt (Medium-Curing Type).

B. American Society of Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428.

1. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600 kN-m/m^3))

C. Arkansas State Highway and Transportation Department, P.O. Box 2261, Little Rock, AR 72203.

1. AHTD - Standard Specifications for Highway Construction, Latest Edition.
2. AHTD 303 - Aggregate Base Course.
3. AHTD Division 400 - Asphalt Pavements
   a. AHTD 407 - Asphalt Concrete Hot Mix Surface Course

PART 2 - PRODUCTS

2.1 ASPHALTIC PAVING MATERIALS

A. Base Coarse: Crushed stone conforming to AHTD Standard Specifications for Highway Construction Section 303, Class 7.

B. Prime Coat: Medium curing cut-back asphalt; MC-30 or MC-70; AASHTO M82; heated and applied within the temperature range 80 degrees F. - 150 degrees F.

C. Hot-mix surfacing material shall meet the following requirements: Asphaltic Cement Hot Mix Surface Course (½") in accordance with Section 407 of the AHTD Standard Specifications for Highway Construction.

2.2 REINFORCEMENT STEEL

A. Reinforcement steel shall be in accordance with Specification Section 32 01 29 "Concrete Pavement Repair".

PART 3 - EXECUTION

3.1 GENERAL

A. Asphalt surfaces for pavements, streets, roads, driveways, parking lots and walks shall be repaired with hot mix asphalt. Minimum thickness of asphalt surface replacement shall be 2-inches. The finished surface shall match and shall be level with surrounding pavement.

B. Before replacing paved surfacing, the existing pavement shall be cut, sawed, or trimmed along straight and vertical lines along each side of the trench.

C. Temporary repairs (if required) to paved surfaces shall be made with cold mix asphalt to allow access. Final repairs shall be made within 60 days weather permitting. Driveways shall be maintained to allow access during all weather conditions.

3.2 EXCAVATION AND BACKFILL

A. Excavate and backfill in accordance with Specifications Section 312300 Trench Excavation, Backfill, and Compacting.

3.3 SUBGRADE PREPARATION

A. Subgrade for asphalt paving improvements shall have organic silty and clayey topsoil and other unsuitable material removed and replaced with approved material.

B. Fill and tamp traces of utility trenches.

C. Replace soft spots as needed.

3.4 BASE COURSE FOR ASPHALTIC PAVING

A. A bituminous tack coat shall be applied to the compacted class 7 base at a rate of 0.40 gallons per square yard. After proper curing of the tack coat, asphalt concrete hot mix surface course shall be placed with a compacted thickness of 2 inches and rolled with a steel wheeled roller to a minimum density of 92% of maximum density by Modified Proctor method.

B. Place material on prepared subgrade in accordance with details shown on the Drawings.

1. Spread base course the same day the material is hauled. It shall be thoroughly mixed, either by repeated handling with a blade grader or by harrowing sufficiently to secure a uniform mixture or coarse and fine particles.
2. Compact base course by systematically rolling and watering as required to obtain a firm, uniform, smooth surface as specified in Division 300 of AHTD Standard Specifications for Highway Construction. Base course shall be compacted in 8- inch lifts.

C. Minimum density shall be 95 Percent Standard Proctor (ASTM D698).

3.5 HOT-MIX SURFACING FOR ASPHALTIC PAVING

A. Plant Mixing and Transporting: Mixing, transportation, and temperature limitations for hot- mix surface course materials shall be in accordance with the requirements of Division 400, Asphalt Pavements of the AHTD Standard Specifications for Highway Construction.

B. Placing, compacting, and acceptance shall be in accordance with Division 400, Asphalt Pavements of the AHTD Standard Specifications for Highway Construction.

C. Surface shall be uniform and shall match adjacent surfaces.

3.6 TEMPORARY REPAIRS TO PAVED SURFACES

A. The surface shall match the surfaces on each side of the trench and shall be in accordance with applicable state, county, or local requirements.

B. The Contractor shall maintain all temporary surfaces in good condition until permanent repairs are complete.

END OF SECTION

SECTION 32 11 23
AGGREGATE BASE COURSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aggregate base course.

1.02 REFERENCE STANDARDS

A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses; 1965 (2004).

B. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; 2015.

C. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2014.

D. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012.

E. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)); 2012.

F. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.

G. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.

H. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.

I. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.

J. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2010.

K. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2010.

L. Standard Specifications for Highway Construction, Arkansas State Highway and Transportation Department, Edition of 2003.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Samples: 10 lb sample of each type of aggregate; submit in air-tight containers to testing laboratory.

C. Materials Sources: Submit name of imported materials source.

D. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

E. Compaction Density Test Reports.

1.04 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. Aggregate Storage, General:
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

C. Verify that survey bench marks and intended elevations for the Work are as indicated.

PART 2 PRODUCTS

2.01 MATERIALS

A. Coarse Aggregate Type AHTD Class 7: Angular crushed stone; free of shale, clay, friable material and debris.
   1. Graded in accordance with AASHTO T 11 and T 27, within the following limits:
      a. 1 1/2 inch sieve: 100 percent passing
      b. 3/4 inch sieve: 50 to 90 percent passing.
      c. No. 4 sieve: 25 to 55 percent passing.
      d. No. 40: 10 to 30 percent passing.
      e. No. 200: 3 to 10 percent passing.

B. Medium Aggregate Type C-Ballast: Natural stone; washed, free of clay, shale, organic matter. C-Ballast for French Drain only.
   1. Graded in accordance with ASTM C136/C136M, within the following limits:
      a. Minimum Size: 1/4 inch.

2.02 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of aggregate materials.

B. Where aggregate materials are specified using ASTM D2487 classification, test and analyze samples for compliance before delivery to site.

C. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.02 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.03 INSTALLATION

A. Under Bituminous Concrete Paving:
   1. Place coarse aggregate to a total compacted thickness of (see Civil Details) inches
   2. Compact to 98 percent of maximum dry density based upon the modified proctor curve.

B. Under Portland Cement Concrete Paving:
   1. Place coarse aggregate to a total compacted thickness of (see Civil Details) inches.
   2. Compact to 98 percent of maximum dry density based upon the modified proctor curve.

C. Place aggregate in maximum 7 inch layers and roller compact to specified density.

D. Level and contour surfaces to elevations and gradients indicated.

E. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

F. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

G. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.04 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

3.05 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for field inspection and testing.

B. Compaction density testing will be performed on compacted aggregate base course in accordance with ASTM D1556, ASTM D2167, or ASTM D6938.

C. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with AASHTO T 180, ASTM D698 ("standard Proctor"), or ASTM D1557 ("modified Proctor").

D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

E. Frequency of Tests: 1 per 5,000 sq. ft. of surface.

F. Proof roll compacted aggregate at surfaces that will be under paving.

3.06 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 32 12 16
ASPHALT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Double course bituminous concrete paving.

1.02 REFERENCE STANDARDS

A. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2014.

B. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction; 2009a.

C. Standard Specifications for Highway Construction, Arkansas State Highway and Transportation Department, Edition of 2014 (included with this specification).

1.03 PERFORMANCE REQUIREMENTS

A. Design paving and subbase at streets and drives for light duty commercial vehicle traffic.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with State of Arkansas Highways standard.

B. Mixing Plant: Conform to State of Arkansas Highways standard.

C. Obtain materials from same source throughout.

1.05 REGULATORY REQUIREMENTS

A. Conform to Arkansas Highway and Transportation Department code for paving work on this property.

1.06 FIELD CONDITIONS

A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.01 MATERIALS

A. Asphalt Cement: ASTM D 946 and AASHTO M 226.

B. Aggregate for Binder Course: In accordance with State of Arkansas Highways standards.

C. Aggregate for Surface Course : Angular crushed washed stone; free of shale, clay, friable material and debris.
   1. Graded in accordance with ASTM C136/C136M, within the following limits:
      a. 3/4 inch sieve: 100% percent passing.
      b. 1/2 inch sieve: 90 to 100 percent passing.
      c. 3/8 inch sieve: 90% percent max. passing.
      d. No. 8 sieve: 28 to 58 percent passing.
      e. No. 200 sieve: 2 to 10 percent passing

D. Mineral Filler: Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter.

E. Primer: In accordance with State of Arkansas Highways standards.

F. Tack Coat: Homogeneous, medium curing, liquid asphalt.

2.02 ASPHALT PAVING MIXES AND MIX DESIGN

A. Binder Course: State of Arkansas Highways standards.

B. Wearing Course: State of Arkansas Highways standards (1/2"[12.5mm] Mix).

C. Surface Course: Section 407, Standard Specifications for Highway Construction, Arkansas State Highway and Transportation Department, Edition of 2014 (1/2"[12.5mm] Mix).
   1. Fines to Asphalt Ratio: 0.60 to 1.6.
   2. Asphalt Content: Design Value
   3. Percent Air Voids: 4.0 (PG 76-22 mixes); 4.5 (PG 64-22 & PG 70-22 mixes)
   4. Percent VMA: 14.0-16.0
   5. Minimum Water Sensitivity Ratio: 80 percent

D. Submit proposed mix design of each class of mix for review prior to beginning of work.

2.03 SOURCE QUALITY CONTROL

A. Test mix design and samples in accordance with Arkansas Highway and Transportation Department Standard Specifications, 2014.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that compacted subgrade is dry and ready to support paving and imposed loads (proof roll with a fully loaded tri-axle dump truck).

B. Verify gradients and elevations of base are correct.

3.02 BASE COURSE

A. See Section 32 23 00.

3.03 PREPARATION - PRIMER

A. Apply primer in accordance with manufacturer's instructions.

B. Apply primer on aggregate base or subbase at uniform rate of 0.3 to 0.10 gal/sq yd.

C. Apply primer to contact surfaces of curbs, gutters, and other concrete or aphalt joints.

3.04 PREPARATION - TACK COAT

A. Apply tack coat in accordance with manufacturer's instructions.

B. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of 0.03 to 0.10 gal/sq yd.

C. Apply tack coat to contact surfaces of curbs, gutters and concrete drainage structures.

D. Coat surfaces of manhole frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.05 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

A. Place asphalt binder course within 24 hours of applying primer or tack coat.

B. Apply tack coat to binder course prior to placing wearing asphalt surface course.

C. Place surface course within two hours of placing and compacting binder course.

D. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

E. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.06 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Compacted Thickness: Within 1/4 inch of specified or indicated thickness.

C. Variation from True Elevation: Within 1/2 inch.

3.07 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for quality control.

B. Provide field inspection and testing. Take samples and perform tests in accordance with AASHTO T-164.

C. Provide Lab test results from hot mix samples pulled and tested at the production plant according to AHTD standard specifications.

3.08 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury for 7 days or until surface temperature is less than 140 degrees F.

END OF SECTION

SECTION 32 13 13

CONCRETE PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

A. The conditions of the Construction Contract and Division 1 B General Requirements apply to the Work specified in this Section.

B. Furnish and construct all exterior portland cement concrete as shown on Drawings and herein specified.

1. Work to be included under this Section shall consist of the following:

a. Pavement
b. Concrete curb and gutter

1.2 QUALITY ASSURANCE:

A. Qualifications of Installers: Provide at least one person at all times during execution of this portion of Work and who is thoroughly familiar with the type of materials being installed and is directly responsible for all Work performed under this Section.

B. Requirements of Regulatory Agencies: It is Contractor's responsibility to comply with the requirements of the regulatory agencies, including the purchase of any permits at their own expense.

C. Construction Tolerances:

1. Vertical alignment shall not vary more than 1/8 inch from the edge of a 10-foot straight edge.
2. Horizontal alignment shall not vary more than 1/2 inch from the plan alignment for pavement.
3. Concrete thickness shall not be less than specified.
4. Reinforcing bars shall be placed to the following tolerances:

a. Clear distance to formed surface, plus or minus 1/4 inch.
b. Sheared length, plus or minus 1 inch.
c. Concrete cover on top bars, 2 inches plus or minus 1/4 inch.
d. Crosswise or lengthwise spacing, plus or minus 2 inches, provided minimum spacing and cover requirements are not violated.

D. Referenced Standards: The current editions of the following American Concrete Institute (ACI) publications shall govern all Work performed hereunder, unless otherwise specified:

1. Recommended Practice for Concrete Floor and Slab Construction B ACI 302.
2. Recommended Practice for Hot Weather Concreting B ACI 305.
3. Recommended Practice for Cold Weather Concreting B ACI 306.
4. Recommended Practice for Construction of Concrete Pavements and Concrete Bases B ACI 316.
5. Building Code Requirements for Reinforced Concrete B ACI 318.

E. Design Criteria:

1. Contractor shall employ an approved independent materials testing laboratory and pay for the service of setting up the design mixes and to analyze the fine and coarse aggregate for the various uses of concrete utilized on the project. Design mixes shall be in accordance with the previously cited ACI 318 publication and in compliance with this Specification. The proposed mixes shall be submitted to OWNER for approval prior to placing of any concrete. The approved mixes established by the laboratory shall be used in the Work as long as the characteristics of the ingredients remain unchanged. If any significant change is made in the ingredients, new mixes shall be prepared and submitted to OWNER for approval.
2. Concrete shall consist of a minimum 28 day compressive design strength of 3,500 psi using portland cement, aggregate, air entraining admixture, water and an air content ranging from 5 to 7 percent. Slump of concrete shall have a range of 2 to 4 inches.
    a. If any of the conditions vary from those as described, Contractor shall submit a revised mix design prepared by the laboratory along with a written request for the variance desired to OWNER for their consideration and approval.
    b. Admixtures shall be used only with the approval in writing by OWNER. All admixtures shall be used in accordance with the manufacturer's instructions and shall be added at the plant. Calcium chloride shall not be used as an admixture.
    c. Mix designs shall be based on Type I cement. Type III (high-early) cement or any other types of cement shall be used only when approved in writing by OWNER. When high-early cement is used, the 7-day strength test shall exceed the specified 28-day strength tests.

1.2 SUBMITTALS:

A. Product Data: Prepare and submit product data for OWNER'S approval. Product data shall include manufacturer's recommended installation instructions.

B. Samples: If requested by OWNER, submit samples for approval of proposed materials.

C. Certification: Submit 3 copies of certification of material compliance as requested by OWNER.

D. Delivery Tickets: Submit a delivery ticket with each truck load of concrete delivered which indicates OWNER'S design mix, truck number, project number, Contractor, ready mix producer, time of batching and total yards of concrete.

E. Test Reports and Design Mixes: Submit three (3) copies of design mixes and material test reports to OWNER.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Form Material:

1. Form material shall be either sound lumber or steel, free of defects and variations in dimensions. The sides of all lumber shall be surfaced and matched to prevent mortar leakage. Metal forms shall be of standard manufacture and need not be new, but shall be free from rust and dirt. Metal forms shall be flat and true to line without punctures. All form material shall be sized and of strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal of same.

a. Rigid forms are to be utilized on tangent alignment and curves having a radius of 150 feet or greater.

b. Curved forms shall be utilized on the curved Work with a radius of 150 feet or less, and shall consist of flexible spring steel or laminated lumber.

B. Reinforcement Materials:

1. Reinforcing bars and dowels shall be of new billet steel conforming to ASTM A615, Grade 60 (60,000 psi yield). Sizes of bars shall be as indicated on Drawings or herein specified.

a. Dowel bars when used for contraction and expansion joints shall be smooth steel bars coated with a thin uniform coating of liquid asphalt (MC-250) or grease on one half the length of the bar plus 2 inches. In addition, dowel bars for expansion joints shall be furnished with end caps designed with one end closed, a minimum length of 3 inches and be positioned to allow bar movement of not less than 1 inch.

b. Dowel bar assemblies may be permitted if fabricated to the width of the pavement section.
c. Tie bars for control, longitudinal and construction joints shall be deformed bars.

2. Welded wire fabric: ASTM A185

C. Concrete Materials:

1. Portland cement shall conform to ASTM C150.

a. Cement shall be a low alkali cement (Type I) containing not more than 0.6 percent by weight of tri-sodium silicate oxide.

2. Coarse aggregate shall conform to Size 57 grade requirements of Table 2 of ASTM C33 standard.
3. Fine aggregate shall conform to ASTM C33 with fineness modulus not to vary more than 0.20 from value assumed in design mix.
4. Water shall be potable, clean and free from deleterious amounts of acid, alkali or organic material.

D. Admixtures:

1. Air entraining agent shall conform to ASTM C260 and shall be added at the mixer.
2. Water reducing agents, (such as super plasticizers), retarding agents, accelerating agents and all other admixtures, shall require approval by OWNER and if used, shall conform to ASTM C494. In no case shall admixtures be permitted as substitute for cement content specified, unless approved by OWNER.

E. Expansion Joint Material:

1. Joint filler material shall consist of a non-extruding standard bituminous bound type "Sealtight Asphalt Expansion Joint" as manufactured by W.R. Meadows, Inc., Elgin, Illinois, or OWNER-approved equal.

a. Material shall conform to ASTM D994.

2. Joint filler material shall consist of preformed non-extruded bituminous bound type "Sealtight-Fibre Expansion Joint" as manufactured by W.R. Meadows, Inc., Elgin, Illinois; "Code 1390" as manufactured by W.R. Grace Company, Cambridge, Massachusetts, or OWNER-approved equal.

a. Material shall conform to ASTM D1751.

b. Material shall be 1/2 inch thick, unless otherwise noted, of widths equal to slab thickness less 1/2 inch or as otherwise indicated.

3. Joint sealant shall be "Gardox" or "Pourethane SL" as manufactured by W.R. Meadows, Inc., Elgin, Illinois, or OWNER-approved equal.

F. Curing Materials:

1. Kraft paper shall be waterproof and nonstaining "Sisalkraft 5K-10" conforming to ASTM C171.
2. Polyethylene film shall be white opaque sheet or roll material not less than 0.006 inch thick (6 mil) conforming to AASHTO-M171.

2.2 PRODUCTION:

A.Concrete shall be ready-mixed, and shall be batched, mixed and transported in accordance with "Specification for Ready-Mixed Concrete" ASTM C94.The production plant equipment and facilities shall meet the requirements of the National Ready Mixed Concrete Association.

PART 3 - EXECUTION

3.1 JOB CONDITIONS:

A. Hot Weather Conditions:

1.The following precautions shall be adhered to:

a. Reject concrete mixture having temperature of 85°F or greater.
b. Pre-wet subgrade.
c. Crushed or flaked ice may be utilized in reducing temperature of mixture.
d. If necessary, reduce temperature of reinforcing steel with wet burlap.
e. Reduce mixing time (agitating time) in truck to 45 minutes.
f. During periods of high winds, shelter windward side with adequate wind breaks.
g. Apply no chemical retarder to finished surface unless permission is granted in writing by OWNER.

B. Cold Weather Conditions:

1. When ambient temperature is 40°F or less, the following precautions are to be adhered to:

a. Subbase shall not be frozen.
b. Concrete mixture delivered at Worksite shall be 55°F (minimum), 85°F (maximum).

c. No calcium chlorides, salts or other chemical accelerators shall be permitted, unless otherwise acceptable in writing by OWNER.
d. Concrete surface shall be maintained at a minimum of 50°F with appropriate thermal insulation for a period of 7 days (normal concrete), 3 days (high early-strength concrete).
e. Refer to previously cited ACI 306 for minimum thickness of thermal protection required.
f. Any concrete that has frozen or disintegrated as a result of freezing shall be removed and replaced at Contractor's expense.

3.2 SUBGRADE PREPARATION:

A. Fine grade and compact subgrade to the plan cross section. Compaction shall be as indicated on the Drawings.

B. After compaction, cut-out soft spots and unstable areas in the subgrade and fill with select fill material and re-compact.

3.3 GRANULAR BASE:

A. Construct the select fill and granular base as shown on Drawings on the prepared subgrade after the final shaping and compacting of the subgrade is completed.

3.4 FORM CONSTRUCTION:

A. Forms shall have the strength and rigidity, regardless of material, such that when they are set in place and braced, they will withstand weight of equipment and weight of concrete without settlement or lateral displacement.

B. Keyway forms in the edge of pavement slabs and at construction joints shall be constructed to the dimensions shown on Drawings. Wood keyway forms, if used, shall be bolted or nailed to the side forms. Metal keyway forms shall be fixed or held rigidly in place by staking or other OWNER approved method.

C. Forms shall be coated prior to the placement of concrete, with a nonstaining form release agent. Wooden form may be prewetted with water. No standing water, adjacent to forms, shall be permitted.

3.5 REMOVAL OF FORMS:

A. Forms for slabs on grade shall not be removed earlier than 12 hours after the placement of concrete has been completed. Within 24 hours of form removal backfill adjacent to the pavement shall be completed.

B. Forms supporting the weight of concrete shall not be released until the concrete has reached its specified 28-day strength. Minimum time elapse after casting and before the false Work supports are released shall be 8 days for spans up to 96 inches center to center of supports, plus 1 additional day for each 12 inches of increase in span length over 84 inches up to 14 days for span of 14 feet and over. Such time period shall be exclusive of those time intervals during which the concrete surface temperature is below 40°F. If temperature remains below 40°F during the casting and curing period, no forms shall be removed until approved field tests indicating adequate concrete strength have been provided.

3.6 REINFORCEMENT PLACEMENT:

A. Tie bars, reinforcement bars and dowel bars shall be clean, free from rust and shall be placed on adequate supports in locations as shown on Drawings. Provide the following minimum thickness of concrete cover:

1. Concrete deposited on ground: 3 inches
2. Formed surfaces against ground: 1-1/2 inches
3. Beams, girders and columns: 1-1/2 inches
4. Slabs, walls and joists: 1 inch
5. Clear distance between parallel bars: 1 inch or nominal bar distance
6. For No. 6 bars or larger: 2 inches
7. No broken brick, block or concrete shall be permitted as reinforcement supports.

B. Welded steel wire fabric shall be placed free from rust, kinks and bends and shall be cut in such a way that the overlap measured between outermark cross wires of each fabric sheet is not less than 2 inches. The fabric shall be cut at contraction joints. It shall be supported by a layer of fresh concrete placed to the depth of the mesh shown on Drawings, followed by placement of the upper layer of concrete.

3.7 CONCRETE PLACEMENT:

A. Place concrete to required depth and width to form a continuous mass requiring a minimum of rehandling. Concrete adjacent to side forms and fixed structures shall be consolidated by means of portable vibrators or by mechanical means with the use of hand spading. Vibrators shall not be used to move concrete horizontally.

B. If it is necessary to place a construction joint prior to a contraction joint, the distance between the construction joint and the previous contraction joint shall not be less than 60 inches.

C. Automatic machine may be used for curb and gutter placement at Contractor's option, if acceptable to OWNER. If machine placement is to be used, submit revised mix design and laboratory test results, which meet or exceed the minimum herein specified. Machine placement must produce curbs and gutters to the required cross-section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified.

3.8 JOINTS:

A General:

1. Construct expansion, contraction and construction joints with face perpendicular to surface of concrete.

    a. Where joining existing structures, match existing contraction or expansion joints.

B. Expansion Joints:

1. All fixed objects, such as buildings and structures or pavement, sidewalks or curb intersections shall be separated by a 1/2 inch expansion joint placed at the full depth of the concrete thickness.
2. For pavement construction, place expansion joints as shown on Drawings.

C. Contraction Joints:

1. Contraction joints shall be placed as shown on Drawings.
2. Cut plastic concrete with appropriate tool to specified depth. Finish edges with 1/4 inch radius tool.
3. Saw-cut joints to specified width and depth on hardened concrete as soon as concrete has hardened sufficiently to prevent raveling or damage to the joint.

D. Joint Sealer: Apply joint sealer to a clean and dry expansion or contraction joint if specified to a point approximately 1/4 inch below the top surface.

3.9 CONCRETE FINISH FOR BOAT RAMPS:

A. After initial strike-off and floating, and prior to finishing, test surface with 10-foot straightedge. Correct irregularities prior to final finishing operations.

B. Apply the following surface finish after surface sheen or excess moisture has disappeared:

1. Apply a V-Groove finish as shown on drawings.

3.10 CONCRETE CURING AND PROTECTION:

A. Cure concrete surfaces for 7 days (normal concrete) and for 3 days (high early strength concrete), using appropriate means of protection as previously cited in ACI 305 and ACI 306.

B. Curing methods shall consist of one of the following:

1. Keep concrete surface continuously wet by ponding with water.
2. Apply moisture proof fabric to entire area lapping joints and edges at least 3 inches. Tape interior joints and weight edges down with sand or other approved material.
3. Apply liquid membrane curing compound to the finished surface in a 2 coat continuous operation with second application applied transversely to the direction of the first application, and in accordance with the manufacturer's directions. Replace damaged areas with equal applications of membrane using compound.

3.11 TESTING AND EVALUATION:

A. Concrete materials and operations shall be tested and inspected as the Work progresses, by an independent testing laboratory. Contractor shall furnish any necessary labor who is familiar with methods of sampling and shall assist the testing agency in obtaining and handling samples, and for safe storage and proper curing of concrete test specimens on work site.

B. Mold and cure three standard 6-inch diameter specimens from each sample in accordance with ASTM C31. Compressive strength test specimens shall be in accordance with ASTM C39. Two specimens shall be tested at 28 days for acceptance and one shall be tested at 7 days for information. The acceptance test results shall be the average of the strengths of the two specimens tested at 28 days. If one specimen in a test manifests evidence of improper sampling, molding or testing, it shall be discarded and the strength of the remaining cylinder shall be considered the test result. Should both specimens in a test show any of the above defects, the entire test shall be discarded. When high-early strength concrete is used, the first specimen shall be tested at 3 days; the remaining two at 7 days.

C. Make at least one strength test for each 50 cubic yards, or fraction thereof, of each mix design of concrete placed in any one day.

D. Determine slump of the concrete sample for each strength test and whenever consistency of concrete appears to vary, using standard slump cone as per ASTM C143.

E. The testing laboratory shall report all test and inspection results to OWNER, OWNER=S Engineer, and Contractor immediately after they are performed. All concrete test reports shall include name of job, date of placement, date of test, batch mix design, slump and the exact location in the Work at which the batch represented by the test was deposited.

F. All costs necessary to prepare concrete test cylinders, make tests and furnishing of written reports shall be borne by the Contractor.

3.12 DEFECTIVE WORK:

A. When tests and inspections of the aggregate base and/or concrete Work indicate non-compliance with the Specification, Contractor and OWNER shall mutually agree on the number and location of additional tests to define and/or verify the deficiency. If the average of the tests for a given area indicate non-compliance the area is considered defective and Contractor shall:

1. Remove and replace defective Work at no cost to OWNER;
2. Correct the Work at no cost to OWNER in a manner acceptable to OWNER;
3. Give OWNER a credit towards the Contract Price if said credit is acceptable to OWNER;
4. If Work is found to be in noncompliance, Contractor shall pay for the defective area removal and replacement, and the tests and inspection costs; or
5. If Work is found to be in compliance, OWNER shall pay for tests and inspection cost.

END OF SECTION

SECTION 32 13 76

SIDEWALKS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Providing concrete sidewalk where shown on Drawings.

B. Providing concrete handicap ramps where shown on Drawings.

1.2 RELATED WORK

A. Section 31 23 00 – Excavating Filling and Grading

B. Section 03 30 00 – Cast-In-Past Concrete.

1.3 SUBMITTALS

A. See Related Work

1.4 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):

1. ASTM D 1751, Specifications for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

PART 2 - PRODUCTS

2.1 CONCRETE

A. General: Materials for use in sidewalk construction shall conform to the requirements for Section 03 30 00 and shall be 4000 psi concrete.

2.2 WORK INCLUDED

A. The joint filler for all expansion joints shall be manufactured according to ASTM D 1751 and shall be elastic waterproof pre-molded compound that will not become soft and push out in hot weather, nor hard and brittle and chip out in cold weather. The strips shall be ½" in thickness except where shown otherwise on the Drawings; their width shall at least equal the full thickness of the slab; and their length shall at least equal the width of the slab at the joint.

2.3 FORMS

A. Forms shall be steel or 2" nominal thickness lumber true to proper dimensions, smooth, sufficiently braced to resist springing out of shape, and accurately set to proper lines and

grades. Used forms shall be free of dirt and mortar. Cross forms shall be ¼" steel of the full width and depth of the concrete work and left in place until the wearing surface has been floated and has obtained its initial set.

2.4 CURING COMPOUND

A. Liquid membrane forming curing compound conforming to AASHTO M 148, Type 2, white pigmented (all-resin base).

PART 3 - EXECUTION

3.1 GRADING AND SUBGRADING

A. Prepare subgrade for walks by excavating or filling to a depth below the top of an intended pavement equal to the thickness of the finished walk and in exact conformity to the grade approved by the Engineer. Remove vegetative matter or material that will not compact properly and replace with suitable material. Place all fill required to bring the subgrade to the proper level in thin layers not exceeding 4 inches deep, and thoroughly ram, tamp or roll until it has been made compact and solid. Bring subgrade to true grade in a uniformly firm condition before placing the concrete. Do not place concrete on the subgrade until the Engineer has inspected and approved both grade and condition of subgrade.

3.2 SETTING FORMS

A. Stake forms and hold to the established lines and grades. Provide minimum 1/8" per foot fall away from structures or as shown on the drawings.

3.3 TREATMENT

A. Wet wood and coat metal forms with oil, soft soap, or whitewash before depositing any material against them. Remove all mortar and dirt from forms that have been previously used.

3.4 MARKINGS

A. Cut surface of concrete walks into flags by marking with an edging tool having a radius of ¼". Make flags not longer than 6 feet on any side nor longer than the width of the sidewalk. Round the slabs on all surface edges, including the cross markings between flags, to a radius of ¼".

3.5 JOINTS

A. Provide an expansion joint ½" in thickness, extending full depth of the concrete and with filler as herein specified, at intervals of not more than 15 feet. Provide a similar joint ½" in thickness in each walkway at intersection of walkways. Also provide an expansion joint ½" in thickness at each intersection of sidewalk and street curb and at such other points as may be designated by the Engineer. Separate sidewalk from abutting structures by ½" expansion joints. Place expansion joints ½" in thickness extending full depth of the concrete in a square outline around each object in sidewalks, such as fire

hydrants, utility poles light standards, etc.

3.6 PLACING CONCRETE

A. Place concrete only on a moist subgrade and not adjacent to or around utility structures until such structures have been set to the proper grade.

B. Transport from the mixer and place by such a means as will not cause segregation of materials or loss of ingredients. Deposit successive batches in one layer by a continuous operation, completing individual sections to the required depth and width. Do not use concrete that has taken its initial set. Fill forms and bring the concrete to the established grade by means of a strike board or straight edge. Thoroughly tamp concrete until mortar is flushed to the surface sufficiently to finish and mark the surface.

C. Spade and/or vibrate the concrete so that it will flow together and completely fill all void spaces especially along forms (including cross forms of joints) to prevent honeycombing and shall be struck off and tamped in an approved manner, until dense surface is obtained, free from porous or rough spots and at the required sections and grade.

D. Use method of placing the various sections so as to produce a straight clean-out joint between them, in order to make each section and independent unit. Do not use any concrete in excess of that needed to complete a section at the stopping of work.

E. Do not pour concrete when temperature is below 35 degrees Fahrenheit, and do not place concrete on frozen subgrade. Take all necessary precautions to prevent damage to concrete in excess of that needed to complete a section at the stopping of work.

F. At all times during construction period, maintain proper drainage, by natural flow or pumping as required, so that water will drain away from excavated areas. Do not allow water to stand in any excavations, or elsewhere, to be covered by concrete. Provide and maintain in proper working order all necessary pumping and other equipment required to maintain drainage.

3.7 FINISH

A. After the concrete has been brought to the established grade by means of a strike board and tamped to bring the mortar to surface, float to a true even surface and finish with steel trowel. After the trowel finish has taken its initial set, brush surface lightly at right angles to center line of sidewalk with a soft bristle brush.

B. Do not apply heat to the concrete surface to hasten its hardening.

3.8 CURING AND PROTECTION:

A. As soon as the concrete has hardened sufficiently to prevent damage, apply specified liquid membrane-forming curing compound in accordance with manufacturer’s written instructions.

B. Protect the freshly finished concrete from hot sun and drying winds until the curing

compound is applied. Do not allow the concrete surface to be damaged or pitted by raindrops. Provide and use, when necessary, sufficient tarpaulins to completely cover all sections that have been placed within the proceeding twelve hours. Erect and maintain suitable barriers to protect the concrete. Repair any section damaged from traffic or other causes occurring prior to its official acceptance. Before the sidewalk is opened to traffic, remove and dispose of the covering.

3.9 FREEZING TEMPERATURE

A. If at any time during the progress of the work, the temperature is predicted to drop below 35 degrees Fahrenheit within 24 hours after placement, heat the water and aggregates and take precautions to protect the work from freezing for at least five days.

END OF SECTION

SECTION 32 17 23.13
PAINTED PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Parking lot markings, including parking bays, crosswalks, and curb markings.

B. Roadway lane markings and crosswalk markings.

1.02 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 MATERIALS

A. Line and Zone Marking Paint: MPI No. 97 Latex Traffic Marking Paint; color(s) as indicated.
   1. Parking Lots: Yellow.
   2. Handicapped Symbols: Blue.

B. Temporary Marking Tape: Preformed, reflective, pressure sensitive adhesive tape in color(s) required; Contractor is responsible for selection of material of sufficient durability as to perform satisfactorily during period for which its use is required.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Fisher & Arnold of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Clean surfaces thoroughly prior to installation.
   1. Remove dust, dirt, and other granular surface deposits by sweeping,

blowing with compressed air, rinsing with water, or a combination of these methods.

2. Completely remove rubber deposits, existing paint markings, and other coatings adhering to the pavement, by scraping, wire brushing, sandblasting, mechanical abrasion, or approved chemicals.

D. Where oil or grease are present, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application; after cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint.

E. Establish survey control points to determine locations and dimensions of markings; provide templates to control paint application by type and color at necessary intervals.

F. Temporary Pavement Markings: When required or directed by Fisher & Arnold, apply temporary markings of the color(s), width(s) and length(s) as indicated or directed.

1. After temporary marking has served its purpose, remove temporary marking by carefully controlled sandblasting, approved grinding equipment, or other approved method so that surface to which the marking was applied will not be damaged.
2. At Contractor's option, temporary marking tape may used in lieu of temporary painted marking; remove unsatisfactory tape and replace with painted markings at no additional cost to Jonesboro Public Schools.

3.03 INSTALLATION

A. Begin pavement marking as soon as practicable after surface has been cleaned and dried.

B. Do not apply paint if temperature of surface to be painted or the atmosphere is less than 50 degrees F or more than 95 degrees F.

C. Apply in accordance with manufacturer's instructions using an experienced technician that is thoroughly familiar with equipment, materials, and marking layouts.

D. Comply with FHWA MUTCD manual (http://mutcd.fhwa.dot.gov) for details not shown.

E. Apply markings in locations determined by measurement from survey control points; preserve control points until after markings have been accepted.

F. Apply uniformly painted markings of color(s), lengths, and widths as indicated on the drawings true, sharp edges and ends.
   1. Apply paint in one coat only.
   2. Wet Film Thickness: 0.015 inch, minimum.
   3. Length Tolerance: Plus or minus 3.
   4. Width Tolerance: Plus or minus 1/8 inch.

G. Roadway Traffic Lanes: Use suitable mobile mechanical equipment that provides constant agitation of paint and travels at controlled speeds.
   1. Conduct operations in such a manner that necessary traffic can move without hindrance.
   2. Place warning signs at the beginning of the wet line, and at points well in advance of the marking equipment for alerting approaching traffic from both directions. Place small flags or other similarly effective small objects near freshly applied markings at frequent intervals to reduce crossing by traffic.
   3. If paint does not dry within expected time, discontinue paint operations until cause of slow drying is determined and corrected.
   4. Skip Markings: Synchronize one or more paint "guns" to automatically begin and cut off paint flow; make length of intervals as indicated.
   5. Use hand application by pneumatic spray for application of paint in areas where a mobile paint applicator cannot be used.

H. Parking Lots: Apply parking space lines, entrance and exit arrows, painted curbs, and other markings indicated on drawings.
   1. Mark the International Handicapped Symbol at indicated parking spaces.
   2. Hand application by pneumatic spray is acceptable.

I. Symbols: Use a suitable template that will provide a pavement marking with true, sharp edges and ends, of the design and size indicated.

3.04 DRYING, PROTECTION, AND REPLACEMENT

A. Protect newly painted markings so that paint is not picked up by tires, smeared, or tracked.

B. Provide barricades, warning signs, and flags as necessary to prevent traffic crossing newly painted markings.

C. Allow paint to dry at least the minimum time specified by the applicable paint standard and not less than that recommended by the manufacturer.

D. Remove and replace markings that are applied at less than minimum material rates; deviate from true alignment; exceed length and width

tolerances; or show light spots, smears, or other deficiencies or irregularities.

E. Remove markings in manner to avoid damage to the surface to which the marking was applied, using carefully controlled sand blasting, approved grinding equipment, or other approved method.

F. Replace removed markings at no additional cost to Jonesboro Public Schools.

END OF SECTION

SECTION 32 92 00

SEEDING AND SODDING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

This section shall cover the work of furnishing sowing and establishing an acceptable growth of grass from seed, as well as covering the work of furnishing and planting solid grass sodding in various locations throughout the limits of work.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 31 20 00: Site Grading & Filling

1.03 QUALITY ASSURANCE

A. Qualifications of Workmen

Provide at least one person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct all work performed under this Section.

B. Applicable Documents

The following specifications and standards of the issues listed and referred to in this Section form a part of this Specification to the extent required by reference thereto.

1. U.S.A. Standard for Nursery Stock, American Association of Nurserymen, Inc., 1973.

C. Approvals and Rejection of Materials and Work

1. The selection of all materials and execution of all preparations required under the Drawings and Specifications shall be subject to the approval of the Design Professional.

2. The Owner's Representative shall have the right to reject any and all materials, any and all work, which in his opinion does not meet the requirements of the Specifications or Drawings at any stage of the operations. All rejected materials shall be removed from the site and shall not be discarded on adjacent sites.

3. The Contractor shall notify the Owner's Representative at least 48 hours in advance of the time he intends to begin sodding and shall not proceed with such work until permission to do so has been granted by the Owner's Representative. Before starting the grassing operation on any area, final dressing shall have been completed.

4. All seeding, sodding, and related operation shall be continuous operations.

D. Maintenance of Site during Planting

Sidewalks, roads and other pavement adjacent to planting operation shall be kept clean and free from obstructions, mud and debris at all times. Wheels of vehicles used in work shall be cleaned if necessary. Flushing of streets or disposal of dirt or debris into sewers or drainage ditches will not be permitted. Dust shall be controlled by approved means to the satisfaction of the Owner's Representative.

1.03 PLANT AVAILABILITY

All sod specified shall be located and certified available to be installed following completion of the related work.

1.04 PRECAUTIONS

Locate underground utilities and drainage lines on the site with flags or similar markings prior to excavating or driving stakes. Take proper precautions to

prevent damaging or disturbing these improvements. Contractor is responsible for damage or dislocation by his company.

1.05 GUARANTEE

A. One year after final completion of project, lawn shall be solid color, well matted, and reasonably free from weeds.

B. Inspection for Beginning of Guarantee Period

1. Inspection of the planting work, to determine its completion for beginning the guarantee period, will be made by the Design Professional, and given approval in writing upon notice requesting such inspection by the Contractor.
2. All planting must be alive, healthy, and a uniforms stand of grass in order to be considered complete.

C. Final Inspection and Replacements

Inspection of the planting to determine its final acceptance will be made at the conclusion of the guarantee period by the Owner's Representative. No grassing shall be accepted unless the area shows a uniform, healthy stand of grass.

1.06 PRODUCT HANDLING

A. DELIVERY AND STORAGE

1. Insofar as is practicable, sod shall be laid the day of delivery. In the event that this is not possible, the Planting Contractor shall protect the sod not laid by placing it in a shaded area.

2. Sod that cannot be laid immediately on delivery shall be kept well watered and shall not remain unplanted for longer than 48 hours after delivery to the site.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials shall be in accordance with the U.S.A. Standard for Nursery Stock, and shall have a normal growth habit and be sound, healthy, vigorous and free from insect infestation.

1. The health of all materials shall be in accordance with the State D.O.T. specifications.

2. The quality of all plant materials shall be in accordance with the State D.O.T. specifications.

2.02 HYDRAULIC SEEDING

A. Seed shall meet the requirements of the State D.O.T. and no "Below Standard" seed will be accepted.

B. Grass seed, fertilizer and hydro mulch shall be delivered and stored in original containers in such a manner that protection from damage by freezing, heat, moisture, rodents or other causes is ensured. Ensure that labels or other identification are not removed or defaced.

C. Grass seed: to federal and local seed laws and having minimum germination of 75 percent and minimum purity of 97 percent. Seed mix shall contain 100% Common Bermuda (hulled).

D. Mulch: Conwed, Fibramulch, Verdyol or approved equal capable of dispersing rapidly in water. The mulch shall be free of weeds and other foreign matter, containing no growth or germination inhibiting factors.

E. Fertilizer: A complete commercial fertilizer with minimum 50 percent of elements derived from organic sources.

F. Legume inoculant: approved agricultural type appropriate to legume used. Legume and inoculant will be mixed separately per tank load.

G. At the discretion of the Owner's Representative or Design Professional, samples may be taken for testing. Sampling and testing will be in accordance with the requirement of the State Department of Agriculture.

2.03 SOD

A. Block sod shall be cleanly cut in strips having a reasonably uniform thickness of not less than 2 inches and a uniform width of 12 inches and length of 24 inches. Block sod to be used as noted on plans.

B. Rolled sod shall be cleanly cut in strips having a reasonably uniform thickness of not less than 22 inches. Sod shall be cut in uniform widths of either 24", 30" or 42", with a minimum length of 25 yards to a roll.

C. All sod shall consist of live, dense, well rooted growth of 419 tifway Bermuda or Meyer or Zoysia free from Johnson grass, nut grass and other obnoxious grasses and weeds. Sod shall be installed between March 1 and October 1.

2.04 MISCELLANEOUS MATERIALS

A. Topsoil

Fertile, friable, natural topsoil of a loamy character without admixture of clay, hardpan, mulch, marl, shell or fine sand and capable of sustaining vigorous plant growth. It shall contain a normal amount (5-8%) of decomposed organic matter and shall be free of stones, lumps, plants or their root, or seeds, sticks and other extraneous matter and shall contain no substance or material inhibitory to plant growth. The results of soil tests by the Contractor shall show that topsoil pH is between 5 and 7 and that topsoil is free of excessive soluble salts at time of use.

B. Fertilizer

1. Commercial Fertilizer: Commercial Fertilizer shall be 13-13-13. Fertilizer shall be a standard commercial fertilizer containing the specified percentages by weight of nitrogen, phosphoric acid, and potash.

    a. The fertilizer shall be furnished in standard containers with the name, weight, and guaranteed analysis of the contents clearly marked. The container shall insure proper protection in handling and transporting the fertilizer.

b. All commercial fertilizer shall comply with local, state, and federal fertilizer laws.

2. Agriculture Limestone: Agriculture limestone shall contain not less than 85% of calcium carbonate and magnesium carbonate combined and shall be crushed so that at least 85% will pass the No. 10 mesh sieve.

C. Mulch Material

1. All mulch material shall be air-dried and reasonably free to noxious weeds and weed seeds or other materials detrimental to plant growth on the project or on adjacent agriculture lands. Mulch material shall be wheat straw.

a. When seeding with mulch is specified, the mulch material shall be spread evenly over the seeded area at the approximate rate of 100 pounds per 1,000 square feet immediately following the seeding operation.

b. All portions of the seeded areas shall be covered with a uniform layer of mulch so that approximately 25% of the ground is visible.

c. Water mulch and seedbed thoroughly, and immediately, after completion of mulching. Soil shall be moistened to a depth of one (1) inch.

4. Water

Only potable water shall be used.

PART 3 - EXECUTION

3.01 SEEDBED PREPARATION AND HYDRAULIC SEEDING METHOD

A. The seedbed shall be prepared in the following manner and sequence.

1. Each area to be seeded shall be scarified, disced, harrowed, raked, or otherwise worked until it has been loosened and pulverized to a depth of not less than 1 2" (inches). This

operation shall be performed only when the soil is in a tillable and workable condition.

2. All construction material debris, rocks, and refuse material larger than 2 inch diameter, shall be removed from the seed beds.

3. No seeding shall be done during windy weather or when the ground surface is frozen, wet, or otherwise non-tillable.

B. HYDRAULIC SEEDING AND HYDRAULIC MULCHING

1. The Contractor shall accurately measure the quantities of each of the materials to be charged into the hydraulic mulcher, either by weight or by a system of weight-calibrated volume measurements approved by the Owner's Representative.

2. Seed, fertilizer and hydraulic mulch shall be thoroughly mixed in a water slurry and be distributed uniformly over the surface area via an approved hydraulic mulcher.

3. The rates of application per acre shall be as indicated below:

Seed Mix	425 lb.
5-20 20 Fertilizer	650 lb.
Hydraulic Mulch	1,500 lb.
Water	9,000 gal.

Increase mulching rate to 850 pounds per acre when seeding after June 1 and before August 15.

Where mulching is determined to be insufficient through hydraulic seeding application additional straw mulching must be applied to the seeded areas.

4. After charging, no water or other material shall be added to the mixture in the hydraulic mulcher.

5. The Contractor shall ensure that fertilizer in solution does not come in contact with the foliage of any trees, shrubs, or other

susceptible vegetation.

6. The Contractor shall take all reasonable care to prevent the contamination by operations of structures, fences, utilities and all such installations and where such contamination occurs, he shall remove it to the satisfaction of and by means approved by the Owner's Representative.

7. Due to the variation in soil types and particle size, topography, contours and various land forms, the slurry shall be applied in such a manner as to prevent puddling or movement on the soil surface.

C. If in the opinion of the Owner's Representative any seeded areas that do not show a uniform or healthy stand of grass, the Contractor shall reseed and/or refertilize those areas as directed by the Owner's Representative without any additional cost to the Owner.

3.02 SODDING METHOD

A. The area to be sodded shall be brought to the lines and grades shown on the plans or as directed by the Owner's Representative. The surface of the ground to be sodded shall be loosened to a depth of not less than 1 inch with a rake or other device. The ground shall be sprinkled until saturated for a minimum depth of 1 inch and kept moist until the sod is placed.

B. Immediately before placing the sod, fertilizer and lime shall be applied uniformly to the prepared surface of the ground. Fertilizer shall be applied at the rate of 8 pounds of grade 13-13-13 or equivalent per 1,000 square feet. Agricultural limestone shall be applied at the rate of 75 pounds per 1,000 square feet.

C. Sod shall be placed as soon as practical after removal from the point of origin and shall be kept in a moist condition during the interim. The sod shall be carefully placed by hand on prepared ground surface with the edges in close contact and as far as possible in a position to break joints.

D. Immediately after placing the sod, it shall be thoroughly wetted and rolled with an approved roller or hand tamped as approved by the Owner's Representative. On sloped of 2 to 1, or steeper, pinning or pegging is required to hold the sod in place.

E. The sod shall be watered as needed by the Contractor for a period of three weeks after which ammonium nitrate shall be applied at the rate of 3 2 pounds per 1,000 square feet and then watered. The Contractor shall not allow any equipment or material placed on any planted area and shall erect suitable barricades and guards to prevent this equipment, labor or the public from traveling on or over any area planted with sod.

3.03 CARE DURING CONSTRUCTION

A. All seeded areas shall be cared for properly to the Owner's Representative satisfaction until acceptance of the work. Such care shall include watering and mowing the seeding areas when required by the Owner's Representative. When mowing is required, mower blades shall be set at sufficient height to protect the vitality of the growth.

B. Surfaces gullied, eroded areas, or any damaged areas found following seeding shall be repaired by regrading and reseeding as directed by the Owner's Representative.

C. The Contractor shall regrade, refertilize, and reseed any or all seeded areas as directed by the Owner's Representative to correct any unsatisfactory and unacceptable conditions as determined by the Owner's Representative regardless of who may have caused the unacceptable or unsatisfactory area.

D. The Contractor shall be responsible for protecting his work at all times and shall erect temporary barricades to do so.

E. If in the opinion of the Owner's Representative that any seeded areas do not show a uniform or healthy stand of grass, the Contractor shall reseed and or refertilize those areas as directed by the Owner's Representative without any additional cost to the Owner.

END OF SECTION

SECTION 33 11 35

VERTICAL TURBINE HIGH SERVICE PUMPS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish and install, two (2) Vertical Turbine High Service Pumps as shown on the plans. Pumps shall have discharge size and motor ratings as noted. A single source supplier that adheres to the quality standards established and expressly named in this specification shall supply all equipment.

B. Acceptable manufacturers are Sulzer or substitute approved by the Engineer (See Paragraph 1.03 Pre-Submittal). A manufacturer being named in this specification notwithstanding, all equipment approved for this project shall meet or exceed all performance, service, and warranty requirements of this specification.

1.02 RELATED REQUIREMENTS

A. Bid Form
B. General Conditions
C. Section 01 33 00: Shop Drawings
D. Section 09 97 13.21: Painting
E. Division 16: Electrical

1.03 PRE-SUBMITTAL

A. The Contractor may submit alternate equipment for consideration provided that certified documentation, stamped and signed by a registered professional engineer, which shows compliance with, or an itemized list of deviations/exceptions with technical justification of such to all performance, construction, service and warranty requirements of this specification. This submittal shall be submitted by the pump manufacturer or its authorized representative at least ten (10) business days prior to bid. Equipment must be conditionally approved by the Engineer in writing at least five (5) business days prior to bid for all named or substitute manufacturers in order to be offered for this project. Three (3) business days prior to bid, the Engineer will furnish a

final listing of equipment appearing to meet the specifications and conditionally approved for this project. In no case shall equipment be accepted for this project if not approved by the Engineer in writing prior to bid. Pre-submittal data shall include, but not be necessarily limited to: typical motor, as well as pump, performance curves; compliance documentation for all performance values described in Section 1.06, compliance documentation for all construction details described in, and calculations required by, Section 1.06; a full system analysis of the piping system showing the inclusion of the specified air and vacuum valves shall be required; and Service warranty compliance documentation required by Section 4 of this specification

1.04 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. The pump manufacturer shall have a minimum of 500 units of similar type pumps installed and operating for no less than five (5) years in the United States.
2. All equipment approved for this project shall meet or exceed all performance, service, and warranty requirements of this specification.
3. The pumps shall be suitable for pumping clean, potable water and shall be designed and fully guaranteed for this use. The fluid temperature range shall be from 40 degrees to 104 degrees F.

1.05 TESTING

A. General

Each pump shall be shop tested and field tested as specified hereinafter. All costs for the tests shall be borne by the Contractor. The Contractor shall submit the complete shop test procedures to the Engineer for approval at least 30 days prior to the shop test. In the event any equipment fails to meet the performance values set forth in this specification, the equipment shall be modified and re-tested or replaced with equipment that performs in accordance with this specification.

B. Shop Tests

Each pump shall be tested for performance at the factory to determine the head vs. capacity, motor total electrical power draw (KVA), and

motor active electrical power draw (KW) for the full speed at which the pumps are specified and shown on a performance test curve as continuous functions throughout the pump's performance range. Tests of models, prototypes or similar units will not be acceptable.

All tests shall be run in accordance with the test code for centrifugal pumps of the Standards of Hydraulic Institute B Level, latest edition. The motor and cable on each pump shall be tested for moisture content or insulation defects. After the test, the pump cable end shall be fitted with a shrink-fit rubber boot to protect it from moisture or water.

C. Field Tests

Equipment shall be field tested as specified hereinafter. The Contractor shall provide the services of authorized equipment supplier's representatives to conduct all field tests.

1. Acceptance tests shall be run to demonstrate that the pumping units, motors and control system meet the following requirements:

   a. The pumping units operate as specified without excessive noise, cavitation, vibration, and without overheating of the bearings.

   b. All automatic and manual controls function in accordance with the specified requirements.

1.06 PERFORMANCE

A. Vertical turbine high service pumps shall meet the following performance requirements:

Item (Units)	Pump #1 Hatchery Building Supply	Pump #2 Spring Pump	Pump #3 Recirculation Pump	Pump #4 Hatchery Building Pump
Primary Duty Point (GPM/ft./Pump Effy)				
MIN. Shutoff Head (ft.)				
MAX. Pump Power Required – Primary				

Duty Point				
MAX. Pump Speed (RPM)				
MAX. NPSHrer at Primary Duty Point (ft.)				
Motor Rating (HP) @ 40 Degrees C.				
Voltage / Cycle / Phase				
Motor Design Type				
Motor Service Factor				
Motor Insulation				
MIN. Motor Efficiency at Full Load				
MIN. Motor PF at Full Load				
NEMA Code Letter				
MIN. Breakdown Torque (% FL)				
MAX. Motor Pole Number				
MIN. Pump Discharge Size (inches)				

1.07 SUBMITTALS

A. Furnish complete assembly, foundation support, and installation drawings, together with detailed specifications and data covering pumps, motors, material used, parts, devices and other accessories forming a part of the equipment furnished shall be submitted for approval in accordance with the procedure set forth in the General Conditions. Data and specifications for the equipment shall include, but shall not be limited to the following:

a. Setting Plans. Setting plans shall include:

1. Anchor bolt layout
2. Anchor bolt dimensions
3. Outline dimensions and weights of pumps, bases, motors, and control enclosures.

b. Pumps. Data and drawings shall include:

1. Manufacturer, type and model number.
2. Assembly drawing, nomenclature and material list, O&M manual, and parts list.
3. Type, manufacturer, model numbers, location and spacing of bearings.
4. Impeller type, diameter, number of vanes and identification number.
5. Complete motor performance data including: rating, voltage/phase/frequency; design type; service factor; insulation class; motor pole number; actual rotation speed when combined with the specified pumps; current, power factor and active input power (KW) as a continuous function of shaft power from no load to at least 115 percent load, start (max. inrush) current; locked rotor current; NEC code letter; and motor torque as a continuous function through the motor start cycle from no rotation to synchronous speed.
6. Complete performance test curve(s) showing full range (shutoff to run-out) head vs. Capacity, NPSHR, hydraulic efficiency, motor active (KW) input power, motor total (KVA) input power (Based on measured current and voltage), and shaft power (BHP). See Section 1.05 (B): Shop Tests.
7. Location and description of Service Centers and spare parts stock.
8. Warranty for the proposed equipment.

The manufacturer shall indicate, by arrows to points on the Q/H curves, limits recommended for stable operation, between which the pumps are to be operated to prevent surging, cavitation, and vibration. The stable operating range shall be as large as possible and shall be based on actual hydraulic and mechanical characteristics of the units and shall meet the hydraulic performance requirements of the proposed system.

B. Furnish shop drawings and other pertinent data to the Engineer and obtain his approval before fabrication. The drawings shall be complete with respect to dimensions, materials of construction, wiring diagrams, and all supporting engineering information.

C. At least one month before installation of this work, submit four (4) copies of operation and maintenance instructions to the Engineer.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver store and handle items of equipment in a manner that will prevent any damage.

B. Follow manufacturer's instructions for short term and long-term storage, particularly with respect to proper lubricants and periodic rotation of shafts and bearing.

1.08 CO-ORDINATION

A. Co-ordinate this work with the work of other trades to avoid interferences and to provide for timely installation.

1.09 WARRANTY

A. See Section 4

PART 2 - PRODUCTS

2.01 Vertical Turbine High Service Pumps

A. At the location shown on the plans, furnish and install two (2), Vertical Turbine High Service Pumps with cast discharge head, hollow shaft motor, mechanical seals and threaded column pipe. Each pump shall be capable of delivering flows @ TDH as shown in the performance data table above.

2.02 PUMP DESIGN GENERAL

A. The pumping unit shall be suitable for outdoor or indoor installation, consisting of a discharge head, vertical shaft, single or multi-stage turbine type bowl assembly, directly connected to a vertical hollow shaft motor and shall rotate counter clockwise when viewed from the driver. A thrust bearing in the driver shall support the static weight of the motor rotor, pump shafting, impeller and the hydraulic thrust load developed by the ***pump***. The thrust bearing in the driver shall be arranged to withstand any momentary pump up-thrust at start-up and shall limit the total movement of the pump shaft under these conditions to less than 0.002".

2.03 PUMP BOWL

A. The suction bell (case) and pump bowl shall be made of close-grained cast iron, (**ASTM A48, Class 30**). Bowl fluid passages shall be coated and free of foundry imperfections and other detrimental defects. The bowls shall be flanged and bolted together, for sizes 9" and larger, to provide maximum strength, maximum life and simplified maintenance. The bowls shall bolt together with cap screws or studs and nuts, to avoid extreme localized stresses. The intermediate bowl and suction bell shall be provided with wear rings at the location of each impeller seat to reduce maintenance cost. Strainers, if specified shall be 304SS, basket type clip-on strainer for Suction Bells and cone strainer for Suction Case.

2.04 DISCHARGE HEAD

A. The discharge head shall be made of close-grained cast iron **(ASTM A48, Class 40 Ductile Iron)** free of foundry imperfections and other detrimental defects. Discharge flange, cast integral, shall be machined and drilled per ANSI 125# FF flange. The head shaft shall be of **stainless steel (ASTM A583-416) turned, ground and polished**. Impeller adjustment, on vertical hollow shaft motor, shall be provided at the top of the motor by means of steel, (**ASTM A108-Grade 1018**), nut. On vertical solid shaft motors, this shall be through an adjustable flanged coupling between the motor shaft and head shaft.

2.05 COLUMN

A. The minimum 6" column assembly shall be constructed using steel (**ASTM A53**) threaded column sections, **304SS** bearing retainers, **rubber** bearings and a **stainless steel (ASTM 582-416)** shaft. Column pipe sections not to exceed 10 feet in length, top and bottom sections shall not exceed 5 feet in length. The column shall be sized to limit friction loss to 5 feet per 100 feet length – based on design flow. Bearing spacing shall not exceed 5 or 10 feet for 3600/3000 or 1800/1500 RPM respectively. Bearing retainer shall be provided at each column joint to locate line shaft bearings. Bearings spacing shall be such that the operating speed of pump is at least 20% away from the critical speed of the shaft to prevent pump resonance.

2.06 MOTOR

A. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, TEFC. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The motor shall be designed for continuous duty. The motor shall be capable of withstanding at least 6 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the motor control panel.

B. The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of +/- 10%. The motor shall be designed for continuous operation in up to a 40°C. ambient and shall have a NEMA Class B maximum operating temperature rise of 80° C. A motor performance chart shall be provided upon request exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.

C. Motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire performance range, from shut-off to a point below the corresponding static head for this pump station.

2.07 PUMP COATING

A. The pump bowl, pump discharge column assembly and pump discharge head shall be coated with Catalyst Cured Epoxy: Carboline 891.

2.08 SHAFT SEAL AND COUPLING

A. For this **product, lubricated column assembly** shall be a single cartridge mechanical seal, providing positive seal and minimum maintenance. By-pass shall be provided when discharge pressure exceeds 175 psi.

B. For hollow shaft motors, a threaded coupling shall be furnished to

connect the pump's top shaft to the motor shaft and to facilitate vertical adjustment of the impeller while assuring proper clearances, as well as providing access for mechanical seal replacement. The shaft diameter shall be a minimum of 1.25" for this installation. When a mechanical seal is required, a spacer shall be provided to accommodate removal of the mechanical seal without removing the driver. All flanged couplings, for 500 HP and larger units operating at speeds over 2500 RPM, are to be dynamically balanced.

2.09 IMPELLER & WEAR RINGS

A. The impeller shall be made of **Stainless Steel (ASTM A743-CA-15)** material free of sand holes, blowholes, or other imperfections. The impeller shall be mounted on the bowl shaft with an axial and circumferential stainless steel key or stainless steel lock collet, to provide a non-slip engagement and to allow easy disassembly. The impeller shall be **statically** and **dynamically** balanced to reduce vibration.

B. The rotating and stationary wear rings for these units shall be constructed of Nickel Aluminum Bronze - B148 Alloy, C95400 (Rotating) and C95500 (Stationary).

2.11 PROTECTION

A. All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding.

B. A motor heater shall be provided to prevent freezing of the unit in subzero temperatures.

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect all equipment upon arrival at job site and prior to installation. Notify manufacturer of any damage and/or shortage.

B. Inspect concrete mounting pads and anchor bolts for correct size and alignment prior to installation.

3.02 PREPARATION

A. Make corrections and/or repairs as required for items inspected and found to be deficient.

3.03 INSTALLATION

A. Install pumps and accessories in strict accordance with the manufacturer's instructions.

3.04 FIELD QUALITY CONTROL

A. The manufacturer's field engineer or representative shall inspect and check the installation after erection and be on hand for initial start-up of the equipment for a period of at least three days. He shall also instruct treatment plant personnel in the operation and maintenance of the system.

3.05 ADJUSTING AND CLEANING

A. Adjust equipment as required and within limits of manufacturer's instructions for proper alignment.

B. Apply proper type and quantity of lubricants for short term storage or start-up operation as applicable.

C. Clean equipment of any foreign matter or substances.

D. Field paint all components to be painted in accordance with manufacturers recommendations.

3.06 PROTECTION

A. After installation and painting protect the equipment from any damage by work of other trades. Repair any damage that nevertheless occurs.

PART 4 - SERVICE AND WARRANTY

4.01 SERVICE

A. The pump manufacturer shall have an authorized factory service center capable of completely servicing the proposed pumps within 100 miles of

the project site. The pump manufacturer shall have a direct factory service center/stocking facility capable of completely servicing, and which stocks identical complete drive units, and spare parts for, the proposed pumps within 500 miles of the project site.

4.02 PUMP WARRANTY

A. The pump manufacturer shall provide prorated warranty for the units supplied to the Owner against defects in material and workmanship for a period of at least five (5) years or 10,000 operating hours in writing under the operating conditions presented by this project. Pump manufacturer shall demonstrate ability to support claimed warranty coverage by meeting all requirements of Section 4.01 of this specification.

END OF SECTION

SECTION 33 16 23

GROUND-SUPPORTED FLAT-BOTTOM WATER STORAGE TANK

1.01 GENERAL REQUIREMENTS

A. Scope

The Contractor shall be responsible for all labor, materials and equipment necessary for the design, fabrication, construction, painting, disinfection and testing of a welded carbon steel water storage tank built at grade level on a concrete foundation. Design and construction of the Water Storage Tank shall conform to all requirements of AWWA D100 Standard for Welded Carbon Steel Tanks for Water Storage, except as modified by the requirements of these contract documents. The Contractor may use Section 14 of the AWWA D100 as a part of the design. Tanks designed on this basis must incorporate all the provisions of this section. The requirements of Section 3 of the AWWA D100 are superseded by any differing requirements of Section 14.

B. Qualification of Manufacturer

1) The design and construction of the Ground-Supported Flat-Bottom Water Storage Tank shall only be undertaken by a Contractor with a minimum of five years experience with tank construction. The Contractor must be able to demonstrate experience through the design and construction of at least five Ground-Supported Flat-Bottom Water Storage Tanks. The Contractor shall not subcontract the design or erection of the steel tank.

2) As providing a safe work environment is critical for this project, other contractors, and the community, to be approved to bid on this project, given the complexity, and risk associated with the work, all tank contractors are required to have an Experience Modification Rate (EMR) below 0.75 and a Total Recordable Incident Rate (TRIR) below 2.5 for the last three (3) years. Bidders are required to verify the above requirement by providing with their proposal a statement from their insurance carrier confirming the EMR requirement, and their last three (3) years of OSHA 300 Logs to confirm the TRIR requirement.

C. Submittals

No bid will be considered unless this information is provided with the

proposal.

1) A list of five Ground-Supported Flat-Bottom Water Storage Tanks constructed within the last five years, including the Owner, tank capacity and the Engineer.

2) A preliminary drawing of the tank showing major dimensions and plate thickness upon which the bid is based, tank diameter, the high water level and the dimensions of the supporting foundation.

3) A foundation design drawing showing preliminary dimensions and approximate quantities of concrete and reinforcing steel.

D. Standard Specifications

All work on the water storage tank shall fully conform to the requirements of the latest published editions of the following Standard Specifications:

1) AWWA (American Water Works Association) D100 Standard for Welded Carbon Steel Tanks for Water Storage.
2) AWWA D102 - Standard for Painting Steel Water Storage Tanks.
3) AWWA C652 - Standard for Disinfection of Water Storage Facilities.
4) AWS (American Welding Society) D1.1
5) NSF (National Sanitation Foundation) 61 - Materials in contact with Potable Water.
6) Steel Structures Painting Council Manual - Volume 1 - Good Painting Practice,
7) Steel Structures Painting Council Manual - Volume 2 - Systems and Specifications.
8) ACI 318 - Building Code Requirements for Reinforced Concrete
9) ACI 301 –Specifications for Structural Concrete

E. Tank Details

The tank shall be all-welded construction of the most economical design. All members of structural steel or of reinforced concrete shall be designed to safely withstand the maximum stresses to which they may be subjected during erection and operation.

1) The minimum operating capacity of the storage tank will be 50,000 US gallons.
2) The tank diameter will be 14’ feet.

3) The height of the tank, top of foundation to High Water Level, shall be 49'- 9" feet.
4) Top of foundation elevation shall be 1275.
5) The existing ground elevation is 1274.5.
6) The finished ground elevation shall be 1274.00.

F. Permits, Easements, Electrical Lines and Utilities

Permits, licenses, airspace authority approval and easements required for the construction of the tank and associated work shall be provided by the Owner.

The site plan or specifications shall clearly indicate the approximate location of all overhead or underground electrical lines and other utilities and piping. The Owner is responsible for relocating or de-energizing any electrical or utility lines that may interfere with the safe construction of the foundation or structure(s). In general, no overhead lines, or supports, shall pass or be located within 50 feet of any part of the structure or the footprint of the tank. A minimum vertical clearance of 15 feet shall be provided along any access routes.

G. Working Drawings

After contract award and prior to construction, the Contractor shall provide engineering drawings and design calculations for the steel tank and the foundation. Drawings shall show the size and location of all structural components and the foundations along with reinforcement details, the required strength and grade of all materials and the size and arrangement of principle piping and equipment. The drawings and calculations shall bear the certification of a professional Engineer licensed in the State of Arkansas. The design coefficients and resultant loads for snow, wind and seismic forces, and the methods of analysis shall be documented.

2.01 DESIGN

A. General

The structural design of the storage tank shall conform to the following design standards except as modified or clarified as follows:

1) Foundations – AWWA D100 and ACI 318 – Building Code Requirements for Reinforced Concrete.
2) Steel Tank - AWWA D100
3) The Contractor may use Section 14 of the AWWA D100 as a part of the design. Tanks designed on this basis must incorporate all

the provisions of this section. The requirements of Section 3 of the AWWA D100 are superseded by any differing requirements of Section 14.

4) Steel Tank Painting – AWWA D102

B. Environmental Loads – AWWA D100 and ASCE 7

1) Wind Load – Wind pressure shall be determined in accordance with AWWA D100, Section 3.1.4. Basic wind speed used in the Wind Pressure formula shall be determined using the mapped site location and Figure 1 of AWWA D100. For tanks located in coastal regions, the Owner's Engineer shall consider the use of an increased basic wind speed as appropriate.

Basic Wind Speed (BWS) = 110 MPH

2) Seismic Load – Seismic loads shall be determined in accordance with AWWA D100, Section 13.

a) Region Dependent Transition Period (T_L) =12 (Fig. 19)

b) Site Class D (Table 25)

c) MCE Spectral Response Acceleration at 0.2sec (S_S) and 1sec (S_1) (Fig's. 5-18)
S_S = 0.148
S_1 = 0.087
Longitude = 94° 17′ 45.40″ W (at tank center)
Latitude = 36° 21′ 0.34″ N (at tank center)

d) Importance Factor (I_E) = 1 (Table 24)

3) Snow Load – Snow load shall be determined in accordance with AWWA D100, Section 3.1.3.1.

C. Foundation

A Geotechnical investigation has been carried out at the site and a copy of the report is included with the Contract Documents. Recommendations for the foundation and allowable bearing capacities are defined in this report. The Owner shall retain the services of the Geotechnical consultant to verify the adequacy of the bearing stratum after the Contractor has carried out the excavation and before any concrete or reinforcement is placed. The concrete foundation shall be designed and constructed by the Contractor based upon the recommendations contained in the Geotechnical report. The report must provide the allowable soil bearing pressure with appropriate factors of safety, the active and passive earth pressure

coefficients, the angle of soil internal friction, its cohesion, unit weight and recommendations for bearing depth and backfill requirements.

D. Steel Tank

1) **General**
The materials, design, fabrication, erection, welding, testing and inspection of the steel tank shall be in accordance with the applicable sections of AWWA D100 except as modified in this document.

2) **Minimum Plate Thickness**
The minimum thickness for any part of the structure shall be 3/16 inch for parts not in contact with water and 1/4 inch for parts in contact with water.

3) **Tank Roof**
The tank roof shall be designed as per the project drawings. All interior lap joints will be sealed by means of caulking or continuous seal welding. The interior lap joints shall be defined to include roof plate laps. If roof is supported by rafters, the rafter shall be welded to the roof plates as required structurally. Any unwelded rafter to plate joints shall be sealed by caulking. The minimum thickness for roof plates not in contact with water will be 3/16".

3.01 CONSTRUCTION

A. **Concrete Foundation**
The foundation shall be designed and constructed to safely and permanently support the structure. The basis of the foundation construction shall be consistent with the soils investigation data included herein at the end of these specifications. Appropriate changes to construction schedule and price will be negotiated if, during excavation, soil conditions are encountered which differ from those described in geotechnical report. The concrete foundation shall be constructed in accordance with ACI 301. Minimum concrete compressive strength shall be as specified in Section 33 00 00, "Cast-In-Place Concrete".

B. **Steel Tank Construction**

1) **General**
The erection of the steel tank shall comply with the requirements of Section 10 of AWWA D100 except as modified by these documents.

2) **Welding**
All field welding shall conform to AWS and Section 10, AWWA D100. The contractor shall ensure welders or welding operators are qualified in accordance with ASME Section IX or ANSI/AWS B2.1.

3) **Fabrication**
All fabrication and shop assembly shall conform to the requirements of AWWA D100, Section 9, Shop Fabrication.

4) **Erection**

a) Plates subjected to stress by the weight or pressure of the contained liquid shall be assembled and welded in such a manner that the proper curvature of the plates in both directions is maintained. Plates shall be assembled and welded together by a procedure that will result in a minimum of distortion from weld shrinkage.

b) Joints in bottom of tank shall be continuously lap welded on top side only. The bottom ring of the tank wall shall be continuously welded to the floor plate both inside and outside.

5) **Inspection and Testing**
Inspection of shop and field welds shall be in accordance with AWWA D100, Section 11, Inspection and Testing. All inspection shall be performed prior to interior and exterior field painting. Radiographic inspection shall be performed by an independent testing agency with all cost included in the Contractor's bid and paid by the Contractor.

6) **Painting and Disinfection**
Surface preparation and coating of all steel surfaces shall be in accordance with Section 09 97 13.24 "Coating System for Steel Water Storage Tanks".

4.01 ACCESSORIES

A. **General**
The following accessories shall be provided in accordance with these specifications. All items shall be in full conformity with the current applicable OSHA safety regulations and the operating requirements of the structure.

B. **Ladders**

1) An exterior tank ladder shall be attached to the tank shell extending from approximately 8' above top of foundation to the top of the shell.

2) Ladder side rails shall be a minimum 3/8 inch by 2 inches with a 16 inch clear spacing. Rungs shall be not less than 3/4 inch, round or square, spaced at 12 inch centers. The surface of the rungs shall be knurled, dimpled or otherwise treated to minimize slipping. Ladders shall be secured to the tank by brackets located at intervals not exceeding 10 feet. Brackets shall be of sufficient length to provide a minimum distance of 7 inches from the center of the rung to the nearest permanent object behind the ladder.

C. **Fall Protection**
Ladders shall be equipped with a fall arrest system meeting OSHA regulations. The system shall be supplied complete with safety harnesses, locking mechanisms, lanyards and accessories for two persons.

D. **Openings**

1) **Roof Hatches**
Provide two access hatches on the roof of the tank. One hatch shall be 30 inch diameter and allow access from the roof to the interior of the tank. The hatch will be hinged and equipped with a hasp for locking. The hatch cover shall have a 2 inch downward edge. The second hatch will be 24 inch diameter and flanged with a removable cover so constructed that an exhaust fan may

be connected for ventilation during painting operations. The openings shall have a minimum 4 inch curb.

2) **Tank Vent**
The tank vent shall be centrally located on the tank roof above the maximum weir crest elevation. The tank vent shall have an intake and relief capacity sufficiently large that excessive pressure or vacuum will not develop during maximum flow rate. The vent shall be designed, constructed and screened so as to prevent the ingress of wind driven debris, insects, birds and animals. The vent shall be designed to operate when frosted over or otherwise clogged. The screens or relief material shall not be damaged by the occurrence and shall return automatically to operating position after the pressure or vacuum is relieved.

3) **Shell Access Manhole**
One 30 inch diameter and one 24 inch diameter shell manhole shall be provided near grade level to allow access to the tank interior. The manholes are to be located 180 degrees apart. The manhole lid shall be hinged or otherwise self-supported and open outward.

E. **Rigging**
A painter's rail attached to the roof, pipe couplings with plugs in the roof or other attachments that provide complete access for painting shall be furnished.

F. **Piping**

1) **Inlet/Outlet Piping**
The vertical inlet/outlet pipe connection to the bottom of the tank shall be an 8 inch standard weight carbon steel pipe with appropriate transition to a base elbow of the same diameter. The vertical pipe shall be attached through the bottom of the tank as near to the shell wall as feasible. The connection from the piping to the tank floor shall be a watertight connection.

2) **Overflow**
The overflow pipe shall be designed to carry the maximum design flow rate of 250 GPM. The 8" inch steel overflow pipe shall have a minimum wall thickness of ¼". A suitable weir shall be provided inside the tank with the crest located at High Water

Level. The overflow pipe shall extend from the weir and down the exterior of the tank terminating approximately 1 to 2 feet above grade and discharge onto a concrete splash pad. The point of discharge shall have a 45 degree bend and be equipped with a stainless steel screen.

G. **Identification Plate**
A tank identification plate shall be mounted above a shell manhole. The identification plate shall be corrosion resistant and contain the following information.

1) Tank Contractor
2) Contractor's project or file number
3) Tank capacity
4) Tank diameter and height to High Water Level
5) Date erected

5.01 Guarantee

A. The tank Contractor shall guarantee its work for a period of one year from the completion date defined in the contract documents to the extent that it will repair any defects caused by faulty design, workmanship or material furnished under the specifications. If Contractor is not advised of any defects within 30 days of end of guarantee period, guarantee shall be considered fulfilled and complete. Defects caused by damaging service conditions such as electrolytic, chemical, abrasive or other damaging service conditions are not covered by this guarantee.

B. All guarantees obtained by the tank Contractor from the manufacturer or installer of paint, equipment or accessories not manufactured by tank Contractor shall be obtained for the benefit of the Purchaser.

SECTION 33 30 00

SEWERAGE SYSTEMS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Installation of sanitary sewerage system.

1.02 RELATED WORK

A. Section 31 23 33: Trenching, Backfilling and Compaction

PART 2 - PRODUCTS

2.01 DUCTILE IRON PIPE AND FITTINGS (ALL PROCESS PIPING)

A. Pipe:

1. Manufactured in accordance with ANSI A-21.50 (AWWA C- 151) and ANSI A- 21.10 (AWWA C-110).
2. An internal lining system as described herein.
3. A minimum of 1 mil thick bituminous coating on the outside surface for buried service and primed for exposed service per Protective Coatings specifications.
4. Clearly mark with manufacturer's name, D.I. or Ductile, weight, class or nominal thickness, and casting period.
5. Unless otherwise specified or shown on the plans, ductile iron pipe shall be Class 250 for 200 psi working pressure.
6. Ductile iron pipe shall be used for all process piping, interconnecting lines between unit processes, RAS/WAS lines and where indicated in plans.

B. Fittings:

1. Fittings 4"-24": Pressure rated at 250 psi.
2. Fittings 30"-60": Pressure rated at 250 psi.
3. Joints meeting the requirements of ANSI A-21.11 (AWWA C-111).

C. Interior Lining: As specified herein.

2.02 POLYVINYL CHLORIDE PIPE AND FITTINGS (6" to 15" Diameter)

A. All PVC gravity pipe and fittings 6-15 inches in diameter shall be solid wall PVC; no profile wall PVC pipe is allowed for pipes 15 inches or less in diameter. PVC solid wall pipe and fittings for gravity sewer applications shall conform to the requirements of ASTM D 3034. The standard dimension ratio (SDR) shall be SDR 26 (Type PSM). PVC resin shall conform to ASTM D 1784 cell class 12454C. A different cell class shall be allowed only if the material meets the requirements of a superior cell class than 12454C. 6-inch diameter PVC pipe shall only be used for service laterals. Fittings for PVC gravity sewer pipe shall be fabricated from PVC meeting the respective ASTM PVC pipe standard for molded or extruded PVC. The wall thicknesses of the waterway and bell of fittings shall be no less than the respective minimum thicknesses for the equivalent pipe. All fittings shall be compatible with the pipe to which they are attached.

B. All PVC gravity pipe joints shall be gasketed bell and spigot push-on type conforming to ASTM D 3212, unless directed otherwise in these Specifications. Gaskets shall be part of a complete pipe section and purchased as such. Lubricant shall be as recommended by the pipe manufacturer.

C. PVC pressure pipe may be used for force mains only up to 6" diameter. Pipe shall be C-900, Pressure Class 165 psi (DR 25).

2.03 INTERIOR LINING SYSTEMS FOR DIP AND FITTINGS

A. Ceramic Epoxy Lining System

1. All pipe used in the construction of this project may be lined internally with Protecto 401 or equal which meets the following specification.
2. Condition of Pipe Prior to Surface Preparation: All pipe and fittings shall be delivered to the application facility without asphalt, cement lining, or any other lining on the interior surface. Because removal of old linings may not be possible, the intent of this specification is that the entire interior of the ductile iron pipe and fittings shall not have been lined with any substance prior to the application of the specified lining material and no coating shall have been applied to the first six inches of the exterior of the spigot ends.

3. Lining Material: The standard of quality is Protecto 401 Ceramic Epoxy. The material shall be an amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment. Any request for substitution must be accompanied by a successful history of lining pipe and fittings for sewer service, a test report verifying the following properties, and a certification of the test results.
   a. A permeability rating of 0.00 when tested according to Method A of ASTM E-96-66, Procedure A with a test duration of 30 days.
   b. The following test must be run on coupons from factory lined pipe:
      1. ASTM B-117 Salt Spray (scribed panel) - Results to equal 0.0 undercutting after two years.
      2. ASTM G-95 Cathodic Disbondment 1.5 volts @ 77EF. Results to equal no more than 0.5mm undercutting after 30 days.
      3. Immersion Testing rated using ASTM D-714-87.
         a. 20% Sulfuric Acid-No effect after two years.
         b. 25% Sodium Hydroxide-No effect after two years.
         c. 160EF Distilled Water-No effect after two years.
         d. 120EF Tap Water (scribed panel)-0.0 undercutting after two years with no effect.
   c. An abrasion resistance of no more than 4 mils (10mm) loss after one million cycles - European Standard EN 598: 1994 section 7.8 Abrasion resistance.
4. Application:
   a. Applicator: The lining shall be applied by a competent firm with a successful history of applying linings to the interior of ductile iron pipe and fittings.
   b. Surface Preparation: Prior to abrasive blasting, the entire area to receive the protective compound shall be inspected for oil, grease, etc. Any areas where oil, grease, or any substance which can be removed by solvent is present shall be solvent cleaned using the guidelines outlined in DIPRA-1 Solvent Cleaning. After the surface has been made free of grease, oil or other substances, all areas to receive the protective compounds shall be abrasive blasted using compressed air nozzles with sand or grit abrasive media. The entire surface to be lined shall be struck with the blast media so that all rust, loose oxides, etc., are removed from the surface. Only slight stains and tightly

adhering annealing oxide may be left on the surface. Any area where rust reappears before lining must be reblasted.

c. Lining: After the surface preparation and within 8 hours of surface preparation, the interior of the pipe shall receive 45 mils nominal dry film thickness of Protecto 401. No lining shall take place when the substrate or ambient temperature is below 40 degrees Fahrenheit. The surface also must be dry and dust free. If flange pipe or fittings are included in the project the lining shall not be used on the face of the flange.

d. Coating of Bell Sockets and Spigot Ends: Due to the tolerances involved, the gasket area and spigot end up to 6 inches back from the end of the spigot end must be coated with 6 mils nominal, 10 mils maximum Protecto Joint Compound. The Joint Compound shall be applied by brush to ensure coverage. Care should be taken that the Joint Compound is smooth without excess buildup in the gasket seat or on the spigot ends. Coating of the gasket seat and spigot ends shall be done after the application of the lining.

e. Number of Coats: The number of coats of lining materials applied shall be as recommended by the lining manufacturer. However, in no case shall this material be applied above the dry thickness per coat recommended by the lining manufacturer in printed literature. The maximum or minimum time between coats shall be that time recommended by the lining materials manufacturer. **No material shall be used for lining which is not indefinitely recoatable with itself without roughening of the surface.**

f. Touch-Up and Repair: Protecto Joint Compound shall be used for touch-up or repair in accordance with manufacturer's recommendations.

5. Inspection and Certification:

a. Inspection

1. All pipe and fitting linings shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC-PA-2 Film Thickness Rating.

2. The interior lining of all pipe barrels and fittings shall be tested for pinholes with a Holiday Test per ASTM G62 Method B. Any defects found shall be repaired prior to shipment.

3. Each pipe joint and fitting shall be marked with the date of application of the lining system along with its numerical sequence of application on that date and records maintained by the applicator of his work.

b. Certification: The pipe or fitting manufacturer must supply a certificate attesting to the fact that the applicator met the requirements of this specification, and that the material used was as specified.

5. Handling: Protecto 401 lined pipe and fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. shall be placed inside the pipe and fittings for lifting, positioning, or laying.

2.04 CONCRETE MATERIALS

A. Class A in all cases with a minimum strength of 4,000 psi.

2.05 CASTINGS FOR FRAME AND COVERS

A. Gray iron, Class 30 unless otherwise specified, meeting AASHTO M-108.

B. Cleaned and coated with bituminous paint that will produce an acceptable finish that is not affected by exposure to hot or cold weather.

C. Rings and covers for use on watertight manholes shall be machined to smooth uniform bearing that will provide a watertight seal.

2.06 PRE-CAST AND CAST-IN-PLACE CONCRETE STRUCTURES

A. Precast Manholes shall conform to AASHTO M-199 SR, ASTM C-478, or per structural details shown on approved shop drawings.

B. The following additional specifications shall apply:
   a. ASTM C 443, Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
   b. ASTM C 497, Test Methods for Concrete Pipe, Manhole Sections, or Tile
   c. ASTM C 1244, Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill

C. Exterior of precast and cast-in-place structures shall be coated with an approved bitumastic waterproofing sealant.

D. Use pre-molded rubber or approved bitumastic gaskets at all joints between sections of precast structures.

E. Interior Protective Lining Systems are required for manholes used in sanitary sewer or sewer process water applications and shall conform to Section 09982 of these specifications.

2.07 MANHOLE BASES

A. Manhole bases shall be poured in place using Class A, 4000 psi concrete only if the pre-cast bases do not comply with section 02722, sub-section 3.06, Item E, Nos. 1-4, and then only when pre-approved by the Engineer.

B. Base sections shall have holes provided when delivered to the job site and shall be marked for proper location.

C. Base section heights shall be determined by the supplier.

2.08 FILTER FABRIC

A. The filter fabric shall be a non-woven fabric made from polypropylene monofilament yarns. The fabric is to be non-biodegradable and inert to most soil chemicals, acids, and alkalies over a pH range of 3 to 11.

B. The filter fabric shall have an equivalent opening size of U.S. Standard sieve. Filter fabric shall be poly filter as manufactured by Carthage Mills, Inc., Cincinnati, Ohio, Mirafi 140 N as manufactured by the Calanese Corp. or equal.

2.09 SEWAGE VALVES

A. Swing check valves are of self-contained free-swinging disc style. Valves conform to all standards set forth in AWWA C508. Manufacturer should have a minimum of ten years' experience supplying AWWA C508 valves.

1. Valves shall conform to ANSI B16.1: Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800 and AWWA C508: Swing Check Valves for Waterworks Service, 2" through 24" NPS. Valves are rated for 200 PSI water working pressure. All testing is done in accordance with AWWA C508.

2. Valves have integrally cast flat face flanges in accordance with ANSI BI6.1 Class 125. All cast iron used conforms to ASTM A126 CLB. Valve Hanger and Disc are of cast iron conforming to ASTM A126 CLB. Hinge Pins are stainless steel and conform to ASTM A276 GR304. Seat Rings are of Low Zinc Bronze conforming to ASTM B62 or of stainless steel conforming to ASTM A276 GR316. Internal and external coatings are high build two component epoxy conforming to AWWA C550.
3. All valves utilize a single disc mounted to a clevis hinge which prevents the disc from tipping. The valve disc swings open once the pump starts and allows for full flow. When closed the valve offers a tight shut-off. Valve body and cover are of Cast Iron, valve hinge is of Cast Iron. Disc seating surface is either Bronze, Stainless Steel or of Buna-n depending on application. Valve seat rings are of Bronze or Stainless Steel.
4. The valve body has a bolted cover design and flanges are integral to body casting –not wafer style. Valve body and disc are designed in such a way as to minimize turbulence. Spring systems are externally mounted on the side of the body and do not come into contact with main line media.
5. Markings on the valves are in accordance with AWWA C508, and include the name of manufacturer, the year of manufacture, maximum working pressure and size of valve. All valves are built for horizontal installation. However, all valves operate equally well in the vertical installations.

B. Knife Gate Valves shall be stainless steel, Buna resilient seated, bi-directional valves rated for 150 PSI CWP. Valves shall be designed, manufactured and tested to MSS SP-81 standard or AWWA C520 standard and rated for outdoor service.

1. Knife gate valves shall be non-clogging, full port valves.

2. Knife gate valves shall be LVC Figure 77 valves by Pratt or approved equal.

C. Plug valves shall be of the non-lubricating, eccentric type and shall be designed for a working pressure of 175 psi for valves 12" and smaller, 150 psi for valves 14" and larger. Valves shall provide tight shut-off at rated pressure. Valve shall be the Pratt Ballcentric Plug Valve as manufactured by the DeZurick, Henry Pratt Company, or approved equal.

1. Valves 12" and smaller shall have round port design. 14" and larger valves shall have rectangular port design.
2. The plug valve body shall be cast iron ASTM A126 Class B with welded-in overlay of at least 95% nickel alloy content on all surfaces contacting the face of the plug. Sprayed, plated, nickel welded rings or seats screwed into the body are not acceptable.
3. The valve plug shall be ductile iron ASTM A-536, Grade 65-45-12, in valve sizes up to 20", and ASTM A126 Class B cast iron in sizes 24" and larger, with Buna N resilient seating surface to mate with the body seat.
4. Valve flanges shall be in strict accordance with ANSI B16.1, Class 125.
5. Plug valve shall be furnished with permanently lubricated sleeve type bearings conforming to AWWA C517. Bearings shall be of sintered, oil impregnated type 316 stainless steel ASTM A-743 Grade CF-8M or bronze ASTM B-127.
6. Valves shaft seals shall be of the "U" cup type, in accordance with AWWA C517. Seals shall be self-adjusting and re-packable without moving the bonnet from the valve.
7. Unless specified with an electric actuator, 6" and smaller exposed valves shall be provided with wrench actuators. 8" and larger exposed valves shall be provided with worm gear type manual actuators. All buried valves shall be provided with worm and gear actuators suited for the intended service. Valve actuators shall be fully grease packed and have stops in the open/close position. The actuator shall have a mechanical stop which will withstand an input torque of 450 lbs. against the stop. The actuator shall be able to provide 1.25 times the required operating torque under full rated line pressure combined with a flow velocity of 8 feet per second.

2.10 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

A. HDPE 4710 Pipe

1. Pipe shall conform to the standards set in ASTM F714.
2. Sewer pipe shall be manufactured with premium, highly engineered 4710 resin that provides maximum performance and formulated with a minimum of 2% carbon black for maximum protection against UV rays.
3. PE 4710 HDPE material shall conform to ASTM D3350 with the cell classification of 445574C and is listed with The Plastics Pipe Institute (PPI).

4. The standard laying length of HDPE pressure sewer pipe is 40 feet.
5. Pipe shall be a minimum of DR 17, DIPS sizing, with a pressure rating of 125 psi.

2.11 AIR RELEASE VALVES

A. All air release valves, combo valves, and air/vacuum release valves shall be stainless steel and sized according to the information on the plans. The valves shall be as manufactured by GA Industries, Figure 925 SS or 942 SS, Vent-O-Mat Series RGXII by RF Valves, or preapproved equal.

B. New stainless steel isolation ball valves shall be provided at each location. Ball valves shall be full port, Class 150, as manufactured by NIBCO, Watts, or preapproved equal.

2.12 ELECTRIC ACTUATORS FOR VALVES

A. Where specified, the Contractor will provide and install electric actuators for valves as indicated on the plans. Actuators shall conform to AWWA C542.

B. All valves with electric actuators shall be provided with a manual wheel as a back-up means to actuate the valve.

C. Actuators shall be Limitorque Series MX or approved equal. Actuator motors, couplings, and gears shall be selected by the provider to ensure proper operation.

D. Actuator manufacturer shall be responsible for final sizing of actuator motor and gearing for each valve and/or gate. Contractor is responsible for power and control cabling to the actuators.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prior to laying pipe, prepare a suitable bedding according to Section 02221.

B. Before placing pipe in the trench, field inspect for cracks or other defects; remove defective pipe from the construction site.

C. Swab the interior of the pipe to remove all undesirable material.

D. Prepare the bell end and remove undesirable material from the gasket and gasket recess.

3.02 INSTALLING GRAVITY SANITARY SEWERS

A. Lay pipe true to the lines and grades from the grade and alignment stakes, or equally usable references.
   1. Where laser equipment is used, provide offset hubs at every 50 foot station for purposes of checking grade between sections.
   2. Where batter boards are used, furnish stakes at intervals of 50 feet along the route of the pipeline.
   3. Set stakes at such distance from centerline of excavation as is suitable for the excavating method and machinery used.
   4. Provide and use accurately set batter boards at each 50-foot interval in establishing the bottom invert of each pipe laid.

B. Accurately establish the centerline of each pipe using a string stretched between targets and a plumb line extended to the centerline of the pipe.

C. Carefully inspect all pipe and each fitting prior to its placement in the trench and reject and remove any defective pipe or fitting from the job site.

D. Lay pipe progressively up grade, with bell upstream, in such manner as to form close, concentric joints with smooth bottom inverts. Joining of all pipe shall be in accordance with manufacturer's specifications.

E. Bed each pipe section in accordance with Section 02221.

F. Unless otherwise specified, provide all gravity sewer lines with a minimum of 4 feet of cover in roadways and 3 feet of cover in open areas, unless ductile iron pipe or concrete encasement is used.

G. Do not allow walking on completed pipelines until backfill has been placed to a depth of at least 6 inches above the crown of the pipe.

H. Keep the interior of the pipe free of all unneeded material, and upon completion of a section between any two manholes it shall be possible to view a complete circle of light when looking through the pipe.

I. When laying pipe ceases, close the open ends of the pipe with a suitable plug for preventing the entrance of foreign materials.

J. Couplings and adapters used for joining dissimilar gravity pipe materials, for repairing and rejoining sections of gravity sewer, and for connecting the first full joint of pipe to a short stub through a manhole wall shall meet the requirements of ASTM C-425.

K. All couplings and adapters for gravity sewer pipe shall be of rubber, plastic and metallic materials that will not be attacked by municipal wastewaters or aggressive elements in the soil and conform to ASTM C-425, Section 5.

3.03 INITIAL PROOF TESTING OF SANITARY SEWERS

A. It is the intent to specify a "test as you go" procedure in order to establish confidence in the installation and avoid the unnecessary delay of final acceptance.

B. Before a reach of pipeline is approved for payment, successfully proof test that reach for grade, alignment, cleanliness, and leakage.

C. In the event that four or more reaches fail to satisfactorily pass proof testing procedures, cease pipe laying until deficiencies are identified and corrected.

D. The basis for grade, alignment and cleanliness testing will be a visual inspection. Leakage testing will be by means of low-pressure air or exfiltration or infiltration as deemed by the Engineer.

E. Proof test flexible pipeline installation for deflection by pulling a "go-no go" test mandrel through the line after the initial backfill is complete to avoid unnecessary dig-ups.

3.04 FINAL TESTING

A. Before the job is accepted and before any existing services are connected, a final testing procedure is to be followed.

B. Perform a visual inspection when groundwater levels are above the pipeline if possible. All visible leaks shall be repaired. It shall be the Contractor's responsibility to show proof that the groundwater is above the pipe without additional compensation.

C. If there is evidence of infiltration, make measurement with suitable pipe weirs:
   1. If the flow through the lower most manhole of a continuous section of sewer does not exceed 25 gallons/day/inch/mile of pipeline and the groundwater level is representative of the highest annual level, the entire continuous section shall be approved for leakage.
   2. The leakage test will be conducted with all lines connected (including service lines).
   3. If the apparent infiltration rate exceeds 25 gallons/day/inch/mile, then take additional weir measurements to isolate those sections leaking.
   4. Any single reach of pipeline which exhibits an apparent infiltration rate in excess of 25 gallons/day/inch/mile will not be accepted and all leaks will be located and corrected.

D. If it is not practical to wait for groundwater levels that are representative of the highest annual level, the Contractor may request approval on the basis of a low-pressure air exfiltration (or other approved exfiltration) test.
   1. Such tests, if approved by the Engineer, will be conducted in accordance with ASTM C-828 or latest revision.
   2. When an exfiltration test is used as a substitute for infiltration testing, correct all conditions that are potential sources of infiltration.

E. If flexible pipe is used, pull an approved go-no go deflection mandrel of 95/100 pipe diameter through all reaches of gravity sewer main. This test shall be conducted no sooner than 30 days after completion of backfilling of the tested reach. No sections will be accepted that exhibit a deflection of more than 5%.

3.05 LOW PRESSURE AIR EXFILTRATION TEST (GRAVITY LINES)

A. Calculate the pressure drop as the number of minutes for the air pressure to drop from a stabilized pressure of 4-1/2 to 3-1/2 PSIG.

B. Times for mixed pipe sizes of varying lengths should be calculated as described in ASTM, C828-76T using formula $t = k\ d/q$ ($q = .0020$).

C. Lengths of section under test shall not exceed 1,000 linear feet.

D. The following times are for one pipe size only:

MINIMUM TEST TIME FOR VARIOUS PIPE SIZES
(BASED UPON ASTM C828-80)

Nominal Pipe Size, Inches	Time, seconds per 100 feet	Nominal Pipe Size, Inches	Time, seconds per 100 feet
3	128	21	892
4	170	24	1020
6	255	27	1147
8	340	30	1275
10	425	33	1402
12	510	36	1530
15	637	42	1785
18	765	48	2040

3.06 PRESSURE TESTS (FORCE MAINS)

A. After the pressure lines have been laid, subject all newly laid pipe or any valved section thereof to a hydrostatic pressure of at least 1.5 times the working pressure at the point of testing.

B. Test pressures shall:

1. Not be less than 1.50 times the working pressure at the highest point along the test section.
2. Not exceed the pipe or thrust restraint design pressures.
3. Be of at least 2-hour duration.
4. Not vary by more than $\pm$5 psi.
5. Not exceed twice the rated pressure of closed valved or hydrants included in the test section.
6. Not exceed the rated pressure of resilient-seated butterfly valves.
7. Be at least 150 psi.

C. Pressurization

1. Slowly fill each valved section of pipe with water.
2. Apply the specified test pressure , based on the elevation of the lowest point of the line or section under test and correct to the elevation of the test gauge by means of a pump connected to the pipe in a manner satisfactory to the Owner.

D. Air Removal

1. Before applying the specified test pressure, expel air completely from the pipe, valves, and hydrants.
2. If permanent air vents are not located at all high points, install corporation cocks at such points to expel air as the line is filled with water.
3. After all the air has been expelled, close the corporation cocks and apply the test pressure.
4. At the conclusion of the pressure test, remove the corporation cocks and plug or leave in place at the discretion of the Owner.

E. Examination

1. Carefully examine all exposed pipe, fittings, valves, hydrants, and joints.
2. Repair or replace any damaged or defective pipe, fittings, valve, or hydrants, that are discovered with sound material and repeat the test until it is satisfactory to the Owner.

3.07 MANHOLE RINGS AND COVERS

A. Grout manhole rings and covers in place with cement mortars.

B. The bearing surfaces between cast rings and covers shall be machined, fitted together, and match marked to prevent rocking.

C. All castings shall be of the types, dimensions, and weights as shown on the plans and shall be free of faults, cracks, blow-holes, or other defects.

3.08 VACUUM TESTING OF MANHOLES & SIPHON STRUCTURES

A. All manholes, either cast-in-place or pre-cast, shall be vacuum tested as follows:
   1. All lift holes shall be plugged with an approved non-shrink grout.
   2. All pipes entering the manhole shall be plugged, taking care to securely brace the plug from being drawn into the manhole.
   3. The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturer's recommendations.
   4. A vacuum of ten (10) inches of mercury shall be drawn and the vacuum pump shut-off. With the valves closed, the time shall be measured for the vacuum to drop to nine (9) inches. The

manhole shall pass if the time is greater than sixty (60) seconds for 48" diameter, seventy-five (75) seconds for 60" diameter, and ninety (90) seconds for 72" diameter manholes.

5. If the manhole fails the initial test, necessary repairs shall be made while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.

3.09 FILTER FABRIC

A. Use filter fabric for sewer pipe. Delete only when directed to by the Engineer.

B. The fabric will be used to completely encapsulate the pipe, and pipe bedding.

C. The fabric must overlap on the top a minimum of 18 inches.

3.10 TIE-INS

A. Existing lines shall remain in place and in working order until the exact planned time of tine-ins is required.

B. Should existing lines become damaged during construction at any time prior to time of tie-in, the Contractor shall assume full responsibility for repairing and returning to normal operation.

C. Tie-ins shall be made in full coordination with the Engineer and the Owner upon completion of and testing of all new sewer lines.

END OF SECTION

SECTION 33 40 00

PIPE CULVERTS AND STORM SEWERS

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 20 00: Site Grading and Filling

B. Section 31 23 33: Trenching, Backfilling and Compaction

1.02 WORK INCLUDED

A. This work shall consist of the construction of pipe culverts and storm sewers of the kinds and dimensions shown on the plans or stipulated in the proposal. The construction shall be accomplished in accordance with these specifications and in reasonably close conformity with the lines, grades, and cross-sections shown on the plans or established by the Engineer. The work shall include such labor, materials, and equipment as may be necessary to make connections with other drainage structures as shown on the plans or as directed by the Engineer.

1.03 MATERIALS

A. Materials for specials and connections to other pipes or structures, required to complete the work as indicated on the plans or directed by the Engineer shall be approved by the Engineer prior to construction.

B. The sizes of pipe shall be identified by the nominal inside diameter. The pipe shall be of the sizes stipulated in the contract, shown on the plans, or established by the Engineer.

1.04 EQUIPMENT

A. The equipment provided by the contractor shall include hoisting equipment capable of handling and placing the pipe in final position without damage to the pipe. Mechanical tamps shall also be included.

B. All of the above equipment, as well as any additional equipment necessary for the satisfactory performance of this construction, shall

be on the project and approved by the Engineer before work will be permitted to begin.

PART 2 - PRODUCTS

2.01 REINFORCED CONCRETE PIPE

A. All storm drainage pipe shall be reinforced concrete pipe, unless noted as otherwise on plans, and conforming to the following:

1. Reinforced Concrete Pipe: shall conform to ASTM C76 for the specified diameters and strength classes. Horizontal and vertical elliptical pipe shall conform to ASTM C507. Arch pipe shall conform to ASTM C506.
2. Precast reinforced concrete end sections shall conform to the cited specifications to the extent to which they apply.

B. Joints for concrete pipe shall be rubber gasket joints.

C. Rubber Gasket Joints - Rubber gaskets shall conform to ASTM Specifications C443, and shall be continuous rubber rings fitting snugly into the annular space between the parallel surfaces of the tongue and groove ends of the pipe to form a flexible and watertight seal under all conditions of service. Make rubber gasket joints as recommended by the gasket manufacturer and generally as follows: Prior to installing the pipe and when recommended by the gasket manufacturer, the gasket shall be cemented to the tongue end of the pipe with a special rubber cement furnished by the manufacturer of the gasket. When placing gasket, the pipe tongue surface shall be dry and clean. Affix gasket to the pipe not more than 24 hours prior to installation. Before installing pipe, the entire interior of the groove shall be cleaned and lubricated, as well as the gasket over which the groove is fitted. All pipe shall be aligned with the previously installed pipe and the joint pulled together tightly. If the gasket becomes loose or displaced, the pipe section shall be removed and the joint remade satisfactorily. All joints shall be inspected both inside and outside for gasket faulting or displacement.

D. The sizes of pipe shall be identified by the nominal inside diameter. The pipe shall be of the sizes stipulated in the contract, shown on the plans, or established by the Project Engineer.

2.03 DUCTILE IRON PIPE (D.I.)

A. All D.I. pipe shall be of the nominal diameter(s) shown on the plans and shall conform to ANSI/AWWA C150/A21.50. D.I. pipe shall meet the standards of ASTM A746 and shall be designed to the same formulas and design criteria as pipe designed per ANSI/AWWA C150/A21.50.

B. All D.I. pipe shall have coal tar Tnemec series 46-465 HB Tnemecol two coats (12 to 18 mils total thickness) or equal for resistance to corrosion attack to protect interior and exterior. The minimum pressure classes required for D.I. pipe on this project follows: 30" D.I pipe (ASTM A746): pressure class 150.

2.04 DRAINAGE STRUCTURE MATERIALS

A. Materials used in this construction, in addition to meeting the general stipulations of these Specifications, shall meet the following requirements:

Structural Steel	ASTM A 36
Building Brick, Concrete	ASTM C 55
Sewer Brick	AASHTO M 91
Masonry Mortar	AASHTO M 150
Steel Bar Reinforcement	Sec. 03200
Gray Iron Castings	ASTM A 48
Precast Manholes & Structures	ASTM C 478

B. Portland cement concrete shall be Class A concrete, and shall be manufactured, placed and cured in accordance with the applicable requirements of Section 03300.

C. All bolts, anchors, frames, hangers, etc. for castings and plates shall be as approved by the Project Engineer.

PART 3 – CONSTRUCTION REQUIREMENTS

3.01 STRUCTURE, EXCAVATION AND FOUNDATION PREPARATION

A. This work shall be performed in accordance with the Arkansas

Department of Transportation (ARDOT) specifications. Bedding for pipe culverts and storm sewer cross drains shall have a longitudinal camber of the magnitude specified by the Engineer.

B. When excavation is made for installing storm sewers across private property, the topsoil and sod disturbed by the excavation operations shall be salvaged and replaced in its original position, unless otherwise specified. All costs of restoring the area to its original conditional shall be included in the unit price bid for other items of construction.

3.02 LAYING PIPE CULVERTS AND STORM SEWERS

A. Pipe culverts and storm sewers shall be laid beginning at the downstream end of the pipe line. The lower segment of the pipe shall be in contact with the shaped bedding throughout its full length. Bell or groove ends of rigid pipe and outside circumferential laps of flexible pipe shall be placed facing upstream.

3.03 JOINING PIPE

A. Rigid pipe may be of bell and spigot or tongue and groove design, unless one type is specified. The method of joining pipe sections shall be such that the ends are fully entered and the inner surfaces are reasonably flush and even.

B. Joints for rigid pipe shall be made with rubber gaskets as recommended by the pipe manufacturer.

C. Rubber ring gaskets shall be installed so as to form a flexible watertight seal. When other type joints are permitted, they shall be installed or constructed in accordance with the recommendations of the manufacturer.

D. Pipe shall be inspected before any backfill is placed. Any pipe found to be out of alignment, unduly settled, or damaged shall be taken up and relaid or replaced.

3.04 BACKFILLING

A. After the pipe is installed, the trench shall be backfilled in accordance with Section 02221.

3.05 DISPOSAL OF EXCESS OR UNSUITABLE MATERIAL

A. Excess or unsuitable excavated material shall be disposed of as directed by the Engineer.

END OF SECTION

SECTION 33 49 00

STORM DRAINAGE STRUCTURES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This work shall consist of constructing manholes, inlets, and pipe endwalls at the locations shown on the Plans, and in reasonably close conformity to the lines, grades, and design dimensions shown on the Plans, or as directed by the Engineer, and in accordance with the provisions of these Specifications.

B. The work shall include the furnishing and installation of such incidental appurtenances and connections to pipe and other structures as may be required to complete the construction as shown on the Plans or as directed by the Engineer.

1.02 MATERIALS

A. Materials used in this construction, in addition to meeting the general stipulations of these Specifications, shall meet the following requirements:

Structural Steel	ASTM A 36
Building Brick, Concrete	ASTM C 55
Sewer Brick	AASHTO M 91
Masonry Mortar	AASHTO M 150
Steel Bar Reinforcement	Section 03 20 00
Gray Iron Castings	ASTM A 48
Manhole Steps	ASTM C 478
Manhole Tops	ASTM C 478

B. Portland cement concrete shall be Class A concrete, and shall be manufactured, placed and cured in accordance with the applicable requirements of Section 03 30 00.

C. All bolts, anchors, frames, hangers, etc. for castings and plates shall be as approved by the Engineer.

1.03 EQUIPMENT

A. All equipment necessary for the satisfactory performance of this construction shall be on the project and approved by the Engineer before work will be permitted to begin.

PART 2 - CONSTRUCTION REQUIREMENTS

2.01 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 23 00: Excavating, Filling and Grading

B. Section 03 30 00: Cast-in-Place Concrete

2.02 STRUCTURE EXCAVATION, FOUNDATION PREPARATION AND BACKFILL

A. All work shall be done in accordance with the requirements of Section 31 23 00 - Trenching, Backfilling, Compaction.

2.03 CONCRETE CONSTRUCTION

A. All concrete construction shall be accomplished in accordance with the requirements of Section 03 30 00, Cast-in-Place Concrete.

2.04 INVERTS

A. Inverts shall be of Class A concrete and shall conform to the shapes indicated on the Plans. The inverts shall be so constructed as to cause the least possible resistance to flow. The shape of the inverts shall conform uniformly to inlet and outlet pipes. A smooth and uniform finish will be required.

2.05 INLET AND OUTLET PIPES

A. Inlet and outlet pipes shall extend through the walls of manholes and inlets for a sufficient distance beyond the outside surface to allow for connections, but shall be cut off flush with the wall on the inside surface, unless otherwise directed.

B. The concrete or brick and mortar shall be so constructed around the pipes as to prevent leakage and form a neat connection.

2.06 CASTINGS AND FITTINGS

A. Castings and fittings shall be handled in a manner that will prevent damage. All damaged castings and fittings shall be rejected.

B. All castings and fittings shall be placed in the positions indicated on the Plans or as directed by the Engineer, and shall be set true to line and grade.

If castings are to be set in concrete or cement mortar, all anchors or bolts shall be in place and position before concrete or mortar is placed. The casting shall not be disturbed until the mortar or concrete has set.

C. When castings are to be placed upon previously constructed masonry, the bearing surface of masonry shall be brought true to line and grade and present an even bearing surface in order that the entire face or back of the casting will come in contact with the masonry. Castings shall be set in mortar beds or anchored to the masonry as indicated on the Plans or as directed by the Project Engineer.

D. All castings shall be set firm and snug and shall not rattle. Unless otherwise specified, gray iron castings shall be cleaned and treated with two coats of bituminous paint.

END OF SECTION

SECTION 33 49 13
SEPARATION OF PIPE UTILITIES

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Location of piped utilities to separate water mains from sewer facilities.

1.02 RELATED WORK

A. Appropriate Piped Utility Sections

PART 2 - PRODUCTS

2.01 PARALLEL INSTALLATION

A. Separate water mains at least 10 feet horizontally, measured edge to edge, from any sewer facility whenever possible.

B. When local conditions prevent a horizontal separation of 10 feet, closer installations may be made if:
   1. The bottom of the water main is at least 18" above the top of the sewer facility; or
   2. The sewer is constructed of materials equivalent to water main standards and pressure tested to assure watertightness prior to backfilling.

2.02 CROSSINGS

A. Separate water mains crossing sewer facilities by at least 18" between the bottom of the water main and the top of the sewer facility whenever possible.

B. When local conditions prevent a vertical separation as described above, the following construction shall be used:
   1. Sewers passing over or under water mains should be constructed of materials equivalent to water main standards and pressure tested to assure watertightness prior to backfilling.
   2. Water mains passing under sewers shall, in addition, be protected by providing:
      a. A vertical separation of at least 18" between the bottom of the sewer and the top of the water main.
      b. Adequate structural support for the sewer to prevent excessive deflection of joints and settling on and breaking the water mains.
      c. That the length of water pipe be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.

2.03 SEWER FACILITIES

A. Do not install water mains or sewer facilities which pass through or contact each other.

END OF SECTION