PROJECT MANUAL
INCLUDING SPECIFICATIONS
FOR CONSTRUCTION

CLASSROOM ADDITION
JUNIOR HIGH SCHOOL
Stuttgart School District
Stuttgart, Arkansas

ARCHITECT PROJECT NO. 26015
DATE: September 14, 2026

CONSTRUCTION MANAGER:
Clark Contractors, LLC
11101 Anderson Drive, Suite 100
Little Rock, Arkansas

LEWIS ARCHITECTS ENGINEERS
ELLIOTT • MCMORRAN • VADEN
RAGSDALE • WOODWARD • INCORPORATED
501.223.9302 • FAX 501.223.9909 • WWW.LEMVRW.COM

11225 HURON LANE • SUITE 104 • LITTLE ROCK, AR 72211

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01 22 00 Unit Pricing
01 23 00 Alternates
01 31 19 Project Meetings
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03 20 00 Concrete Reinforcement
03 31 00 Cast-In-Place Concrete
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04 05 13 Masonry Mortaring
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04 73 23 Cast Stone Masonry

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DIVISION FIVE METALS

05 12 00 Structural Steel
05 31 23 Steel Roof Deck
05 36 00 Composite Steel Deck
05 41 00 Lightgage Metal Framing
05 50 00 Metal Fabrications

DIVISION SIX WOOD, PLASTICS AND COMPOSITES

06 06 00 Lumber
06 10 00 Rough Carpentry
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07 19 00 Water Repellants
07 21 00 Thermal Insulation
07 25 00 Weather Barrier
07 26 16 Under Slab Vapor Barrier/Retarder
07 42 93 Metal Soffit
07 50 00 Single Ply (Mechanically Fastened) Roof System
07 60 00 Flashing and Sheet Metal
07 84 00 Firestopping
07 92 00 Joint Sealants

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08 11 00 Metal Doors and Frames
08 14 29 Wood Doors
08 41 00 Entrances and Storefront
05 54 00 Storm Shelter Thermal Window Systems
08 71 00 Door Hardware
08 80 00 Glazing

DIVISION NINE FINISHES

09 21 00 Gypsum Board Assemblies
09 30 00 Tile
09 51 00 Acoustical Ceilings
09 53 00 Acoustical Ceiling Suspension Assemblies
09 65 00 Resilient Flooring
09 68 00 Carpeting
09 91 00 Painting
09 96 56 Epoxy Coatings

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DIVISION TEN SPECIALTIES

10 14 00 Signage
10 21 13 Toilet Compartments
10 28 13 Toilet Accessories
10 41 00 Exterior Security Vault
10 44 16 Fire Extinguishers
10 73 26 Walkway Canopies

DIVISION ELEVEN EQUIPMENT

Not Used

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12 24 13 Roller Shades
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13 34 19 Metal Building Systems

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Not Used

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21 13 00 Fire-Suppression Sprinkler Systems

DIVISION TWENTY TWO PLUMBING

22 01 00 Plumbing

DIVISION TWENTY THREE HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

23 00 00 Heating, Ventilation and Air Conditioning
23 09 23 Direct Digital Control Systems for HVAC
23 74 33 Dedicated Outdoor Air Units

DIVISION TWENTY FIVE INTEGRATED AUTOMATION

Not Used

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26 05 00 Common Work Results for Electrical
26 05 19 Low-Voltage Electrical Power Conductors and Cables
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 09 23 Occupancy Sensors
26 24 16 Panelboards
26 27 26 Wiring Devices
26 28 16 Enclosed Switches and Circuit Breakers
26 29 13 Enclosed Controllers
26 51 00 Interior Lighting
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27 10 00 Structured Cabling
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28 46 00 Fire Alarm Systems

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31 11 00 Clearing and Grubbing
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31 23 00 Excavation and Fill
31 25 00 Erosion and Sedimentation Control
31 31 16 Termite Control

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32 12 16 Asphaltic Paving
32 31 13 Chain Link Fences and Gates
32 92 19 Seeding

DIVISION THIRTY THREE UTILITIES

33 40 00 Stormwater Utilities

DIVISION THIRTY FOUR TRANSPORTATION

Not Used

DIVISION THIRTY FIVE WATERWAY AND MARINE CONSTRUCTION

Not Used

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DIVISION FORTY PROCESS INTERCONNECTIONS

Not Used

DIVISION FORTY ONE MATERIAL PROCESSING AND HANDLING EQUIPMENT

Not Used

DIVISION FORTY TWO PROCESS HEATING, COOLING AND DRYING EQUIPMENT

Not Used

DIVISION FORTY THREE PROCESS GAS AND LIQUID HANDLING, PURIFICATION AND STORAGE EQUIPMENT

Not Used

DIVISION FORTY FOUR POLLUTION AND WASTE CONTROL EQUIPMENT

Not Used

DIVISION FORTY FIVE INDUSTRY-SPECIFIC MANUFACTURING EQUIPMENT

Not Used

DIVISION FORTY SIX WATER AND WASTEWATER EQUIPMENT

Not Used

DIVISION FORTY EIGHT ELECTRICAL POWER GENERATION

Not Used

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INSTRUCTION TO BIDDERS

1. Securing Documents:

Copies of the proposed Contract documents are on file at the office of the Architect:

Lewis, Elliott, McMorran, Vaden,
Ragsdale & Woodward, Inc.
11225 Huron Lane, Suite 104
Little Rock, AR 72211

2. General Instructions, Terms and Conditions:

a. These General Instructions, Terms and Conditions and any special terms and conditions become part of any contract entered into in the event any part or all of the bid is accepted by Stuttgart School District.

3. Definitions:

a. All definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201 - 2017, are applicable to these Instructions to Bidders.

b. Bidding documents include the advertisement or invitation to bid, execution of the contract which modify or interpret the bidding documents, including drawings and specifications, by addition, deletions, clarifications or corrections. Addenda will become part of the Contract Documents when the construction contract is executed.

c. The words vendor, bidder, offerer, company, proposer and contractor may be used synonymously in this document.

d. The terms “District” or “Owner” are used interchangeably and refer to the Stuttgart School District.

e. Pursuant to Arkansas Code Annotated 22-9-203, the State encourages all small, minority, and women business enterprises to submit bids for capital improvements. Encouragement is also made to all general contractors that in the event they subcontract portions of their work, consideration is given to the identified groups.

4. Examination of Drawings, Specifications, and Site of Work:

a. Before submitting a bid, each bidder shall carefully examine the Drawings, read the Specifications and all other proposed Contract Documents, and visit the site of the 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 all costs of all items necessary to perform the Work as set forth in the proposed Contract Documents. No allowance will be made to any bidder because of lack of such examination or knowledge. The submission of a bid will be construed as conclusive evidence that the bidder has made such examination.

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b. Should the bidder find discrepancies in, or omissions from the drawings, or other bidding documents, or should he be in doubt as to their meaning, he should at once, notify the Architect, who will send a written addendum to all bidders. Neither the Owner nor the Architect will be responsible for any oral instructions. Any addenda issued during the time of bidding are to be covered in the proposal and in closing a contract, they will become a part thereof.

5. Bidding Procedures:

a. Proposals shall be made upon the bid form issued by the Architect. The signature of the individual authorized to bind the bidder shall be in longhand; no oral, or telephonic proposals will be considered, but modifications by fax of bid already submitted will be considered if received prior to the hour set for opening.

b. Proposals shall also include "Bidder Assurances and Disclosure" form as issued by the Architect. Failure to include the "Bidder Assurances and Disclosure" form may result in disqualification.

c. Proposals, including "Bidder Assurances and Disclosure" form, must be signed by an individual authorized to bind the bidder. The person signing the bid should show title or authority to bind his/her firm to a contract. Signature must be in ink. Failure to sign the bid may result in disqualification. Bid must be completed in ink or typed. "Bidder Assurances and Disclosure" form must be notarized.

d. Bids received prior to the time of opening will be kept, unopened. No bid received after the hour set for their opening, will be considered, except that when a bid arrives by mail after the time fixed for opening, but before the award is made, and is shown to the satisfaction of the Owner that the non-arrival on time was due solely to delay in the mails, a fault for which the bidder was not responsible, such bids will be received and considered. No responsibility will be assumed by any person for the premature opening of a bid not properly addressed and identified.

e. In case of a difference in written words and figures the amount in written words shall govern.

6. Bid Bond:

a. A 5% bid bond or a certified check in the amount of 5% of the bid shall accompany all bids submitted on projects that exceed $35,000 (A.C.A. § 22-9-203). The bid bond shall be executed by a surety company approved by the Owner, and authorized to do business in the State of Arkansas. In lieu of bond, the Bidder may furnish a cashiers check, in an amount equal to 5% of Bid, drawn on National Bank or a Bank having a membership in the Federal Reserve System and signed by the President or Cashier. The successful bidder's security will be retained until he has signed the Contract and furnished the required Labor and Materials Payment and Performance Bond. The Owner reserves the right to retain the security of the next lowest bidder until the lowest bidder enters into contract or until 60 days after bid opening, whichever is shorter. All other bid security will be returned as soon as practicable. If any bidder refuses to enter into a contract, the Owner will retain his bid security as liquidated damages but not as a penalty.

7. Substitutions:

a. Where a definite material is specified, it is not the intent to discriminate against any "approved equal" product of another manufacturer. It is the intent to set a definite standard.

b. Open competition is expected, but in all cases, complete data must be submitted for comparison and test when required by the Architect.

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c. The materials, products and equipment described in the Bidding documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution.

d. No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least ten days prior to the date for receipt of Bids. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. Information shall be submitted in a format that compares the proposed product in a direct comparison to the specified product; line number to line number in specifications. A statement setting forth changes in other materials, equipment or other portion of the Work including changes in the work of other contracts that incorporation of the proposed substitution would require shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

e. If the Architect approves a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.

f. No substitutions will be considered after the Contract award unless specifically provided in the Contract documents.

g. No substitution shall be made unless authorized in writing, by the Architect.

h. All bidders shall base their proposals on the material or specialty specified. Any proposal for substitution shall be submitted within 30 days after the award of the contract.

i. Should a substitution be accepted and should the substitute material prove defective or otherwise unsatisfactory for the service intended within the guaranty period, the Contractor shall replace this material or equipment with that which was originally specified, without cost to the Owner.

8. Conflict of Interest:

a. By submitting a bid, the Contractor represents and warrants that no director, board member or employee of the District is in any manner interested directly or indirectly in the bid or contract which may result from the bid or in any of the expected profits which might arise therefrom; further, that no attempt has been made to influence or gain favorable advantage by communicating directly or indirectly with any official of the School District. It is understood that any action taken which might tend to degrade the integrity of the competitive bidding process will be considered as grounds for disqualification or a breach of this contract.

9. Qualifications of bidders:

a. The bidder will not be acceptable if he is engaged on any other work which impairs his ability to finance this contract or provide proper equipment for the proper execution of same.

b. The bidder must be prepared to furnish a performance bond and labor & material payment bond in accordance with the Contract Documents written by a surety company authorized to do business in the State of Arkansas.

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c. In determining the responsibility of the low bidder, the following will be considered; whether the contractor has:

1. Permanent place of business.
2. Experienced job superintendent available.
3. Adequate equipment.
4. Financial ability to perform contract.
5. Had appropriate experience.
6. State contractor's license.

10. Rejection of bids:

a. The Bidder acknowledges the right of the School District to reject any or all bids and to waive any informality or irregularity in any bid received. In addition, the Bidder recognizes the right of the School District to reject a bid if the Bidder failed to furnish any required bid security, or to submit the data required by the bidding documents, or if the bid is in any way incomplete or irregular. The School District may reject any and all bids and may reject a bid of any party who has failed to perform, been unfaithful and/or delinquent in any former relationship with the School District. The School District shall be the sole judge as to which bid is best and, in determining that fact, may consider the contractor's business integrity, financial resources, experience, facilities and/or capacity for performing the work.

11. Assignments:

Neither this contract nor any interest therein nor claim thereunder may or shall be assigned or transferred by the Contractor except as expressly authorized in writing by the School District. No contract, subcontract or agreement shall be made by the Contractor with any other party for furnishing any of the product, work or services herein contracted without the written approval of the School District.

12. Contract Changes:

In no event shall any understanding or agreement, contract modification, change order or other matter which would constitute a deviation from the terms of this contract be effective or binding upon the School District unless expressly stated and agreed to in writing executed by the School District official possessing contractual authority for said district.

13. Contract Guidelines:

Offerers agree that a contract does not become effective until it is awarded and a written agreement, purchase order, award letter, or other notice to proceed is executed or issued by the School District and the Architect.

14. Non-Collusive Affidavit:

By submitting a bid, the company and the individual personally signing the bid represent and warrant that such bid is genuine and is neither collusive nor made for or on behalf of any person not named, and that he has neither induced nor solicited any other company to place a sham bid nor directly or indirectly caused another company to refrain from or be unable to present a bid.

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15. Penalty for Collusion:

If at any time it shall be found that the person, firm or corporation to whom a contract has been awarded has, in presenting any bid, colluded with any other part or parties, then, in the sole discretion of the District, the contract so awarded shall be null and void or considered breached and the contractor shall be liable to the District for any and all loss and damage of whatsoever nature, which the District may suffer and the District may seek a new contractor.

16. Non-Discrimination:

The company shall not discriminate against, or segregate, a person or a group of persons on account of race, color, creed, religion, sex, sexual orientation, marital status, familial status, national origin, ancestry, disability of condition of acquired immune deficiency syndrome (AIDS) or AIDS-related complex in carrying out is duties and obligations pursuant to this agreement nor shall the company or any person claiming under or through the company establish or permit any such practice or practices of discrimination or segregation. The company must include in any and all subcontracts a provision similar to the proceeding.

17. Proprietary Information:

All information submitted in response to this bid is public after the bid opening. The bidder should not include as a part of the response to the invitation to bid any information which the bidder believes to be a trade secret or otherwise privileged or confidential. If the bidder wishes to include such material with a bid, then the material should be supplied under separate cover and identified as confidential. The District does not warrant or agree to, but will endeavor to, keep that information confidential. Contractor acknowledges that information in the possession of the District may be subject to the provisions of the Arkansas Freedom of Information Act.

18. Reservations:

The IFB does not commit the District to award a contract, to pay any costs incurred in the preparation of a bid in response to the invitation, or to procure or contract for services or supplies. The District reserves the right to accept, or reject, in part or its entirety, any bid received as a result of the IFB, it is is in the best interest of the District to do so.

19. Severability:

The finding or determination of any part or parts of the General Instruction, Terms and Conditions is void, unenforceable, invalid or voidable shall result in only that part being stricken with the remainder to continue in full force and effect.

20. Withdrawal of Bid: A bid may be withdrawn before the expiration of the time during which bids may be submitted, without prejudice, by submitting a written request for its withdrawal to the District Contracting Official.

21. No Smoking Policy: The Stuttgart School District has a No Smoking Policy on all school properties.

It is the policy of the Board of Education that all uses of tobacco and tobacco products, including smokeless tobacco, will be prohibited on all District facilities. At no time will the use of tobacco products be permitted in classrooms, corridors, restrooms, locker rooms, work areas, cafeterias, offices, faculty lounges, gymnasiums, all other rooms and school grounds.

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This policy applies to all Staff Members, Students, Visitors, General Contractors, Sub-Contractors, and Vendors. This policy is strictly enforced without exception.

END OF SECTION

Bidder Assurances and Disclosure -
School District Bid

Name of School District:_____

Bid Description/Number:_____

Bid Opening Date:_____

Assurances:

I, _____ hereby state:

1. I am the duly authorized agent of _____, the bidder submitting the competitive bid which is attached to this statement, for the purpose of certifying the facts pertaining to the existence of collusion among and between bidders and school district officials, as well as facts pertaining to the giving or offering of things of value to school district personnel in return for special consideration in the awarding of any contract pursuant to the bid to which this statement is attached.
2. I am fully aware of the facts and circumstances surrounding the making of the bid to which this statement is attached and have been personally and directly involved in the proceedings leading to the submission of the bid.
3. Neither the bidder nor anyone subject to the bidder's direction or control has been a party:
    a. To any collusion among bidders in restraint of freedom of competition by agreement to bid at a fixed price or to refrain from bidding;
    b. To any collusion with any school district official or employee as to quantity, quality or price in the prospective contract, or as to any other terms of the prospective contract; or
    c. In any discussions between bidders and any school district official concerning exchange of money or other thing of value for special consideration in the awarding of a contract.
4. I hereby guarantee that the specifications outlined in the bid shall be followed as specified and that deviations from the specifications shall occur only as part of a formal change process approved by the Board of Directors of the school district.

Disclosure:

1. Does any school board member or employee of the school district have a financial interest in your business or hold a position as officer, director, trustee, partner, or other top level management?_____ Yes _____No

2. Does any school board member or employee of the school district have a family relationship with anyone employed by your business? _____Yes _____No

(If the answer is yes to either of the above questions, provide details in a separate attachment to this form.)

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3. Did you or your company assist the school district or any agent of the school district with the development of the bid specifications? _____Yes _____No
   If yes:
   a. Were you or your company compensated? _____Yes _____No
   b. Is your company's name or identity included anywhere within the specifications? _____Yes _____No
   c. Were you offered any preferential treatment in the bid evaluation process? _____Yes _____No

(If the purchase will be from the school district's federal child nutrition food service fund, potential bidders cannot have input into the development of specification. – 7 Code of Federal Regulations 3016.60(b))

_____ _____
Signature Date

_____ _____
Name Title

_____
Company

Subscribed and sworn to before me this _____day of _____, 20_____.

_____
Notary Public

Any person determined to have made a false statement on the form or any bidder who acts contrary to the provisions of the form after its agent has executed the form shall be guilty of a Class C misdemeanor.

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REQUIRED CONTRACT FORMS

The following are the construction document forms that, where required by the Architect, will be used during this project. These documents are either furnished in the project manual or available for inspection at the Architect's office:

Lewis, Elliott, McMorran, Vaden,
Ragsdale & Woodward, Inc.
11225 Huron Lane, Suite 104
Little Rock, AR 72211
and/or available for purchase at:
Construction Manager

Bid Form	As furnished in the Project Manual or by the Construction Manager
*Form of Agreement Between Owner & Contractor	AIA Document A133
Bid Bond	AIA Document A310 or Cashiers Check
Performance Bond and Labor and Material Payment Bond	AIA Document A312
Insurance and Bonds	AIA Document A133 – 2019, Exhibit B
*Change Order	AIA Document G701
Application and Certificate for Payment	AIA Document G702 and G703
*Certificate of Substantial Completion	AIA Document G704
Certificate of Insurance	Acord Form (See sample furnished)
Contractor's Affidavit of Payment of Debts and Claims	AIA Document G706
Lien Waiver Form (Builder's or Contractor's Affidavit)	As furnished in Project Manual
Consent of Surety – Reduction in or Partial release of Retainage	AIA Document G707A
Consent of Surety Company to Final Payment	AIA Document G707
*Architect's Supplemental Instructions	AIA Document G710
Proposal Request	AIA Document G709
Construction Change Directive	AIA Document G714

*Indicates forms furnished and procedures initiated by the Architect and/or Construction Manager

END OF REQUIRED CONTRACT FORMS

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SAMPLE OF LIABILITY
INSURANCE FORM

GENERAL:

The Contractor's insurance carrier shall supply the "Acord Certificate of Insurance" form exactly as shown on the sample form furnished in this Project Manual, and a notorized letter of endorsement "Specifically permitting the waiver of rights provision in Article 11.1.2.7 of the General Conditions of the Contract for Construction, AIA Document A232 - 2009, as amended by the Supplementary Conditions and bound into this Project Manual".

END OF SECTION

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SAMPLE CERTIFICATE FOR NABHOLZ CONSTRUCTION

ACORD

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER Insurance Agency Name & Address	CONTACT NAME: Please include contact information PHONE (A/C, No, Ext): FAX (A/C, No): E-MAIL ADDRESS:
INSURED Subcontractor Name and Address Name should match on contract	INSURER(S) AFFORDING COVERAGE — NAIC # INSURER A : ABC Insurance Company INSURER B : Company must be acceptable carrier to NCS INSURER C : INSURER D : INSURER E : INSURER F :

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	GENERAL LIABILITY [X] COMMERCIAL GENERAL LIABILITY [ ] CLAIMS-MADE [X] OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: [ ] POLICY [X] PRO-JECT [ ] LOC	Y	Y	Policy Number	Policy Dates		EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG	$ 2,000,000 $ 100,000 $ 5,000 $ 2,000,000 $ 2,000,000 $ 2,000,000
A	AUTOMOBILE LIABILITY [X] ANY AUTO [ ] ALL OWNED AUTOS [ ] SCHEDULED AUTOS [ ] HIRED AUTOS [ ] NON-OWNED AUTOS	Y	Y	Policy Number	Policy Dates		COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident)	$ 2,000,000 $ $ $
	[ ] UMBRELLA LIAB [ ] OCCUR [ ] EXCESS LIAB [ ] CLAIMS-MADE [ ] DED [ ] RETENTION $	Y	Y	Umbrella can be used to reach required limits			EACH OCCURRENCE AGGREGATE	$ $
A	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? Y / N [ ] (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below	N / A	Y	Policy Number	Policy Dates		[X] WC STATU-TORY LIMITS [ ] OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	 $ 1,000,000 $ 1,000,000 $ 1,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

Nabholz Construction Corporation, its parent and affiliated companies, employees, agents, and principals; Owner and others as required by Prime Contract are named as additional insured under the General Liability and Auto Liability. The General Liability, Auto Liability and the Workers Compensation policies contain a Waiver of Subrogation in favor of Nabholz Construction Corporation, its parent and affiliated companies, employees, agents, and principals; Owner and others as required by Prime Contract.

*** General Liab Additional Insured Endorsement is attached. Workers Compensation Waiver of Subrogation Endorsement is attached.****

General Liability Endorsement must be equivalent to CG2010 and CG2037 10 01 -ongoing & completed ops required.

CERTIFICATE HOLDER

Nabholz Construction Corporation - South Central
c/o CertFocus
P.O. Box 140528
Kansas City, MO 64114

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

Must be signed by a licensed agent

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Document editions: 04/01/13 | 07/01/04 | **10/01/01** | 03/01/97 | 10/01/93 | 11/01/85
ISO | Commercial General Liability Forms | 10/01/01

POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY
CG 20 10 10 01

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

ADDITIONAL INSURED – OWNERS, LESSEES OR CONTRACTORS – SCHEDULED PERSON OR ORGANIZATION

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

SCHEDULE

Name of Person or Organization:

(If no entry appears above, information required to complete this endorsement will be shown in the Declarations as applicable to this endorsement.)

A. Section II – Who Is An Insured is amended to include as an insured the person or organization shown in the Schedule, but only with respect to liability arising out of your ongoing operations performed for that insured.

B. With respect to the insurance afforded to these additional insureds, the following exclusion is added:

2. Exclusions

This insurance does not apply to "bodily injury" or "property damage" occurring after:

(1) All work, including materials, parts or equipment furnished in connection with such work, on the project (other than service, maintenance or repairs) to be performed by or on behalf of the additional insured(s) at the site of the covered operations has been completed; or

(2) That portion of "your work" out of which the injury or damage arises has been put to its intended use by any person or organization other than another contractor or subcontractor engaged in performing operations for a principal as a part of the same project.

CG 20 10 10 01

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Document editions: 04/01/13 | 07/01/04 | **10/01/01**
ISO | Commercial General Liability Forms | 10/01/01

POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY
CG 20 37 10 01

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

ADDITIONAL INSURED – OWNERS, LESSEES OR CONTRACTORS – COMPLETED OPERATIONS

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

SCHEDULE

Name of Person or Organization:
Location And Description of Completed Operations:
Additional Premium:

(If no entry appears above, information required to complete this endorsement will be shown in the Declarations as applicable to this endorsement.)

Section II – Who Is An Insured is amended to include as an insured the person or organization shown in the Schedule, but only with respect to liability arising out of "your work" at the location designated and described in the schedule of this endorsement performed for that insured and included in the "products-completed operations hazard".

CG 20 37 10 01

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LIEN WAIVER FORM

STATE OF ARKANSAS
COUNTY OF_____
_____of_____
(Name) (Address)

being first duly sworn deposes and says:

That he is the contractor and/or material supplier who worked on or furnished material to be used in the construction and improvements on the property located in _____, more particularly described as follows:

Affiant further states that all material used therein was of the quality prescribed in plans and specifications approved by the architects, Owner, or both, that all laws, ordinances, building codes and civic regulations concerning construction or repair of building(s) have been complied with and that the Owner has inspected said improvements and accepted same as being complete and satisfactory.

Affiant further states that all charges and costs for labor performed, material furnished, and fixtures installed on said premises have been fully paid; that said premises are free and clear of all lienable claims whatsoever arising under and by virtue of said construction, and warrants and guarantees to hold Owner, and those claiming under the Owner, including any mortgagee or title insurance company, free and immune from any liability therefore.

The release is given in order to induce payment in the amount of _____ and on recept of this amount due, this release may be recorded, becomes valid, enforceable and of full effect.

Affiant further states that said construction began on the_____day of_____, 2026 and was completed on or before the _____day of _____, 2026, and he acknowledges receipt of all monies due him in connection therewith.

_____
Contractor/
Material Supplier

STATE OF ARKANSAS
COUNTY OF_____

Subscribed and sworn to before me this_____day of_____, 2026.

_____
Notary Public

My commission expires:
_____

SEAL

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"THE GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION", STANDARD FORM OF THE AMERICAN INSTITUTE OF ARCHITECTS, 2017 EDITION, A.I.A. DOCUMENT, A201, ARTICLES 1 THROUGH 15 INCLUSIVE, CONSISTING OF THIRTY-NINE PRINTED PAGES, ARE HEREBY INCORPORATED AS A PART OF THE PROJECT MANUAL AND SHALL BE AS THOUGH THEY WERE ATTACHED HERETO. THE GENERAL CONDITIONS ARE ON FILE FOR PUBLIC INSPECTION AT THE OFFICE OF LEWIS, ELLIOTT, MCMORRAN, VADEN, RAGSDALE & WOODWARD, INC., 11225 HURON LANE, SUITE 104, LITTLE ROCK, ARKANSAS."

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SUPPLEMENTARY
CONDITIONS

1. The "General Conditions of the Contract for Construction, Construction Manager as Adviser Edition", AIA Document A201, 2017, Articles 1 through 15 inclusive, is a part of this Contract.

2. The following supplements shall modify, delete, and/or add to the General Conditions. Where any article, paragraph, or subparagraph in the General Conditions is supplemented by one of the following paragraphs, the provisions of such article, paragraph, or subparagraph shall remain in effect and the supplemental provisions shall be considered an added thereto. Where any article, paragraph, or subparagraph in the General Conditions is amended, voided, or superseded by any of the following paragraphs, the provisions of such article, paragraph, or subparagraph not so amended, voided, or superseded shall remain in effect.

3. Add subparagraph 1.1.9:

"The word "Provide" shall mean to furnish and install, complete in place, operating, tested and approved".

4. Add subparagraph 1.1.10:

"The word "Product(s)" refers to the materials, systems, and equipment provided by the Contractor".

5. In subparagraph 3.4.3, add:

"Any person whose work is unsatisfactory to the Owner or the Architect shall be removed from the work upon receipt of written notice from the Architect".

6. Add subparagraph 3.4.4:

"All Contractors and Subcontractors engaged in the Work shall conform to the labor laws of the State of Arkansas, and the various acts amendatory and supplementary thereto, and to all other laws, ordinances, and legal requirements applicable there to".

7. Add subparagraph 3.7.6:

"The Contractor shall be a licensed contractor as provided by the Act Number 124 of the 1939 Act Number 217 of 1945 and Act Number 153 of 1951 and Act Number 150 of 1965 as enacted by the General Assembly of the State of Arkansas".

8. Delete subparagraphs 3.9.2 and 3.9.3 in their entirety and substitute the following subparagraph 3.9.2:

"The superintendent and assistants shall be satisfactory to the Architect, and shall not be changed except with the consent of the Architect, unless the superintendent proves to be unsatisfactory to the Contractor and ceases to be in his employ".

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9. Add subparagraph 3.13.3:

3.13.3 "All material shall be arranged and maintained in an orderly manner without hindering the use of walks, drives, roads, and entrances. Should it be necessary at any time to move material, sheds, or storage platforms, the Contractor shall do so as and when directed, and at his own expense".

10. Add subparagraphs 7.2.1 and 7.2.2:

7.2.1 The contractor shall be required to furnish the original bills and payrolls and support the statement with proper affidavits. The burden of proof of the costs rests upon the Contractor. Bills for extras will be allowed only when work is ordered in writing. No bills based on verbal orders will be allowed by the Architect unless accompanied by a written order from the Architect. The Contractor waives all claim for extension of time of completion on account of extra work, unless application for such extension is made by the Contractor in writing within twenty (21) days of the time such work is ordered.

7.2.2 The Contractor shall not make any changes except on written order of the Owner. Contractor's request for a Change Order to the Work shall be made on the AIA Document G709 and shall provide itemized breakdown of whole sum listing unit quantities and costs of all labor and materials. Contractor shall submit all verifying data as required to support claims, such as copies or original invoices, payrolls, etc. Requests shall identify percentage sums included for insurance, taxes, bonds, overhead and profit. Percentages shall not be allowed for changes altering allowances. Changes in the work by cost and a mutual acceptable fixed or percentage fee shall be computed as follows:

a. Net cost of materials, plus State Sales Tax.
b. Net delivery cost.
c. Net placing cost plus W.C. Insurance premium and FICA Tax.
d. 12% Overhead and Profit Charge on (1) through (3) allowed.
e. Allowable Bond Premium.

Where changes in the work involve subcontract work, the Contractor shall add to cost of subcontract work a profit charge of 5% total overhead and profit charge.

11. Delete subparagraph 7.4 and substitute the following:

"The Architect will have authority to order minor changes in the Work in the form of Field Orders which interpret the Contract Documents or order minor changes in the work without change in Contract Sum or Contract Time. Such changes shall be effected by written Field Order, and shall be binding on the Owner and the Contractor. The Contractor shall attend to such Field Order promptly".

12. Add subparagraphs 7.4.1 and 7.4.2:

7.4.1 "If the Contractor considers that a change in Contract Sum or Contract Time is required, he shall submit an itemized proposal to the Architect through the Construction Manager immediately and before proceeding with this work. If the proposal is found to be satisfactory and in proper order, the Field Order will in that event be superseded by a Change Order as provided in Paragraph 7.2. The Contractor shall attend to such Field Orders promptly".

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7.4.2 "When the time required for processing a Change Order would cause a delay in the progress of the Work, the Architect may issue a Field Order which, when signed by the Owner and the Construction Manager, will authorize the Contractor to proceed with changes in the work, which may change the Contract Sum and/or the Contract Time. Such Field Orders will be subsequently incorporated in the work as Change Orders as provided in paragraph 7.2. The Contractor shall attend to such Field Order promptly".

13. Delete subparagraph 9.3.1 and substitute the following:

"On or before the twenty-fifth day of each calendar month, the Construction Manger shall submit to the Architect an itemized Application for Payment on AIA Document G702, supported by data substantiating the Construction Manager's right to payment submitted on AIA Document G703 and attached thereto. The Construction Manager shall submit one (1) legible copy of these prepared Application for Payment forms and (1) legible copy of each invoice or statement supporting requests for payment of materials or equipment stored on job site or in an approved bonded warehouse". These forms can be emailed to the address as provided at the Pre-Construction meeting or by mailing, shipping or hand-delivery.

"Throughout entire job, the Owner will pay 95 percent of the amount due the Construction Manager on account of progress payments in compliance with Act 193 of 2009 amended AR. Code. Ann. § 22-9-604(a). No retainage will be withheld on material and/or equipment stored on job site or in an approved bonded warehouse".

14. 10.2.2 Add the following new subparagraphs:

10.2.2.1 Project with trenching or excavation which exceeds five feet in depth shall comply with Arkansas Code Annotated §22-9-212.

10.2.2.2 The current edition of OSHA Standard for Excavation and Trenches Safety System, 29 CFR 1926, Subpart P, shall be incorporated by reference in this contract.

15. NOTE: Refer to Sample of Liability Insurance Form for Sample Acord Form. Add the following clauses to 11.1.1:

11.1.1.1 The Contractor shall purchase and maintain Workers Compensation insurance providing Statutory Workers compensation benefits as well as Employers Liability Coverage of at least $1,000,000.00 Limit of Liability.

The following endorsements providing extensions of coverage shall be attached forming a part of said Workers compensation policy:

a. Broad Form All States Endorsement
b. Maritime or Jones Act coverage - where applicable, such as work on navigable waters.
c. United States Longshoremen's & Harbor Workers Coverage (may be voluntary if job is not close to body of water).

11.1.1.2 Comprehensive General Liability insurance shall be purchased and maintained by the contractor providing the following coverages and limits of liability:

a. Premises & Operations
b. Independent Contractors

c. Completed Operations and Products
d. X-Explosion, C-Collapse, U-Underground Property Damage Coverage – When Applicable Included
e. Contractual Liability/Blanket Coverage
f. Personal Injury Coverage with Employee Exclusion Removed
g. Owner and Architect shall be named as an Additional Insured on CGL Policy including Completed Operations
h. Additional insured shall be provided with a certificate of insurance

Limits No Less Than:

$1,000,000 Per Occurrence
$2,000,000 Annual Aggregate
$2,000,000 Products/Completed Operations Aggregate

"Per Project Aggregate" endorsement shall be included.

11.1.1.3 Business Auto Liability or Comprehensive Auto Liability policy shall be purchased and maintained by the contractor providing coverage for all owned, non-owned and hired autos.

Limit of Liability required shall be:

$1,000,000.00 Combined Single Limit.

11.1.1.4 An Umbrella Liability Policy shall be purchased and maintained by the contractor providing coverage over and above required underlying Employers Liability, Comprehensive General Liability, and Business Auto Liability coverages.

Limits of Liability shall be no less than $l,000,000.00 per Occurrence/$1,000,000.00 Aggregate.

The Owner and Architect shall be named as an Additional Insured.

11.1.1.5 Property Insurance, (Builder's Risk, Installation Floater, Boiler & Machinery coverage when applicable), providing All-Risk Coverage shall be purchased and maintained by the contractor providing full coverage for all materials, including labor, destined to be part of job and/or already part of job.

The Owner, Architect, Contractor and all Subcontractors shall be included as Named Insureds covering their interest of the said job.

The policy shall reflect a Deductible of $250.00 per occurrence which shall be paid in all cases by the Contractor.

11.1.1.6 Miscellaneous Requirements:

a. All required insurance coverages and bonds shall be provided by an insurance company of a sound financial rating and licensed to do business in the state of the designated job.

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b. Certificates of Insurance shall be filed in duplicate with the Architect and approved by the Owner prior to commencement of the work. The certificates shall reflect coverages, limits of liability, and wording at least as broad as the attached specimen. Use the Accord Certificate of Insurance form as shown by specimen included in this set of specifications. All certificates shall include 30 day written notice of cancellation applicable to the General Liability, Workers Compensation, Automobile and Umbrella policies.

c. The contractor shall not commence work under this contract or allow any subcontractor or anyone directly or indirectly employed by anyone of them to commence work until he has obtained all insurance required under this, and two duly executed Certificates of such insurance shall have been filed with the Architect and approved by the Owner and Contractor has complied with bonding requirements and work order has been issued. Each such certificate and policy shall contain a provision that coverages afforded under the policies will not be cancelled or materially altered until at least thirty days prior written notice has been given to the Owner.

d. The insurance carrier shall issue an endorsement specifically permitting the waiver of rights provision in AIA Document A201, Article 11.3.1.

16. Add subparagraph 11.1.1.7:

If by the terms of this insurance any mandatory deductibles are required, or if the Contractor should elect, with the concurrence of the Owner, to increase the mandatory deductible amounts or purchase this insurance with voluntary deductible amounts, the Contractor shall be responsible for payment of the amount of the deductible in the event of a paid claim.

17. Add subparagraph 11.1.2.1:

"Contractor shall furnish and pay for an Executed Performance Bond on AIA Document A312 and Labor and Material Payment bond on AIA Document A312 in the amount of 100% of the contract sum. No modification to the standard bond forms will be allowed without written consent of the Architect".

18. Add subparagraph 11.1.2.2:

"After being approved by the Architect and/or Construction Manager and prior to any work under this contract, the Contractor shall file the bonds with the circuit clerk and recorder of the county in which the work to be performed is located. Contractor shall obtain from the circuit clerk certificates as evidence that the bonds have been approved and filed with the clerk and said certificates shall be filed with the Architect".

19. Add subparagraph 11.1.5:

"If at any time a surety on any such bond is declared bankrupt or loses its right to do business in this state, Contractor shall notify the Owner immediately and within ten (10) days, furnish an acceptable bond (or bonds), in such form and sum and signed by such other surety or sureties as may be satisfactory to the Owner. The premiums on such bond shall be paid by the Contractor. No further payments shall be deemed due nor shall be made until the new surety or sureties shall have furnished an acceptable Bond to the Owner. Failure to comply with the above requirements may be deemed sufficient grounds for termination of this contract".

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20. Delete subparagraph 11.2.1 in its entirety and substitute the following:

The Contractor shall be responsible for purchasing and maintaining liability insurance as will protect the Owner against claims which may arise from operations under the contract.

21. Delete subparagraph 11.2.2 in its entirety and substitute the following:

11.2.2 The Contractor shall purchase and maintain property insurance upon the entire Work at the site to the full insurable value thereof. Such insurance shall be in a company or companies against which the Owner has no reasonable objection. This insurance shall include the interests of the Owner, the Contractor, Subcontractors, and Subcontractors in the Work and shall insure against the perils of fire and extended coverage and shall include "all risk" insurance for physical loss or damage including, without duplication of coverage, theft, vandalism and malicious mischief. If not covered under all risk insurance or otherwise provided in the Contract Documents, the contractor shall effect and maintain similar property insurance on portions of the work stored off the site or in transit when such portions of the work are to be included in an application for Payment under subparagraph 9.3.2. The form of policy for this coverage shall be completed value.

22. Add subparagraph 11.5.3

The Owner's occupancy or use of any completed or partially completed portion of the Work prior to Substantial Completion shall not commence until the insurance company or companies providing the insurance under Section 11.1.1.5 Property Insurance have consented in writing to the continuance of coverage. The Owner and the Contractor shall take no action with respect to partial occupancy or use that would cause cancellation, lapse, or reduction of insurance, unless they agree otherwise in writing.

23. Delete subparagraph 15.1.6.2 in its entirety and substitute the following:

"Extension of Time Due to Weather Delays: Claims for extension of time due to unusual inclement weather shall be granted only because such unusual inclement weather prevented the execution of major items of the work. Unusual inclement weather is defined as severe weather which is beyond the normal weather recorded and expected for the month of the year as shown in the chart below. Extension of time due to weather delays shall be granted only for those days in excess of the number of days shown. Extension of time requests shall be submitted in writing within 30 days of occurrence and submitted with current pay request.

PRECIPITATION

MONTH	AVERAGE NO. OF DAYS .01" OR MORE
January	10
February	9
March	10
April	10
May	10
June	8
July	9
August	7
September	7
October	6
November	8
December	9

24. In paragraph 15.3, omit any and all references to arbitration.

25. Delete paragraph 15.4 in its entirety.

END OF SUPPLEMENTARY CONDITIONS

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GARNER ENGINEERING PA

Soil and Foundation Study
Junior High School Addition
Stuttgart School District
Stuttgart, Arkansas

Report
To

STUTTGART SCHOOL DISTRICT
C/O LEWIS ARCHITECTS-ENGINEERS
ATTN: JULIA THOMAS
11225 HURON SUITE 104
LITTLE ROCK, AR 72211

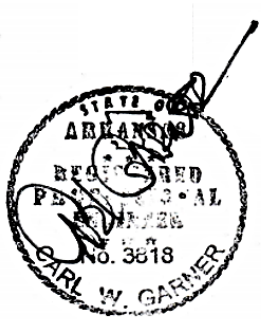
Little Rock, Arkansas
July 4, 2026

Garner Engineering PA
9300 Professor Drive Little Rock, Arkansas 72227 Phone: 501-225-8181
Mobile: 501-681-1491
501-681-1492

July 4, 2026

To: Stuttgart School District
c/o Lewis Architects-Engineers
Attn: Julia Thomas
11225 Huron Suite 104
Little Rock, AR 72211

From: Carl W Garner P.E.



Re: Soil and Foundation Study
Junior High School Addition
Stuttgart School District
Stuttgart, Arkansas

Summarized herein are the results of the subsurface investigation performed for the new Addition to the existing Stuttgart School District Junior High School. This study was based on the Lewis Architects-Engineers Site Plan A0.2 dated 6-15-2025 and subsequent Floor Plan A2.1 dated 6-30-2026. Preliminary structural criteria was provided by Greeson Gatlin Gangluff. A Site Grading Plan was not available for this report.

The approximately 5600 sq ft Addition will include three (3) Classrooms and a Saferoom of primarily masonry design with slab on grade. Foundation loads are expected to generally be light with moderate wall loads for the Saferoom. The Addition will extend from the south wall of the existing Junior High constructed in 2015-2016.

The primary purposes of the study were to:

(A) Develop basic soil and foundation conditions in the area of the building Addition as well as develop subgrade soil conditions for the new drives and parking areas, and

(B) Prepare conclusions and recommendations to aid in design and construction of safe and economical foundation and floor slab and new pavement structures as well as for site grading planning and construction.

In order to accomplish these purposes, the following study was conducted:

- Field investigation comprised of sample borings, a test pit and examination of existing building and site conditions including review of prior grading activity;

- Laboratory testing to evaluate basic engineering properties of the foundation and subgrade soils; and
- Preparation of an engineering report based on results of the field and laboratory studies and available site grading and structural criteria to include recommendations to aid in foundation and slab design, pavement structure design and related construction as well as site grading planning and performance.

GENERAL SITE FEATURES

The new, approximately 5600 sq. ft building will abut the south side of the existing building. The Addition will extend over an area previously graded for the existing building and drive. As a result of prior filling, existing grades in the Addition footprint were observed to slope down to the south. Specific topographic information was not available for this report. The new south parking area is relatively flat lying with grass cover.

From review of historical photographs and discussions with school personnel, a former building was removed from the south portion of the new south parking and drive. Specifics regarding the demolition activity were not available although it is likely that some remnant debris or uncontrolled fill may be present in the former building area. See Appendix A for Google historical photographs.

FIELD AND LABORATORY

The subsurface conditions in the new building area were investigated by two (2) auger sample borings and one (1) sample test pit. Three (3) auger sample borings were located in the new pavement areas. The approximate locations of the borings and test pit are shown on the Plan of Borings and Test Pit, Plate 1. The stratigraphy encountered and results of field and laboratory testing are presented on the Log of Boring and Log of Test Pit, Plates 2 through 6. A Key to Terms and Symbols is included as Plate 7.

The borings were performed with a track mounted rotary drill rig using continuous flight augers and Standard Penetration Test (SPT) procedures. The test pit was excavated with a mini-excavator. During the June 2026 field study, the grassy portion of the site was readily accessible due, in part, to extended dry conditions.

Representative samples of the soils were obtained via the SPT. N-values established by the automatic hammer assisted SPT are tabulated on the log forms in the Blows Per Foot (BPF) column. The estimated insitu cohesive shear strength of samples was obtained with a calibrated hand penetrometer. Cohesion estimates in Tons Per Sq. Ft (TSF) are plotted at appropriate depths on the logs as small circles filled with an X, ⊗, using the scale shown.

The natural soils encountered consist predominantly of clayey alluvial soil types. The surficial existing fill soils were clays. Therefore, soil strength characteristics were

established primarily from cohesion estimates obtained with the calibrated hand penetrometer.

To verify soil classification and establish basic volumetric stability characteristics i.e., shrink-swell, Atterberg Limits were performed in the laboratory. The Atterberg Limits are plotted on the logs using the scale shown in the upper right corner. Natural water content tests were performed to establish soil water content profiles for the borings and test pit. Natural water content results are also plotted on the log forms using the scale and symbols shown.

GENERAL SOIL CONDITIONS

Geologically, the site is underlain by Quaternary Age Terrace deposits of alluvial origin. The Quaternary Terrace units in the site vicinity consist predominantly of surficial soils of low to moderate plasticity silty clays and clays overlying deeper sand deposits. As noted, the native soils are capped locally by fill placed during prior construction.

The soil stratigraphy encountered in the borings and test pit may be generalized as follows. In Borings 1, 2 and 4, existing pavement consisting of 2 to 4 ins. of asphalt over 3 to 6 ins. of crushed stone base was present of the surface.

Existing Fill: In Borings 1 and 2 and Test Pit A, the soils encountered to depths of near 6 ft consisted of fill of variable type and engineering properties.

In Boring 1 the fill found to depths of about 5.5 ft consisted of very stiff grading with depth to stiff and firm reddish tan and gray silty clay and clay, CL, CH. Cohesion values ranged generally from 0.7 to over 1.2 TSF. However, local pockets of very moist to wet silty clay, CL, were encountered with cohesion near 0.5 TSF.

The fill found in Boring 2 and Test Pit A located near the east end of the Addition was firm to soft reddish tan with gray silty clays and clays, CL, CH. These fill soils possessed water contents at or near saturation with related cohesion values of 0.1 to 0.3 TSF and N-values of 1 and 2 BPF.

Stratum I: As noted, Boring 4 was located on existing asphalt pavement. The soils encountered below the pavement section consisted of about 1.5 ft of soft gray silty clay, CL, underlain by firm reddish brown and gray silty clay, CL, that extended to near 4 ft. These soils were moist to wet with cohesion near 0.1 to 0.4 and N-values of 1 to 4 BPF.

Stratum II: In Borings 3 and 5, located in an existing grassy area, the surficial soils consist of about 1.5 to 2 ft of brownish gray clayey silt, ML-CL. Grass/weed roots were present in the upper 4 to 6 ins. The soils possess low plasticity and moderate moisture sensitivity. Soil water contents were found to be significantly below the Plastic Limit. Cohesion estimates in these dry to desiccated soils were over 1.4 TSF. However, the cohesion values are considered to be apparent

and primarily a result of low water contents related to extended dry weather.

Stratum III: The Existing Fill, Strata I and II soils were underlain by very stiff some stiff brown, gray and tan silty clay, CL, was encountered to the 5.5 ft completion depths in Borings 3, 4 and 5 and to near 12 ft in deeper Borings 1 and 2. Apparent cohesive shear strengths typically exceeded 1.0 TSF with water contents below the Plastic Limits. This unit possesses generally low plasticity with pockets of moderately high plasticity clay subject to moderate shrink-swell with water content variation.

Stratum IV: The basal strata found in Borings 1 and 2 below depths of about 12 to 13 ft consisted generally of medium dense tan fine sand, SP. The sandy soils were dry with representative N-values ranging from about 10 to 12 BPF.

Perched groundwater was not encountered during the June 2026 field study. This condition is believed to represent typical static groundwater conditions on the site. However, as noted, the Existing Fill soils were generally moist or saturated notably in Boring 2 and Test Pit A. Permanent static groundwater is at great depth.

The surface and subsurface conditions considered to be of primary consequence to design and performance of the new building, parking areas and drives are:

(a) The encountered presence of 5 to 6 ft of stiff clay Existing Fill in Borings 1, 2 and Test Pit A. These fill soils possessed high water contents with low strength, high compressibility and high moisture sensitivity. Additionally, the clayey soils exhibit high potential for loss of stability under construction equipment with seasonal or induced high water content increase;

(b) The low strength of the clayey silt, ML-CL, Stratum I soils encountered below the existing parking area in Boring 4 and probable instability during pavement demolition and/or site grading;

(c) The moderate moisture sensitivity of the surficial seasonally dry clayey silts, Stratum II, found in Borings 3 and 5 and potential for loss of stability during wetter seasons;

(d) The high strength and low moisture sensitivity, but generally low to locally moderate shrink-swell potential inherent to the silty clay, CL, trace CH, Stratum III. These soils were encountered at depths of about 2 to 6 ft below existing grade across the project area extending to near 12 ft or more;

(e) The possible development of limited, and localized, wet season perched groundwater and saturation in the Existing Fill and/or Stratum I; and

(f) The possible presence of remnant debris or loose or unsuitable fill in the area of the former building demolition in the south-central portion of the new drive and parking.

The interaction of these soil conditions as well as other site factors, project schedule and site grading requirements were paramount to development of subsequent conclusions and recommendations.

CONCLUSIONS/RECOMMENDATIONS

General

The new Addition area contains, in part, the existing building canopy and asphalt pavement with curbs and related utilities that will be removed. The south portion of the footprint is grass covered. The existing grades in the building area vary from El 212 to 213. Planned new Finish Floor is set at El 214.05. Grading from existing grades, would involve less than about 1.5 ft of new Select Fill for the planned FFE.

Site grading for the existing Junior High building included the recommendation for undercutting the upper soils to provide at least 5 ft of Select Fill beneath the floor slab and at least 2 ft below the footings. See General Notes in Appendix B. The Existing Fill found in Borings 1 and 2 and Test Pit A was apparently placed to accommodate the General Notes. Based on discussions with school personnel, it is understood that the existing building slab on grade has experienced some post construction movement.

As noted, elements of the existing structure and pavement will be removed. This demolition may significantly impact the condition of the clayey Existing Fill soils, especially during wetter seasons. Consequently, the moisture sensitive silty clay Existing Fill in the building area as well as Stratum I in the new pavement areas should be undercut and replaced in strict accordance with procedures outlined in Special Subgrade Preparation and Site Grading sections of this report.

Special Subgrade Preparation

Since the Existing Fill encountered in Borings 1 and 2 and Test Pit A exhibited low strength and moderte compressibility, undercut and replacement is recommended. Specially, undercut to depths on the order of 5 to 6 ft should be anticipated in the building area to expose the underlying stiff/very stiff silty clay, Stratum III. Replacement Select Fill should be the type and compaction outlined in Site Grading.

Weak clayey silt/silty clay, ML-CL, Stratum I soils were encountered in Boring 4 in the planned new pavement and drive area. Additionally, stiff dry clayey silt, ML-CL, soils were present to depths of 1.5 to 2 ft in Borings 3 and 5 also in planned new pavement areas. Due to the moisture sensitivity of the Strata I and II soils, selective and general undercut and replacement will be required for the new parking and drives. It is anticipated that wet season undercut depths on the order of 2 to 4 ft would be required in the pavement areas.

As is typical, the depth and area of undercut will be dependent, in part, upon weather i.e., wet or dry, and drying conditions existing at the time of site grading. It is

recommended that a unit price allowance for undercut and replacement of weak, unstable and/or unsuitable should be included in the base bid. The following undercut quantities cross section basis (CSB) were estimated for wet season conditions.

Building Area	-	1800 cu yds cross section basis
Pavement Areas	-	3100 cu yds cross section basis

The actual area and depth of undercut/replacement must be determined after demolition activity and prior to site grading. Final payment quantities should be computed from field measurements before undercut and prior to infilling.

Foundation Considerations

The selection and design of an appropriate foundation system for the structure must include consideration of both soil shear strength and volumetric stability factors. It is understood that maximum Saferoom wall loads may be on the order of 3000 lbs. per ln. ft. Lateral and uplift loads were not available. Based on foundation soil conditions encountered, site grading per Special Subgrade Preparation and preliminary structural criteria, it is concluded that the structure may be founded on shallow spread footings. The spread footing system should be supported on Select Fill placed and compacted per Site Grading criteria.

The structure may be supported on individual and continuous spread footings with a slab on grade. Individual and continuous footings should be founded at a depth of at least 2 ft below finish exterior grade. Footings founded on Select Fill may be sized for net allowable soil bearing pressures of 2800 and 2400 lbs. per sq. ft, (PSF) respectively under the maximum combination of DL, LL, WL and Seismic. A minimum footing dimension of 24 ins. is however recommended. Lateral load resistance may be calculated using a footing base sliding coefficient of 0.35.

With proper subgrade preparation and new fill placement, a slab on fill integral with the foundation elements should be appropriate for the structure. A minimum 4 in. layer of clean, free draining stone or gravel should be provided as a capillary barrier below the slab. The floor slab design may be based on a subgrade modulus value of 120 PCI with the granular fill/Select Fill system. A positive vapor barrier membrane such as 10 mil Visqueen should be placed between the slab and stone fill. More extensive moisture control procedures may be warranted in areas of moisture sensitive floor coverings.

Control joints should be provided in general accordance with ACI suggested practice or as dictated by slab geometry. A saw cut depth of at least 30 percent of the slab thickness is recommended.

The allowable bearing pressures should provide a factor of safety on the order of 3.0 with respect to strength properties of the compacted Select Fill. Based on conditions encountered in the borings and proper implementation of procedures and criteria outlined

in Site Grading it is opined that total post construction settlement or shrink-swell related movement should be less than 0.5 ins. and differential movement of less than about 0.5 ins.

Seismic Criteria

As per Arkansas Act 1100, Arkansas County is located within Seismic Zone 2 "area of moderate anticipated seismic damage." Based on conditions encountered on the site and other geotechnical criteria available, it is concluded that the structures may be designed using a Soil Profile Type S 1. For the profile type a seismic Site Coefficient (S) of 1.0 is considered appropriate. Liquefaction potential is considered to be negligible for the clayey and underlying sandy foundation soils. As outlined in Act 1100 1991, structural design may be based on an Effective Peak Velocity Related Acceleration (A_V) of 0.20. More specifically, Seismic Values A_v – 0.11 and A_a – 0.08, as provided by Arkansas SBS may be applied.

For seismic analysis under current AFPC criteria, Site Class C is recommended.

Pavement Design

New Parking and Drives will be located south of the Addition in part over areas of existing pavement that will be removed. Existing surficial soils, Strata I and II, in the pavement areas were found to generally exhibit moderate to high moisture sensitivity. Accordingly, the potential for undercut of subgrade soil as outlined in Special Subgrade Preparation is considered to be moderate to high in wetter seasons. At the time of the June 2026 field investigation, the Stratum II surface soils exhibited high apparent strength due to the dry conditions. However, these soils are subject to loss of strength and stability during wetter seasons. It is recommended that the condition of Strata I and II soils be specifically evaluated during demolition and at the time of site grading.

With proper undercut/replacement of weak, moisture sensitive silty soils per Special Subgrade Preparation and Site Grading or verification of suitable support of the existing clayey silts, ML-CL, and silty clay, CL, pavement design may be based on a Subgrade Modulus, k, of 100 pci, and CBR of 6.

It is understood that as presently planned, asphalt pavement will be utilized for the drives and light duty parking. The drives will be subject to bus traffic as well as low volume medium duty delivery trucks and trash service vehicle traffic. New parking will be subject primarily to passenger vehicles.

The following asphalt pavement designs were developed on the basis of Select Fill or natural soils consisting of stiff silty clay, sandy clay, CL, exhibiting a CBR of at least 6. It is recommended that at least 12 ins. of Select Fill or approved Strata II or III soils be provided below the pavement sections. The designs are also based on positive surface and subsurface drainage away from the completed pavement.

Component		Thickness
Light Duty Traffic		
Hot-mixed Asphaltic Concrete, or approved ArDOT mix	:	2 ins.
Crushed Stone Base ArDOT Class 7	:	7 ins. compacted to 96 percent Modified Compaction ASTM D 1557
Subgrade	:	12 ins. Select Fill compacted to 92 percent Modified ASTM D 1557 or existing subgrade approved by proofrolling
Medium Duty Truck Drives		
Hot-mixed Asphaltic Concrete, or approved ArDOT mix	:	3 ins.
Crushed Stone Base ArDOT Class 7	:	8 ins. compacted to 96 percent Modified Compaction ASTM D 1557
Subgrade	:	12 ins. Select Fill compacted to 92 percent Modified ASTM D 1557 or existing subgrade approved by proofrolling

Concrete pavement is recommended for dumpster service vehicle drives and maneuvering areas as follows:

6 ins.	PCCP fć = 4000 psi with dowel baskets and 18 ins dowels on 15 ins. centers with 3 – 5 % entrained air
4 ins.	ArDOT Class 7 crushed stone base minimum

In the event a heavy-duty asphalt drive is to be provided, specific design recommendations will be provided.

Crushed stone base should meet ArDOT Class 7 criteria. Base course should be compacted to at least 96 percent of maximum Modified Proctor ASTM D 1557 unit dry weight. Asphalt surface curse should be compacted per ArDOT criteria.

Site Grading

As noted, the surface soils over most of the site are moisture sensitive or locally weak, Existing Fill and Strata I and II, ML-CL. The location and extent of the Existing Fill should be established by observations during construction or by proofrolling with a minimum 20,000 lb. pneumatic-tired roller, loaded dump truck, or similar equipment. As noted, due to the silty nature and high seasonal variability, the Existing Fill and selected Strata I and II soils designated by the Soils Engineer should be removed per Special Subgrade Preparation.

On-site evaluation of actual soil conditions should be performed by the Geotechnical Engineer after demolition and prior to and/or during initial stages of grading. Final decisions on undercutting of existing weak natural soils should be determined on the basis of this evaluation.

Fill, required for backfill or to establish finish grade for the building and pavement areas should consist of select sandy clay, CL/clayey sand, SC, having a Liquid Limit less than 40, and a Plasticity Index of less than 20. In addition, the Select Fill should exhibit a low mass permeability on the order of 10^{-5} cm/sec or less to reduce infiltration. Fill soils should be specifically approved by the Soils Engineer.

Select Fill within the building area should be compacted to at least 95 percent of maximum Modified Proctor dry density (ASTM D-1557) and at least 92 percent in other areas. Placement and compaction should be performed within a water content range of minus 1 to plus 3 percent of Optimum Water Content. Lift thickness should typically be less than 8 ins. or as dictated by compaction equipment type and size.

CONSTRUCTION PROCEDURES

The Existing Fill and Stratum I soils were found to be weak and highly moisture sensitive. Additionally, the Stratum II clayey silt soils encountered to depths of about 1.5 to 2 ft below existing grade in Borings 3 and 5 are subject to strength loss with saturation and may develop pumping and rutting under heavy wheel load equipment during wet seasons, thus increasing construction difficulties. Therefore, we recommend that site grading and also foundation installation be conducted during drier seasons of the year, if possible.

Positive surface drainage should be established and maintained at the site to reduce potential difficulties. Temporary surface drainage improvements should be provided around the site as required to prevent ponding. If construction is initiated during wetter seasons of the year, saturated soils and minor perched groundwater should be anticipated, particularly in the south portion of the site.

Undercutting and excavations for shallow spread footings should be accomplished with conventional excavation equipment with smooth bucket. Prolonged exposure or inundation may result in significant changes in strength, compressibility and volumetric change characteristics of the soil. Therefore, foundation excavations, steel placement, and forming must be completed promptly to reduce the possibility of changes in conditions. Foundation strata disturbed due to exposure or saturation should be undercut to unaltered strata.

Undercut of Existing Fill will require removal along and potentially below existing building footings. Consequently, the Contractor is solely responsible for specific undercut planning for protection of existing footings. Consideration must be given to the potential for Existing Fill sloughing below existing footings. The use of incremental undercut along the building with expeditious infilling with Select Fill must be a priority.

It should be restated that the area of former building demolition extends into the new south parking and uncontrolled filling may be present requiring selective deeper undercut. Supplemental recommendations may be required for grading in the area of the former building.

Site grading work and foundation installation should be monitored by the Soils Engineer or representative. Subsurface conditions significantly at variance with those encountered in the borings, particularly in areas of Existing Fill, should be brought to the attention of the Soils Engineer and work delayed pending evaluation and/or preparation of additional recommendations, if warranted.

The following illustrations are attached and complete this report:

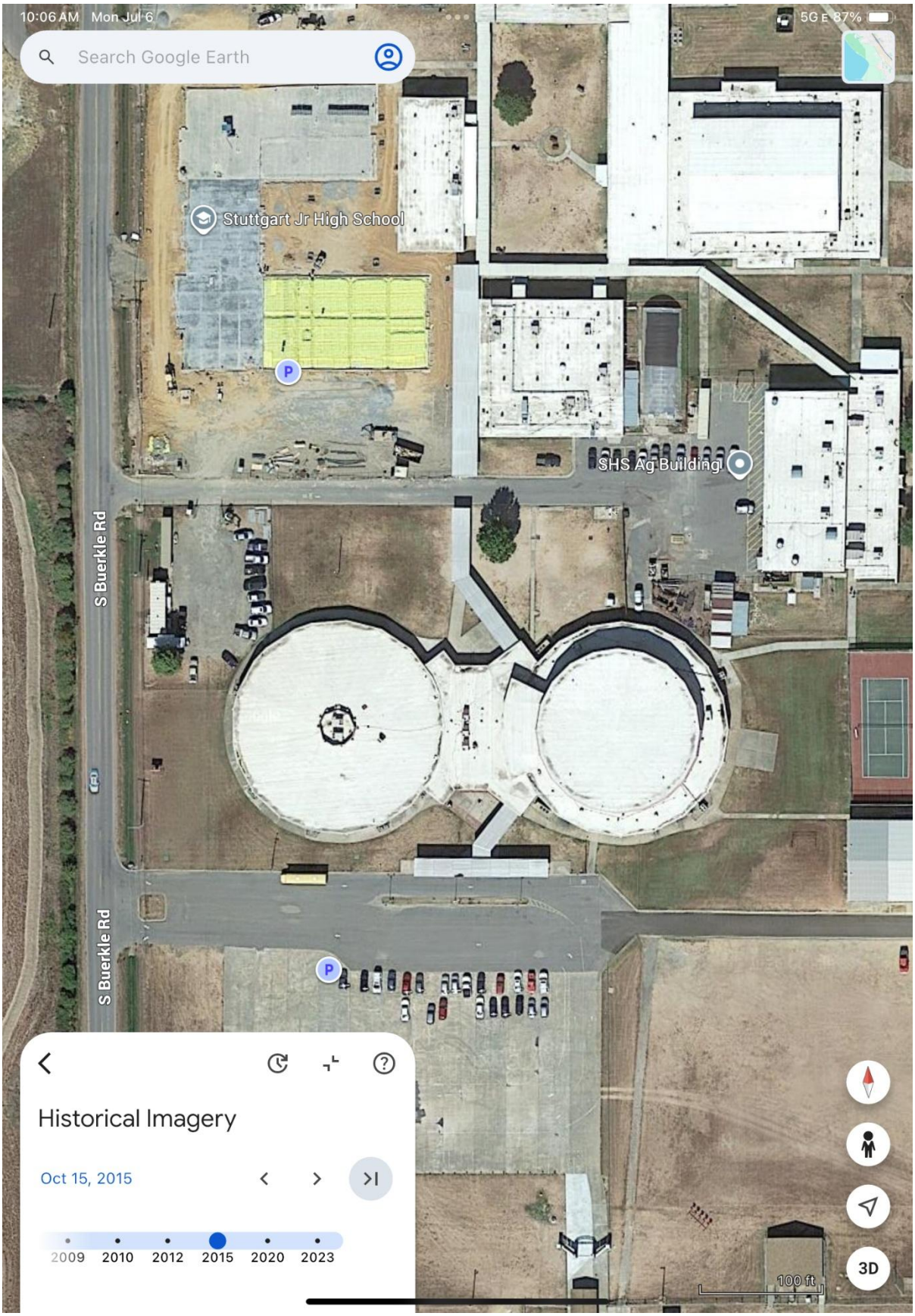
Plan of Borings and Test Pit	Plate 1
Log of Boring	Plates 2 through 5
Log of Test Pit	Plate 6
Key to Terms and Symbols	Plate 7
Historical Photographs	Appendix A
General Notes from Existing Building Construction	Appendix B

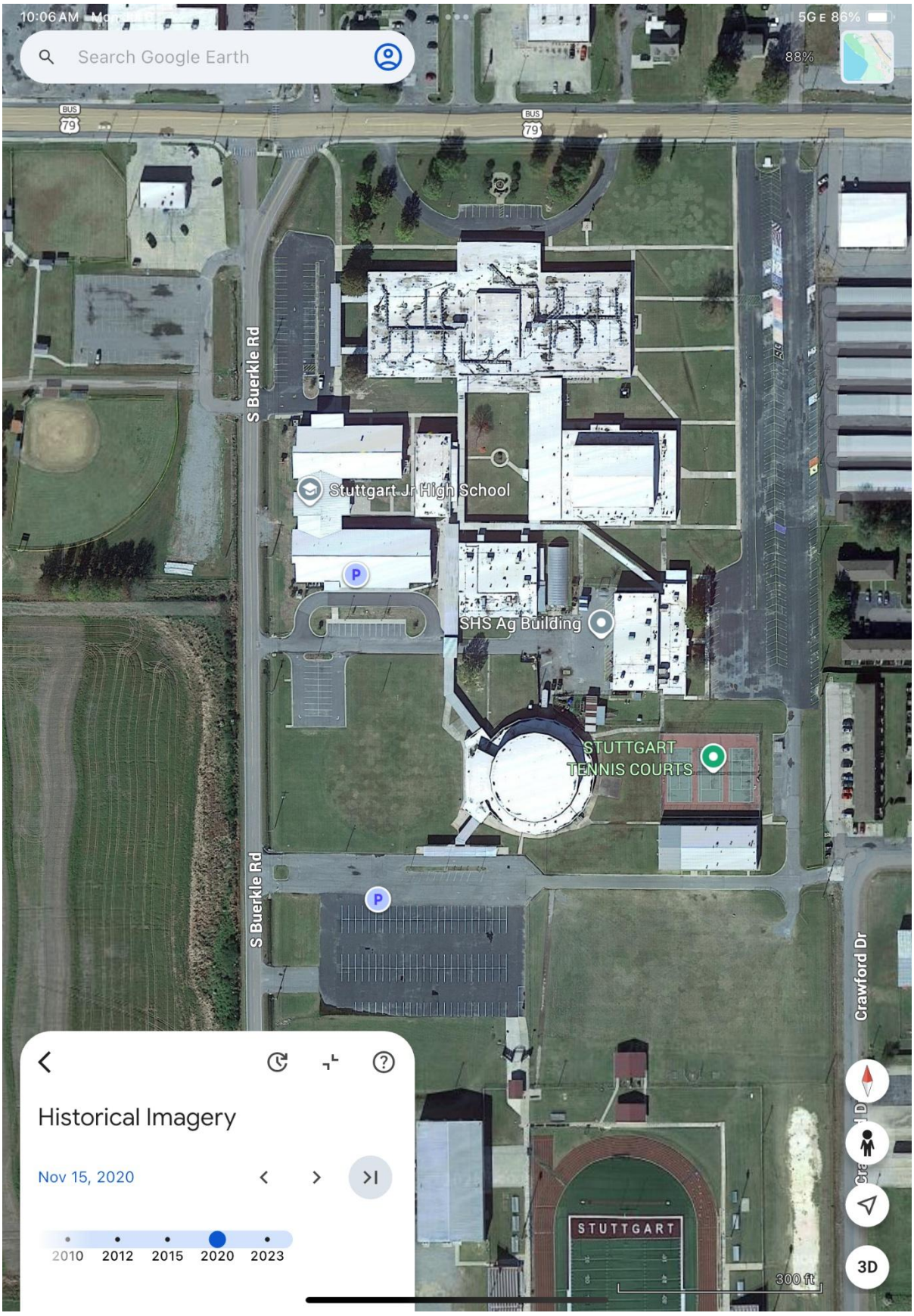
We have appreciated the opportunity to be of service to you on this project. If we may be of additional assistance during final design or construction, please contact us.

Cc: Lewis Architects Engineers
Attn: Julia Thomas
Melinda Jester
Greeson Gatlin Gangluff
Attn: Randy Gangluff P.E.
Minton Engineering
Attn: Josh Minton

APPENDIX A

HISTORICAL PHOTOS


10:06 AM Mon Jul 6
5G E 87%
Search Google Earth
Stuttgart Jr High School
SHS Ag Building
S Buerkle Rd
S Buerkle Rd
Historical Imagery
Oct 15, 2015
2009
2010
2012
2015
2020
2023
100 ft
3D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5G E 86%
Search Google Earth
88%
BUS 79
BUS 79
S Buerkle Rd
Stuttgart Jr High School
SHS Ag Building
STUTTGART
TENNIS COURTS
S Buerkle Rd
Crawford Dr
STUTTGART
300 ft
Historical Imagery
Nov 15, 2020
2010
2012
2015
2020
2023
3D

APPENDIX B

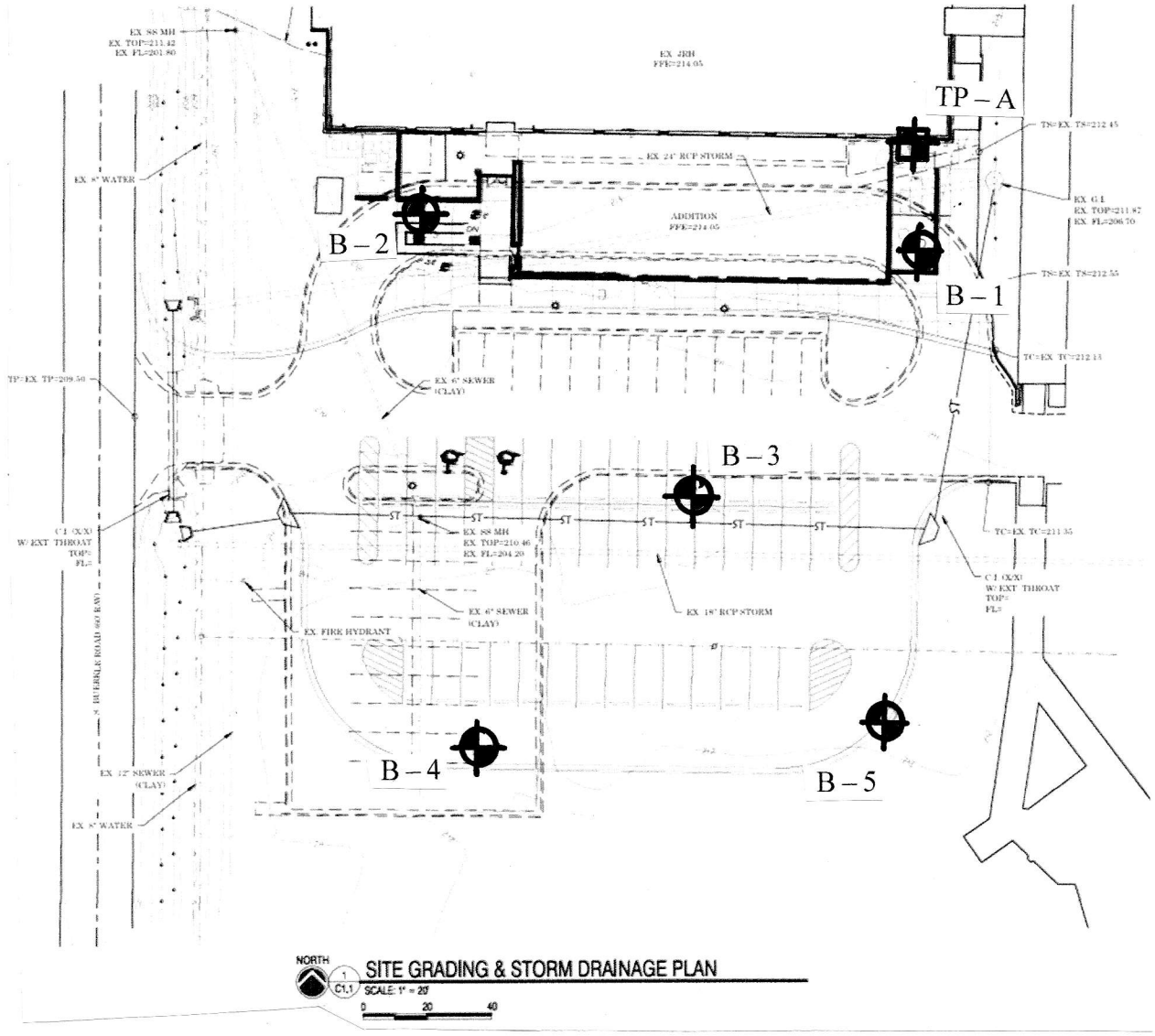
GENERAL NOTES

GENERAL NOTES

1. THE FOUNDATION FOR THIS BUILDING HAS BEEN DESIGNED BASED UPON THE RECOMMENDATIONS OF THE SOIL AND FOUNDATION INVESTIGATION FOR THIS SITE BY ACKLEY ENGINEERING OF BENTON, AR. DATED FEBRUARY 3, 2015 (JOB NO. 15-019) (PHONE NO. 501-794-3500). IT IS RECOMMENDED THAT THE PROPOSED STRUCTURE BE SUPPORTED ON A STIFFENED SHALLOW FOUNDATION. GEOTECHNICAL REPORT RECOMMENDS THAT THE UPPER SOILS BE UNDERCUT, AS NEEDED, TO PROVIDE AT LEAST 5 FEET OF SELECT FILL BENEATH THE FLOOR SLAB AND AT LEAST 2 FT SELECT FILL BENEATH THE FOOTINGS. THE STIFFENED FOUNDATION WILL CONSIST OF A STIFFENED TURNED-DOWN SLAB OR CONVENTIONAL SPREAD FOOTING SYSTEM WITH STIFFENED TURNED-DOWN SLAB POURED OVER THE TOP OF THE SPREAD FOOTINGS.
   THE SPREAD FOOTINGS WILL BE LOCATED AT COLUMNS AND PRE-ENGINEERED METAL BUILDING FRAMES AND CONTINUOUS STRIP TYPE FOOTINGS AT PERIMETER AND CORRIDOR WALLS. CONTINUOUS AND/OR INDIVIDUAL SPREAD FOOTINGS MAY BE SIZED USING A MAXIMUM ALLOWABLE BEARING PRESSURE OF 2,000PSF AND 2,500PSF, RESPECTIVELY. TOP AND BOTTOM REINFORCING WILL BE PROVIDED IN THE PERIMETER FOUNDATIONS. THICKENED SLABS WILL PROVIDED UNDER ALL MASONRY WALLS.

   STRICT ADHERENCE TO THE SITE GRADING RECOMMENDATIONS IS REQUIRED IN ORDER FOR THE SHALLOW FOUNDATION TO PERFORM PROPERLY. SEE NOTE BELOW, TAKEN DIRECTLY FROM THE GEOTECHNICAL REPORT:

   *PROPER LONG-TERM PERFORMANCE IS ALSO CONTINGENT UPON MAINTAINING A RELATIVELY CONSTANT SOIL MOISTURE WITHIN THE UNDERLYING CLAY SOILS. PLUMBING LEAKS CAN RESULT IN SIGNIFICANT **HEAVE** OF BOTH FOUNDATION AND FLOOR SLABS. ANY PLUMBING LEAKS SHOULD BE CORRECTED IMMEDIATELY. ALSO THE UTILITY LINES SHOULD NOT BE BEDDED WITHIN GRAVEL BUT SHOULD BE BEDDED WITHIN THE APPROVED FILL SOILS. THE AREA AROUND THE BUILDING SHOULD BE PROPERLY GRADED TO PROVIDE GOOD RUNOFF. ALSO, ROOF DRAINAGE SHOULD BE PROPERLY DIRECTED AWAY FROM THE BUILDING PERIMETER.*



NORTH

PLAN OF BORINGS AND TEST PIT

JUNIOR HIGH SCHOOL ADDITION
STUTTGART SCHOOL DISTRICT
STUTTGART, ARKANSAS

LOG OF BORING NO. 1

JUNIOR HIGH SCHOOL ADDITION
STUTTGART SCHOOL DISTRICT
STUTTGART, ARKANSAS

Type: AUGER/SPT Location: SEE PLATE 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL (SURF EL: 212.5+)	BLOWS PER FT	UNIT DRY WT. LB./CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT, % — LIQUID LIMIT (10 20 30 40 50 60 70)	- NO 200, %
			ASPHALT 4 INS/CRUSHED STONE 6 INS				
			FILL: VERY STIFF GRAY FINE SANDY SILT, ML, DRY	29			
			FILL: STIFF REDDISH TAN WITH GRAY SILTY CLAY CL, DRY	18			
			- SOFT TO FIRM	2			
5			MOIST	4			
			VERY STIFF GRAY SOME TAN SILTY CLAY, CL, DRY	8			
			- MORE TAN	9			
10							
			MEDIUM DENSE TAN FINE SAND, SP, DRY	12			
15							
			- DRY	10			
20							
25							

COMPLETION DEPTH: 20 FT
DATE: 6-12-2026

DEPTH TO WATER IN BORING: DRY AT DRILLING
DATE: 6-12-2026

GARNER ENGINEERING PA

PLATE 2

LOG OF BORING NO. 2

JUNIOR HIGH SCHOOL ADDITION
STUTTGART SCHOOL DISTRICT
STUTTGART, ARKANSAS

Type: AUGER/SPT Location: SEE PLATE 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURF EL: 213.0+	BLOWS PER FT	UNIT DRY WT. LB./CU FT	COHESION, TON/SQ FT (o) 0.2 0.4 0.6 0.8 1.0 1.2 1.4 PLASTIC LIMIT (+) WATER CONTENT, % (•) LIQUID LIMIT (+) 10 20 30 40 50 60 70	- NO 200, %
			ASPHALT 3.5 INS/CRUSHED STONE 3 INS				
			SOFT REDDISH TAN SILTY CLAY, CL, WET	1		⊗ ●	
			- WET WITH TRACE CRUSHED STONE	2		⊗ ● + +	
5			- WET	1		⊗ ●	
			FILL: STIFF REDDISH TAN SLIGHTLY SANDY CLAY, CL SC. LAMINATED			● ⊗	
			VERY STIFF GRAY AND TAN SILTY CLAY, CL, DRY	9		● ●	
				10		● ⊗	
10							
			DENSE TAN FINE SAND, SP, DRY	44		●	
15							
20							
25							

COMPLETION DEPTH: 15 FT
DATE: 6-12-2026

DEPTH TO WATER IN BORING: DRY AT DRILLING
DATE: 6-12-2026

GARNER ENGINEERING PA

PLATE 3

LOG OF BORING NO. 3

JUNIOR HIGH SCHOOL ADDITION
STUTTGART SCHOOL DISTRICT
STUTTGART, ARKANSAS

TYPE: AUGER/SPT — LOCATION: SEE PLATE 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT. LB/CU FT.	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200, %
			SURF. EL: 211.0±				
			VERY STIFF BROWNISH GRAY CLAYEY SILT, ML CL, DRY	10			
			STIFF GRAY AND BROWN SILTY CLAY, CL, MOIST	5			
5			- VERY STIFF TRACE FERROUS, DRY	10			
10							

COMPLETION DEPTH: 5.5 FT
DATE: 6-12-2026

DEPTH TO WATER IN BORING: DRY AT DRILLING DATE: 6-12-2026

LOG OF BORING NO. 4

JUNIOR HIGH SCHOOL ADDITION
STUTTGART SCHOOL DISTRICT
STUTTGART, ARKANSAS

TYPE: AUGER/SPT — LOCATION: SEE PLATE 1

DEPTH, FT	SYMBOL	SAMPLE	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200, %
			SURF. EL: 211.5+				
			ASPHALT 2 INS/CRUSHED STONE 6 INS				
			SOFT GRAY SILTY CLAY, CL, WET	4			
			FIRM REDDISH BROWN AND GRAY SILTY CLAY, LC, MOIST	1			
5			VERY STIFF GRAY AND TAN SILTY CLAY, CL, MOIST	7			
10							

COMPLETION DEPTH: 5.5 FT
DATE: 6-12-2026

DEPTH TO WATER IN BORING: DRY AT DRILLING DATE: 6-12-2026

LOG OF BORING NO. 5

JUNIOR HIGH SCHOOL ADDITION
STUTTGART SCHOOL DISTRICT
STUTTGART, ARKANSAS

TYPE: AUGER/SPT

LOCATION: SEE PLATE 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT. LB/CU FT.	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200, %
			SURF. EL: 212.0±				
			VERY STIFF BROWNISH GRAY CLAYEY SILT, ML CL, DRY	4			
			VERY STIFF GRAY WITH TAN SILTY CLAY, CL, DRY	5			
5			- MOSTLY TAN TRACE GRAY SILTY CLAY, CL, DRY	6			
10							

COMPLETION DEPTH: 5.5 FT
DATE: 6-12-2026

DEPTH TO WATER IN BORING: DRY AT DRILLING DATE: 6-12-2026

LOG OF BORING NO.

TYPE:

LOCATION:

DEPTH, FT	SYMBOL	SAMPLE	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200, %
			SURF. EL:				
			Not Used	4			
				1			
5				7			
10							

COMPLETION DEPTH:
DATE

DEPTH TO WATER IN BORING: DATE:

LOG OF TEST PIT NO. A

JUNIOR HIGH SCHOOL ADDITION
STUTTGART SCHOOL DISTRICT
STUTTGART, ARKANSAS

TYPE: MINIEX

LOCATION: SEE PLATE 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT. LB/CU FT.	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200, %
			SURF. EL: 213.0+				
1			FILL: FIRM REDDISH BROWN CLAY, CL-CH, TRACE GRAY, MOIST TO WET				
2							
3							
4							

COMPLETION DEPTH: 3.5 FT
DATE: 6-26-2026

DEPTH TO WATER
IN TEST PIT: DRY
DATE: 6-26-2026

LOG OF TEST PIT NO.

TYPE:

LOCATION:

DEPTH, FT	SYMBOL	SAMPLE	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200, %
			SURF. EL:				
			Not Used				

COMPLETION DEPTH:
DATE:

DEPTH TO WATER
IN TEST PIT:
DATE:

SYMBOLS AND TERMS USED ON BORING LOGS

SOIL TYPES
(SHOWN IN SYMBOL COLUMN)

Gravel | Sand | Silt | Clay

Predominant type shown heavy

SAMPLER TYPES
(SHOWN ON SAMPLES COLUMN)

Shelby Tube | Rock Core | Split Spoon | No Recovery

TERMS DESCRIBING CONSISTENCY OR CONDITION

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

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

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

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

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

TERMS CHARACTERIZING SOIL STRUCTURE

SLICKENSIDED — having inclined planes of weakness that are slick and glossy in appearance.

FISSURED — containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.

LAMINATED — composed of thin layers of varying color and texture.

INTERBEDDED — composed of alternate layers of different soil types.

CALCAREOUS — containing appreciable quantities of calcium carbonate.

WELL GRADED — having wide range in grain sizes and substantial amounts of all intermediate particle sizes.

POORLY GRADED — predominantly of one grain size, or having a range of sizes with some intermediate sizes missing.

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

Section 01 21 00

ALLOWANCES

PART ONE - GENERAL

1.1 THE CONSTRUCTION MANAGER SHALL PROVIDE THE FOLLOWING ALLOWANCES IN THE BASE BID:

A. Contingency Allowance: The Construction Manager shall include in the bid a contingency amount of $50,000. This contingency shall be used only upon written approval from the Architect. Any difference in cost above or below this amount shall be adjusted by change order. Overhead and profit shall not be allowed if use of the contingency is necessary.

PART TWO – PRODUCTS

Not Used.

PART THREE – EXECUTION

Not Used.

END OF SECTION

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Section 01 22 00

UNIT PRICING

PART ONE – GENERAL

1.1 THE CONTRACTOR SHALL PROVIDE THE FOLLOWING UNIT PRICE WITH THE BASE BID:

A. SITE UNDERCUT: Remove unsuitable soil and replace with compacted select fill as directed by the Architect's Representative.

Base Bid to include an allowance of 4,900* cubic yards undercut and backfill soils at _____/per cubic yard. Undercut shall be paid at the unit price quoted. Measurement for payment will be based on cross sectional measure established by soil removed below a stripping depth of 8 inches in fill areas and below planned subgrade in cut areas. Payment shall be made at the unit price for quantities less than or greater than the allowance quantity given herein. (*Building – 1,800 cubic yards, Parking – 3,100 cubic yards)

PART TWO – PRODUCTS

Not Used.

PART THREE – EXECUTION

Not Used.

END OF SECTION

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Section 01 23 00

ALTERNATES

PART ONE – GENERAL

1.1 THE CONTRACTOR SHALL PROVIDE THE FOLLOWING ALTERNATES TO THE BASE BID:

A. Deductive Alternate No. 1: State the amount to be deducted from the Base Bid to omit horizontal windows.

B. Deductive Alternate No. 2A: State the amount to be deducted from the Base Bid to cut exterior canopy in half as shown on Sheet A10.1.

C. Deductive Alternate No. 2B: State the amount to be deducted from the Base Bid to omit exterior canopy in its entirety as shown on Sheet A10.1.

D. Deductive Alternate No. 3A: State the amount to be deducted from the Base Bid to remove gang bathroom and replace with two toilets and janitor's closet as shown on Sheet A10.2.

E. Deductive Alternate No. 3B: State the amount to be deducted from the Base Bid to shell Classroom 145 as shown on sheet A10.3.

F. Deductive Alternate No. 3C: State the amount to be deducted from the Base Bid to omit Classroom 145 complete, as shown on sheet A10.3.

PART TWO – PRODUCTS

Not Used.

PART THREE – EXECUTION

Not Used.

END OF SECTION

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Section 01 31 19

PROJECT MEETINGS

PART ONE - GENERAL

1.1 PRECONSTRUCTION CONFERENCE

A. Before the work order has been issued on the project by the Architect, a preconstruction conference shall be held on the job site with the following personnel; Architect's representative, Construction Manager, Superintendent, who will be on the job at all times, metal building contractor, plumbing contractor, mechanical contractor, electrical contractor and, if he so desires, the Owner. This meeting is designed for a two-fold purpose: To clarify any questions about the plans and specifications and the transfer of ideas as to what the Architect will expect for all trades and subcontractors.

B. The purpose being as follows: Distribution by Construction Manager of the following:

1. List of contractors, including addresses, telephone numbers and person to contact (to be used also as a Job Directory).
2. Tentative Progress Schedule prepared in accordance with the following provisions:
   a. Schedule and regulate all construction activities. The schedule shall indicate start and finish dates for activities, submittal and delivery dates for major materials and equipment, and final completion date.
   b. Prepare tentative Progress Schedule for preview at initial progress meeting, final schedule being prepared shortly thereafter.
   c. Discussion of following:
      1) General over-all progress based on tentative Progress Schedule as presented by Construction Manager.
      2) Shop Drawing submission procedure as presented by Architect-Engineer and Construction Manager.
      3) Change Order processing procedure as presented by Architect-Engineer and Construction Manager.
      4) Pay request submission procedure as presented by Architect-Engineer and Construction Manager.
      5) Clarification of Architect-Engineer and Construction Manager personnel, duties, functions and responsibilities.
   d. A pre-work conference shall be required between the Architect's representative, job superintendent and major trades subcontractor before their phase of work begins.

1.2 PROGRESS MEETINGS

A. Contractor shall attend periodic progress meetings on the job upon request of the Architect and/or Construction Manager.

B. Architect and/or Construction Manager reserves the right to initiate additional meetings between above parties as he deems necessary.

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PART TWO – PRODUCTS

Not Used.

PART THREE – EXECUTION

Not Used.

END OF SECTION

Section 01 33 23

SHOP DRAWINGS, PRODUCT DATA & SAMPLES

PART ONE - GENERAL

1.1.1 Work included:

1.1.1.1 Wherever possible throughout the Contract Documents, the minimum acceptable quality of workmanship and materials has been defined by manufacturer's name and catalog number, reference to recognized industry and government standards, or description of required attributes and performance.

1.1.1.2 To ensure that the specified products are furnished and installed in accordance with design intent, procedures have been established for advance submittal of design data and for their review by the Architect. All required submittals, shop drawings, product data, and samples shall be submitted within four (4) weeks after construction contracts have been signed.

1.1.1.3 Make all submittals required by the Contract Documents, and revise and resubmit as necessary to establish compliance with the specified requirements.

1.1.1.4 MATERIAL SAFETY DATA SHEETS (MSDS) SHALL NOT BE SUBMITTED AS PART OF THE SUBMITTAL PACKAGE. THEY ARE NOT A REQUIREMENT OF THE CONTRACT DOCUMENTS.

1.1.2 Related work described elsewhere: Individual requirements for submittals are described in pertinent other Sections of these Specifications.

1.2 QUALITY ASSURANCE

1.2.1 Coordination of submittals: Prior to each submittal, carefully review and coordinate all aspects of each item being submitted and verify that each item and the submittal for it conforms in all respects with the requirements of the Contract Documents. By affixing the Construction Manager’s signature to each submittal, certify that this coordination has been performed. Any Shop Drawing submitted to the Architect that has not been checked thoroughly, stamped and signed by the Construction Manager will be rejected.

1.2.2 Progress schedule: Designate in the Progress 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.

1.3 SHOP DRAWINGS – ELECTRONIC SUBMITTAL PROCEDURES

1.3.1 Summary:

1. Shop drawings and product data submittals shall be transmitted to Architect in electronic (PDF) format via Architect’s SharePoint Portal (sp.laeprojects.com).
2. The use of Procore for transmitting shop drawings and product data submittals shall be allowed as long as LAE is given administration privileges to modify work flow.
3. Details shall be identified by reference to sheet and detail, schedules, or room numbers shown on the Contract Drawings.
4. The intent of electronic submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.

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5. The electronic submittal process is not intended for color samples, color charts, or physical material samples.
6. Shop Drawings shall be present in a clear and thorough manner.

1.3.2 Requirements:

1. All participants in electronic documentation process will be required to have internet access.
2. Necessary software Adobe Acrobat (www.adobe.com) or Blubeam PDF Revu (www.blubeam.com) to produce, view, apply comments and save to PDF files. A PDF reader only will not be adequate.

1.4 PRODUCT DATA

1.4.1 Preparation:

1. Provide cover page with project name and contractor name(s).
2. Include "Table of Contents" if multiple items are included in submittal.
3. Clearly mark each copy to identify pertinent products or models.
4. Show performance characteristics and capacities.
5. Show dimensions and clearances required.
6. Show wiring or piping diagrams and controls.
7. Include special installation instructions.

1.4.2 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.

1.4.3 Submission:

1. Construction Manager ONLY shall request access to Architect's SharePoint Portal (sp.laeprojects.com).
2. Submittal Preparation – Construction Manager may use any or all of the following options:
   a. Contractors and Suppliers provide electronic (PDF) submittals to Construction Manager through means provided by and required by Construction Manager.
   b. Contractors and Suppliers provide paper submittals to Construction Manager who electronically scans and converts to PDF format.
3. Construction Manager shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer / product, dimensions and coordination of information with other parts of the work.
4. Construction Manager shall transmit each submittal to Architect using the Architect's SharePoint Portal (sp.laeprojects.com) or Procore (with administration privileges to modify work flow).
5. At discretion of Architect's Reviewer, paper copies can be requested upon receipt of electronic submittal in order to assist in review. Request will be made through email. Construction Manager will provide the number of paper copies requested.
6. Architect / Engineer review comments will be made available on the Architect's SharePoint Portal for downloading. Construction Manager will receive email notice of completed review.

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7. Distribution of reviewed submittals to contractors and suppliers is the responsibility of the Construction Manager.

1.5 SAMPLES

1.5.1 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.
3. Workmanship when applicable.

1.5.2 Field samples and mock-up:

1. Erect at the project site at a location acceptable to the Architect.
2. Size or area: That specified in the respective specification section.
3. Fabricate each sample and mock-up complete and finished.
4. Remove mock-ups at conclusion of the Work or when acceptable to the Architect.

1.6 NOTIFICATION

1.6.1 Notify the Architect in writing, at the time of submission, of any deviations in the submittals from requirements of the Contract Documents.

1.6.2 Notify the Architect in writing, at the time of resubmission, of changes made on re-submittals other than those previously requested by the Architect.

PART TWO – PRODUCTS

Not Used.

PART THREE – EXECUTION

Not Used.

END OF SECTION

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Section 01 45 29

TESTING LABORATORY SERVICES

PART ONE - GENERAL

1.1 WORK INCLUDED

A. The Owner will employ and pay for the services of an independent testing laboratory to perform specified testing, except where designated otherwise in the Specification Sections.

1. Contractor shall cooperate with the laboratory to facilitate the execution of the required services.
2. Employment of the laboratory by the Owner shall in no way relieve the Contractor's obligations to perform the Work of the Contract.

B. The Owner will pay for all initial services of the testing agency. Similar services required of the Contractor, as outlined in 3.4 – Contractor's Responsibilities, shall be born by the Contractor.

C. Testing laboratory curing and testing is required for cast-in-place concrete. See Section 03 31 00 - Cast-in-Place Concrete.

1.2 RELATED WORK

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

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

B. Related requirements specified in other sections:

1. Certification of products: The respective sections of Specifications.
2. Test, adjust and balance of equipment: The respective Sections of Specifications.
3. Laboratory tests required, and standards for testing: Each specification section listed.

1.3 QUALITY ASSURANCE

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

B. In its work on this project, the testing laboratory will be required to meet the basic requirements of ASTM E329, "Standards of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction".

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1.4 SUBMITTALS

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

1. Architect and Construction Manager
2. Contractor
3. Project Record file at job site

PART TWO - PRODUCTS

Not Used.

PART THREE - EXECUTION

3.1 DUTIES OF TESTING LABORATORY

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

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

1. Comply with specified standards.
2. Ascertain compliance of materials with requirements of the Contract Documents.

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

D. Promptly submit copies of the written report of each test and inspection as required in Article 1.4 above.

3.2 LIMITATIONS OF AUTHORITY OF TESTING LABORATOR

A. The testing laboratory is not authorized to:

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

3.3 FIELD WORK BY TESTING LABORATORY

A. The testing laboratory personnel shall supply field services under the following limitations:

1. There will be no laboratory field services provided for concrete work. Under the requirements of the concrete work, the general contractor shall secure and deliver all samples for testing and the lab shall perform laboratory tests only.
2. Samples of proposed fill material shall be secured by the contractor's personnel and delivered to the laboratory for testing. (See 3.4.2 below.)
3. Laboratory field work is acceptable for the taking of compaction readings. The general contractor shall coordinate the tests, to be certain compacted soil is ready for testing so as to avoid unnecessary re-tests.

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3.4 CONTRACTOR'S RESPONSIBILITIES

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

B. Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing. The cost of securing and delivery to the laboratory shall be born by the Contractor.

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

D. Furnish copies of products test reports as required.

E. Furnish incidental labor and facilities:

1. To provide access to the Work to be tested.
2. To obtain and handle samples at the project site or at the source of the project to be tested.
3. To facilitate inspections and tests.
4. For storage and curing of test specimens.

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

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

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

END OF SECTION

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Section 01 45 33

CODE-REQUIRED SPECIAL
INSPECTIONS AND PROCEDURES

PART ONE - GENERAL

1.1 WORK INCLUDED

A. The Owner will pay for all inspections and testing as required by the 2021 Arkansas Fire Prevention Code referred to as "Special Inspections". (Refer to the attached schedule for required inspections and testing for the project.)

1.2 RELATED WORK

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

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

B. Related requirements specified in other sections:

1. Certification of products: The respective sections of Specifications.
2. Test, adjust and balance of equipment: The respective Sections of Specifications.
3. Laboratory tests required, and standards for testing: Each specification section listed.

1.3 QUALITY ASSURANCE

A. The Special Inspector shall meet one of the minimum qualifications as listed for the applicable Category of Testing and Inspection in accordance with the attached "Minimum Qualifications for Special Inspectors" (E1, E2 and E3).

PART TWO - PRODUCTS

Not used.

PART THREE - EXECUTION

3.1 SPECIAL INSPECTORS RESPONSIBILITIES

A. The Special Inspectors shall:

1. Schedule and manage a pre-construction meeting for special inspections.
   a. The roles and responsibilities of the parties shall be discussed (see Arkansas Special Inspection Guidelines – Special Inspection Responsibilities).
2. Notify the contractor of their presence and responsibilities at the job site.
3. Observe assigned work for which they are responsible for conformance with the plans and specifications.

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4. Report nonconforming items to the immediate attention of the contractor and the Registered Design Professional in Responsible Charge (RDPRC). After the RDPRC's review, the contractor shall make corrections.
5. Write a discrepancy notice (page D2) about each nonconforming item containing:
    a. Description and exact location.
    b. Reference to applicable drawings and specifications.
    c. Resolution or corrective action taken and the date.
6. Provide timely reports (page D1) and furnish these reports directly to the Design Professional and the contractor. The reports should:
    a. Describe the special inspection and tests made, with locations.
    b. Indicate nonconforming items and their resolution.
    c. List unresolved items and parties notified.
    d. Itemize any changes authorized by the Design Professional.
7. Furnish interim reports to the Building Official and Design Professional at the frequency indicated on the *Statement of Special Inspections*.
8. Initial and date the "Date Completed" box in the *Schedule of Special Inspection Services* as the inspection and testing activities are completed.
9. Submit a signed *Final Report of Special Inspections* (page A4) stating that all required special inspections and testing were fulfilled and reported and that any outstanding discrepancies have been corrected.

END OF SECTION

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STATEMENT OF SPECIAL INSPECTIONS

(Completed by the Registered Design Professional in Responsible Charge)

PROJECT: Classroom Addition Junior High School

LOCATION: Stuttgart School District, Stuttgart, Arkansas

PERMIT APPLICANT: Stuttgart School District

APPLICANT'S ADDRESS: 2501 S. Main, Stuttgart, AR 72160

ARCHITECT OF RECORD: Clayton Vaden, AIA

STRUCTURAL ENGINEER OF RECORD: Randy Gangluff, P.E.

MECHANICAL ENGINEER OF RECORD: Randy Ragsdale, P.E., Wade Mobbs, P.E.

ELECTRICAL ENGINEER OF RECORD: Scott Woodward, P.E.

REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE: Clayton Vaden, AIA

This Statement of Special Inspections is submitted in accordance with Section 1704.3 of the 2021 Arkansas Fire Prevention Code. It includes a *Schedule of Special Inspection Services* applicable to the above-referenced Project as well as the identity of the individuals, agencies, or firms intended to be retained for conducting these inspections. If applicable, it includes *Requirements for Seismic Resistance* and/or *Requirements for Tornado Resistance.*

Are *Requirements for Seismic Resistance* included in the *Statement of Special Inspections*?	X Yes	☐ No
Are *Requirements for Tornado Resistance* included in the *Statement of Special Inspections*?	X Yes	☐ No

The Special Inspector(s) shall keep records of all inspections and shall furnish interim inspection reports to the Building Official and to the Registered Design Professional in Responsible Charge at a frequency agreed upon by the Design Professional and the Building Official prior to the start of work. Discrepancies shall be brought to the immediate attention of the Contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and the Registered Design Professional in Responsible Charge prior to completion of that phase of work. A *Final Report of Special Inspections* documenting required special inspections and corrections of any discrepancies noted in the inspections shall be submitted to the Building Official and the Registered Design Professional in Responsible Charge at the conclusion of the project.

Frequency of interim report submittals to the Registered Design Professional in Responsible Charge:

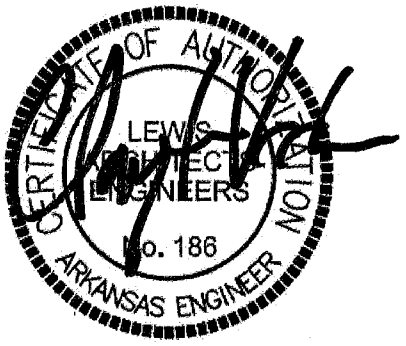
__Weekly __Bi-Weekly __Monthly Other; specify:_____

The Special Inspection program does not relieve the Contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Statement of Special Inspections Prepared by:

Clayton Vaden, AIA
Type or print name

Signature September 14, 2026
Date



Building Official's Acceptance:

Signature Date

Permit Number:

Frequency of interim report submittals to the Building Official:

__Monthly __Bi- Monthly __Upon Completion Other; specify:_____

Statement of Special Inspections
Requirements for Seismic Resistance

See the Schedule of Special Inspections for inspection and testing requirements.

Seismic Design Category: D – Storm Shelter Only

Statement of Special Inspection for Seismic Resistance Required (Yes/No): Yes

Description of seismic force-resisting system subject to special inspection and testing for seismic resistance:
(Required for Seismic Design Categories B, C, D, E or F in accordance with Building Code Section 1705.13.1 through 1705.13.3, and 1705.14.1). Some systems not required in SDC B, see section 1705.13.

Special reinforced masonry shear walls.

Description of designated seismic systems subject to special inspection, testing and qualification for seismic resistance:
(Required for architectural, electrical and mechanical systems and their components that require design in accordance with ASCE 7-16 Chapter 13, have a component importance factor, *Ip*, greater than one and are in Seismic Design Categories C, D, E or F, in accordance with Building Code Section 1705.13.4 and 1705.14.3.)

Description of additional components and systems requiring special inspections, testing and qualification for seismic resistance:
(Required for systems noted in Building Code Sections 1705.13.5 through 1705.13.9 and 1705.14.2 1705.11).

Statement of Responsibility:
Each contractor responsible for the construction or fabrication of a system or component described above must each submit a Statement of Responsibility (pg C1) in accordance with Building Code Section 1704.4.

Statement of Special Inspections
Requirements for Tornado Resistance

See the Schedule of Special Inspections for inspection and testing requirements

Design Wind Speed: 250 m.p.h. Storm Shelter Only

(The tornado design wind speed is 250 miles per hour for the entire state of Arkansas per FEMA P-361 and ICC 500.)

Wind Exposure Category: C

(Wind Exposure Category C should be used to calculate wind pressures acting on community safe rooms and tornado shelters designed and constructed in accordance with FEMA P-361 and ICC 500.)

Statement of Special Inspection for Tornado Resistance Required (Yes/No): _____

(Required for community safe rooms and tornado shelters designed and constructed in accordance with FEMA P-361.)

Description of main wind force-resisting system subject to special inspection for wind resistance:

(Required for systems noted in Building Code Section 1705.12.1 and 1705.12.2)

Special reinforced masonry shear walls.

Description of wind force-resisting components subject to special inspection for wind resistance:

(Required for systems noted in Building Code Section 1705.12.3)

Roof beam anchorage, headed studs at roof slab.

Statement of Responsibility:

Each contractor responsible for the construction or fabrication of a system or component described above must each submit a Statement of Responsibility (pg C1) in accordance with Building Code Section 1704.4.

FINAL REPORT OF SPECIAL INSPECTIONS

(Completed by each Special Inspector)

PROJECT: _____

LOCATION: _____

PERMIT APPLICANT: _____

APPLICANT'S ADDRESS: _____

_____

ARCHITECT OF RECORD: _____

STRUCTURAL ENGINEER OF RECORD: _____

MECHANICAL ENGINEER OF RECORD: _____

ELECTRICAL ENGINEER OF RECORD: _____

REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE: _____

To the best of my information, knowledge, and belief, which are based upon observations or diligent supervision of our inspection services for the above-referenced Project, I hereby state that the special inspections or testing required for this Project, and designated for this Agent in the *Schedule of Special Inspection Services*, have been completed in accordance with the Contract Documents and approved design revisions.

The Special Inspection program does not relieve the Contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Interim reports submitted prior to this final report and numbered___to___form a basis for, and are to be considered an integral part of this final report. The following discrepancies that were outstanding since the last interim report dated _____ have been corrected:

_____

_____

_____

_____

_____

(Attach 8 ½"x11" continuation sheet(s) if required to complete the description of corrections)

Prepared By:

_____

Special Inspection Agent/Firm

_____

Type or print name of Special Inspector

_____

Signature Date

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
1705.1.1 Special Cases (work unusual in nature, including but not limited to alternative construction materials, unusual design applications, systems or materials with special manufacturer requirements. Attach 8 1/2x11 if needed).	Submittal review, shop(3) inspection and/or field inspection.	N			
1705.2 Structural Steel Construction					
1. Review the material test reports and certificates as listed in AISC 360-16, Section N3.2 for compliance with the construction documents	Submittal review	N	Each submittal		
2. Material verification of structural steel	Shop (3) and field inspection	N	Periodic		
3. Anchor Rods and other Embedment(s) (Verify diameter, grade, type, length, embedment. See 1705.3 for anchors)	Field inspection	Y	Continuous		
4. Verify member locations, braces, stiffeners, and application of joint details at each connection comply with construction documents	Field inspection	Y	Periodic		
5. Structural steel welding:					
a. Inspection tasks Prior to Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-1)	Shop (3) and field inspection	Y	Observe or Perform as noted (4)		
b. Inspection tasks During Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-2)	Shop (3) and field inspection	Y	Observe (4)		
c. Inspection tasks After Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-3)	Shop (3) and field inspection	Y	Observe or Perform as noted (4)		
d. Nondestructive testing (NDT) of welded joints: *see Commentary*					
1) Complete penetration groove welds at joints in materials 5/16" thick or greater in Risk Category III or IV	Shop (3) or field ultrasonic testing - 100%	Y	Periodic		
2) Complete penetration groove welds at joints in materials 5/16" or greater in Risk Category II	Shop (3) or field ultrasonic testing - 10% of welds minimum	Y	Periodic		
3) Thermally cut surfaces of access holes when material t > 2"	Shop (3) or field magnetic Particle or Penetrant testing	N	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
4) Welded joints subject to fatigue when required by AISC 360, Appendix 3, Table A-3.1	Shop (3) or field radiographic or Ultrasonic testing	N	Periodic		
5) Fabricator's NDT reports when fabricator performs NDT	Verify reports	N	Each submittal (5)		
6. Structural steel bolting:	Shop (3) and field inspection				
a. Inspection tasks Prior to Bolting (Observe, or perform tasks for each bolted connection, in accordance with QA tasks listed in AISC 360-16, Table N5.6-1)		Y	Observe or Perform as noted (4)		
b.Inspection tasks During Bolting (Observe the QA tasks listed in AISC 360-16, Table N5.6-2)		Y	Observe (4)		
1) Pre-tensioned and slip-critical joints					
a) Turn-of-nut with matching markings		Y	Periodic		
b) Direct tension indicator		Y	Periodic		
c) Twist-off type tension control bolt		Y	Periodic		
d) Turn-of-nut without matching markings		Y	Continuous		
e) Calibrated wrench		Y	Continuous		
2) Snug-tight joints		Y	Periodic		
c. Inspection tasks After Bolting (Perform tasks for each bolted connection in accordance with QA tasks listed in AISC 360, Table N5.6-3)		Y	Perform (4)		
7. Inspection of steel elements of composite construction prior to concrete placement in accordance with SDI QA/QC tasks listed in Section 1705.2.2 for steel deck and AISC 360-16, Table N5.4-2 Section N5 for welding Headed stud anchors	Shop (3) and field inspection and testing	Y	Observe or Perform as noted (4)		
a. Placement and installation of steel headed stud anchors		Y	Periodic		
1705.2.2 Cold-formed Steel Deck (shall be performed according to the requirements of SDI QA/QC)					
1. Inspection or Execution Tasks Prior and After Deck Placement according to Table 1.1 & 1.2 of SDI					
a. Identification markings	Field inspection	Y	Periodic		
b. Manufacturer's certified test reports, deck profile and thickness	Submittal Review	Y	Each submittal		
c. Verify deck installation per construction documents	Field inspection	Y	Periodic		
2. Inspection Prior, During & After Welding of Steel Deck according to Table 1.3, 1.4 & 1.5 of SDI QA/AC:					
a. Prior (Table1.3): Welding procedure Specifications (WPS) available, Manufacturer's certifications for welding consumables available, Material identification (type/grade), welding equipment check.	Field inspection	Y	Periodic		
b. During (Table 1.4): Qualified welders, Environmental Conditions, WPS followed	Field inspection	Y	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
c. After (Table 1.5): Verify size and location of welds, including support, sidelap, and perimeter welds	Field inspection	Y	Periodic		
d. After (Table 1.5): Welds meet visual acceptance criteria	Field inspection	Y	Periodic		
e. After (Table 1.5): Verify repair activities and Document acceptance or rejection of welds	Field inspection	Y	Periodic		
3. Inspection Prior, During & After Mechanical Fastening of Steel Deck according to Table 1.6, 1.7 & 1.8 of SDI QA/AC:					
a. Prior (Table1.6): Manufacturer installation instructions available for mechanical fasteners, Proper tools available for fastener installation, Proper storage for mechanical fasteners	Field inspection	N	Periodic		
b. During (Table 1.7): Fasteners are positioned as required and fasteners are installed according to manufacturer's instructions	Field inspection	N	Periodic		
c. After (Table 1.8): Check spacing, type, and installation of support, sidelap, and perimeter fasteners.	Field inspection	N	Periodic		
d. After (Table 1.8): Verify repair activities and Document acceptance or rejection of	Field inspection	N	Periodic		
1705.2.3 Open-web Steel Joist and Joist Girders (Table 1705.2.3)					
1. Installation of open-web steel joists and joist girders.					
a. End connections - welding or bolted	Field inspection	N	Periodic		
b. Bridging - horizontal or diagonal	Field inspection	N	Periodic		
1705.2.4 Cold-formed Steel Trusses spanning 60 feet or greater					
1. Verify temporary and permanent restraint/bracing are installed in accordance with the approved truss submittal package.	Field inspection	N	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
1705.3 Concrete Construction					
1. Inspection of reinforcement, including prestressing tendons, and verify placement. Placement includes reinforcing bar size, shape, spacing, cover, embedment, orientation, bar length, and splices per the construction documents and approved placement drawings.	Field inspection	Y	Periodic		
2. Reinforcing bar welding					
a. Verify weldability of reinforcing bars other than ASTM A706	Field inspection	N	Periodic		
b. Inspect single-pass fillet welds, maximum 5/16"	Field inspection	N	Periodic		
c. Inspect fillet welds >5/16" and other weld types	Field inspection	N	Continuous		
3. Inspection of anchors cast in concrete	Shop (3) and field inspection	N	Periodic		
4. Inspection of anchors and reinforcing steel post-installed in hardened concrete: Per research reports requirements	Field inspection	Y	Periodic or as required by the research report issued by an		
a. Adhesive anchors installed horizontally or in upwardly inclined orientations to resist sustained tension loads.	Field inspection	Y	Continuous		
b. Mechanical anchors and adhesive anchors not defined in	Field inspection	Y	Periodic		
5. Verify use of approved design mix	Shop (3) and field inspection	Y	Periodic		
6. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests and determine temperature of concrete	Shop (3) and field inspection	Y	Continuous		
7. Inspection of concrete and shotcrete placement for proper application techniques	Shop (3) and field inspection	Y	Continuous		
8. Inspection for maintenance of specified curing temperature and techniques	Shop (3) and field inspection	Y	Periodic		
9. Inspection of prestressed concrete:	In-plant or field review				
a. Application of prestressing		N	Continuous		
b. Grouting of bonded prestressing tendons in the seismic-force-resisting system		N	Continuous		
10. Inspect erection of precast concrete members	Field inspection	N	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
11. For precast concrete diaphragm connections or reinforcement at joints classified as moderate or high deformability elements (MDE or HDE) in structures assigned to Seismic Design Category C, D, E or F, inspection such connections and reinforcement for:					
a. Installation of the embedded	Field inspection	N	Continuous		
b. Completion of the continuity of reinforcement across joints	Field inspection	N	Continuous		
c. Completion of connections in the field.	Field inspection	N	Continuous		
12. Inspect installation tolerances of precast concrete diaphragm connections for compliance with ACI 550.5	Field inspection	N	Periodic		
13. Verification of in-situ concrete strength, prior to stressing of tendons in post tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	Field testing and review of laboratory reports	N	Periodic		
14. Inspection of formwork for shape, lines, location and dimensions	Field inspection	Y	Periodic		
15. Concrete strength testing and verification of compliance with construction documents	Field testing and review of laboratory reports	Y	Periodic		
16. For post-tensioned concrete, inspect cutting of tendon tail, installation of encapsulation cap and filling of stressing pocket in accordance with the construction documents and the post tensioning installation drawings.	Field inspection	N	Continuous		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
1705.4 Masonry Construction					
(A) Level 1, 2 and 3 Quality Assurance:					
1. Prior to constructuction, verification of compliance of submittals	Submittal review	Y	Periodic		
(B) Level 2 Quality Assurance:					
1. Verification of f'_m and f'_{AAC} prior to construction	Testing by unit strength method or prism test method	Y	Periodic		
(C) Level 3 Quality Assurance:					
1. Verification of f'_m and f'_{AAC} prior to construction and for every 5,000 SF during construction	Testing by unit strength method or prism test method	Y	Periodic		
2. Verification of proportions of materials in premixed or preblended mortar, prestressing grout, and grout other than selfconsolidating grout, as delivered to the project	Field inspection	Y	Continuous		
(D) Levels 2 and 3 Quality Assurance:					
1. Verification of Slump Flow and Visual Stability Index (VSI) of selfconsolidating grout as delivered to the project	Field testing	Y	Continuous		
2. Verify proportions of site-mixed mortar, grout and prestressing grout for bonded tendons	Field Inspection	Y	Periodic		
3. Verify location, grade, type, and size of reinforcement and anchor bolts, and prestressing tendons and anchorages	Field Inspection	Y	Periodic		
4. Verify prestressing technique	Field Inspection	~~N~~	Periodic		
5. Verify sample panel construction	Field Inspection	~~Y~~	Periodic		
6. Verify placement of masonry units and mortar joint construction	Field Inspection	Y	Periodic		
7. Verify placement of reinforcement, connectors, and prestressing tendons and anchorages	Field Inspection	Y	Level 2 - Periodic		
		Y	Level 3 - Continuous		
8. Verify grout space prior to grouting	Field Inspection	Y	Level 2 - Periodic		
		Y	Level 3 - Continuous		
9. Verify placement of grout and prestressing grout for bonded tendons	Field Inspection	N	Continuous		
10. Verify size and location of structural members	Field Inspection	Y	Periodic		
11. Verify type, size, and location of anchors, including details of anchorage of masonry to structural members, frames, or other construction.	Field inspection	Y	Level 2 - Periodic		
		Y	Level 3 - Continuous		
12. Verify welding of reinforcement (see 1705.3.1)	Field inspection	N	Continuous		
13. Verify preparation, construction, and protection of masonry during cold weather (temperature below 40° F) or hot weather (temperature above 90° F)	Field inspection	Y	Periodic		
14. Verify application and measurement of prestressing force	Field Inspection	N	Continuous		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
15. Verify placement of AAC masonry units and construction of thin-bed mortar joints (first 5000 SF of AAC masonry)	Field inspection	N	Continuous		
16. Verify placement of AAC masonry units and construction of thin-bed mortar joints (after the first 5000 SF of AAC masonry)	Field inspection	N	Level 2 - Periodic		
		N	Level 3 - Continuous		
17. Verify properties of thin-bed mortar for AAC masonry (first 5000 SF of AAC masonry)	Field inspection	N	Continuous		
18. Verify properties of thin-bed mortar for AAC masonry (after the first 5000 SF of AAC masonry)	Field inspection	N	Level 2 - Periodic		
		N	Level 3 - Continuous		
19. Verify compliance of materials and procedures with the approved submittals	Field inspection	N	Periodic		
20. Observe preparation of grout specimens, mortar specimens, and/or prisms	Field inspection	N	Level 2 - Periodic		
		N	Level 3 - Continuous		
1705.5 Wood Construction					
1. Inspection of the fabrication process of wood structural elements and assemblies in accordance with Section 1704.2.5	In-plant review (3)	N	Periodic		
2. For high-load diaphragms, verification of grade and thickness of structural panel sheathing.	Field inspection	N	Periodic		
3. For high-load diaphragms, verify nominal size of framing members at adjoining panel edges, nail or staple diameter and length, number of fastener lines, and that spacing between fasteners in each line and at edge margins agrees with approved construction documents.	Field inspection	N	Periodic		
4. Metal-plate-connected wood trusses with overall heights of 60 inches or greater inspection shall be performed to verify that the installation of the permanent individual truss member restraint/bracing has been installed in accordance with the approved truss submittal package.	Field Inspection	N	Periodic		
5. Metal-plate-connected wood trusses with a clear span of 60 feet or greater, the special inspector shall verify during construction that the temporary installation restraint/bracing is installed in accordance with the approved truss	Field inspection	N	Continuous		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
6.Mass timber construction for elements in types IV-A, IV-B, and IV-C construction	Field inspection	N	Continuous		
a. Inspection of anchorage and connections of mass timber construction to timber deep foundation systems.	Field inspection	N	Periodic		
b. Inspect erection of mass timber construction	Field Inspection	N	Periodic		
c. Inspection of connections where installation methods are required to meet design loads.		N			
i. Threaded fasteners					
ia. Verify use of proper installation equipment	Field inspection	N	Periodic		
ib. verify use of pre-drilled holes where required	Field inspection	N	Periodic		
ic. Inspect screws, including diameter, length, head type, spacing, installation angle and depth	Field inspection	N	Periodic		
ii. Adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads	Field inspection	N	Continuous		
iii. Adhesive anchors not defined in preceding cell	Field inspection	N	Periodic		
iv. Bolted connections	Field inspection	N	Periodic		
v. Conceaed connections	Field inspection	N	Periodic		
1705.6 Soils					
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	Field inspection	Y	Periodic		
2. Verify excavations are extended to proper depth and have reached proper material.	Field inspection	Y	Periodic		
3. Perform classification and testing of controlled fill materials.	Field inspection	Y	Periodic		
4. During fill placement, verify use of proper materials and procedures in accordance with the provisions of the approved geotechnical report. Verify densities, and lift thicknesses during placement and compaction of compacted fill	Field inspection	Y	Continuous		
5. Prior to placement of controlled fill, observe subgrade and verify that site has been prepared properly	Field inspection	Y	Periodic		
1705.7 Driven Deep Foundations					
1. Verify element materials, sizes and lengths comply with requirements	Field inspection	N	Continuous		
2. Determine capacities of test elements and conduct additional load tests, as required	Field inspection	N	Continuous		
3. Inspect driving operations and maintain complete and accurate records for each element	Field inspection	N	Continuous		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element	Field inspection	N	Continuous		
5. For steel elements, perform additional inspections per Section 1705.2	See Section 1705.2	N	See Section 1705.2		
6. For concrete elements and concrete-filled elements, perform additional inspections per Section 1705.3	See Section 1705.3	N	See Section 1705.3		
7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge	Field inspection	N	In accordance with Statement of Special Inspections		
1705.8 Cast-in-Place Deep Foundations					
1.Inspect drilling operations and maintain complete and accurate records for each element	Field inspection	N	Continuous		
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes	Field inspection	N	Continuous		
3. For concrete elements, perform additional inspections in accordance with Section 1705.3	See Section 1705.3	N	See Section 1705.3		
1705.9 Helical Pile Foundations					
1. Verify installation equipment, pile dimensions, tip elevations, final depth, final installation torque and other data as required	Field inspection	N	Continuous		
2. Perform additional inspections and tests in accordance with the construction documents	Field Inspection and testing	N	In accordance with construction documents		
1705.11 Fabricated Items					
Inspection of fabricated items shall be performed in accordance with Section 1704.2.5					
1. List of fabricated items requiring special inspection during fabrication:	Shop Inspection	N			
2. List of fabricated items to be fabricated on the premesis of a fabricator approved to perform such work without special inspection:		N			

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
1705.12.1 Structural Wood Special Inspections For Wind (Tornado) Resistance					
1. Inspection of field gluing operations of elements of the main windforce-resisting system	Field inspection	N	Continuous		
2. Inspection of nailing, bolting, anchoring and other fastening of elements of the main windforce-resisting system	Shop (3) and field inspection	N	Periodic		
1705.12.2 Cold-formed Steel Special Inspections For Wind (Tornado) Resistance					
1.Inspection during welding operations of elements of the main windforce-resisting system	Shop (3) and field inspection	N	Periodic		
2.Inspections for screw attachment, bolting, anchoring and other fastening of elements of the main windforce-resisting system	Shop (3) and field inspection	N	Periodic		
1705.12.3 Wind-resisting Components					
1. Roof covering, roof deck and roof framing connections	Shop (3) and field inspection	Y	Periodic		
2. Exterior wall covering and wall connections to roof and floor diaphragms and framing.	Shop (3) and field inspection	Y	Periodic		
1705.13.1 Structural Steel Special Inspections for Seismic Resistance					
1. Fabricator and erector documents (Verify reports and certificates as listed in AISC 341-16,Section J2 for compliance with construction documents)	Submittal Review	N	Each submittal		
2. Structural steel welding:					
a. Inspection tasks Prior to, During and After Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 341-16, Table J6.1, J6.2 &	Shop (3) and field inspection	N	Observe or Perform as noted (4)		
b. Nondestructive testing (NDT) of welded joints in accordance with AISC 341-16, Section J6.2.	Shop (3) and field testing	N	Periodic		
3. Structural steel bolting:					
a. Inspection tasks Prior to, During and After Bolting (Observe, or perform tasks for each bolted connection, in accordance with QA tasks listed in AISC 341-16, Table J7.1, J7.2 & J7.3)	Shop (3) and field inspection	N	Observe or Perform as noted (4)		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
4. Other Steel Structure Inspections, in accordance with QA tasks listed in AISC 341-16, Table J8.1:					
a. RBS requirements	Shop (3) and field inspection	N	Observe (4)		
b. Protected zones	Shop (3) and field inspection	N	Observe (4)		
5. Composite construction:					
a. Inspection tasks Prior to, During and After Concrete Placement (Observe, or perform tasks, in accordance with QA tasks listed in AISC 341-16, Table J9.1, J9.2 & J9.3)	Field inspection	N	Observe (4)		
6. H-Piling:					
a. Inspection of H-piling in accordance with AISC 341-16, Table J10.1	Field Inpsection	N	Periodic		
1705.13.2 Structural Wood Special Inspections for Seismic Resistance					
1. Inspection of field gluing operations of elements of the seismic-force resisting system	Field inspection	N	Continuous		
2. Inspection of nailing, bolting, anchoring and other fastening of components within the seismic-force-resisting system	Shop (3) and field inspection	N	Periodic		
1705.13.3 Cold-formed Steel Light-Frame Construction Special Inspections for Seismic Resistance					
1. Inspection during welding operations of elements of the seismic force-resisting system	Shop (3) and field inspection	N	Periodic		
2. Inspections for screw attachment, bolting, anchoring and other fastening of components within the seismic force-resisting system	Shop (3) and field inspection	N	Periodic		
1705.13.4 Designated Seismic System Verification					
Inspect and verify that the component label, anchorage or mounting conforms to the certificate of compliance in accordance with 13.2.2 of ASCE 7-16	Field inspection	N	Periodic		
1. Architectural Designated Seismic Systems (per ASCE 7-16)					
a. Interior non-structural partition walls and connections	Field Inspection	N	Periodic		
b. Parapets	Field Inspection	N	Periodic		
c. Chimneys	Field Inspection	N	Periodic		
d. Exterior non-structural walls elements and connections	Field Inspection	N	Periodic		
e. Veneer	Field Inspection	N	Periodic		
f. Suspended Ceiling Systems	Field Inspection	N	Periodic		
g. Cabinets	Field Inspection	N	Periodic		
h. Storefront and curtainwall	Field Inspection	N	Periodic		
i. Access Floors	Field Inspections	N	Periodic		
j. Glass in glazed interior and exterior storefront and curtainwall systems	Field Inspection	N	Periodic		
k. Laboratory Equipment	Field Inspection	N	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
2. Mechanical & Electrical Designated Seismic Systems (per ASCE 7-16)					
a. Mechanical and Electrical Components					
1) Air-side HVAC fans, air handlers, air conditioning units, cabinet heaters, air distribution boxes, and other mechanical components constructed of sheet metal framing	Field Inspection	N	Periodic		
2) Wet side HVAC, boilers, furnaces, atmospheric tanks and bins, chillers, water heaters, heat exchangers, evaporators, air separators, manufacturing or process equipment and other mechanical components constructed of high-deformability materials	Field Inspection	N	Periodic		
3) Engines, turbines, pumps, compressors, and pressure vessels	Field Inspection	N	Periodic		
4) Elevator and escalator components	Field Inspection	N	Periodic		
5) Generators, batteries, invertors, motors, transformers, and other electrical components constructed of high deformability	Field Inspection	N	Periodic		
6) Motor control centers, panel boards, switch gear, instrumentation cabinets, and other components constructed of sheet metal framing	Field Inspection	N	Periodic		
7) Communication equipment, computers, instrumentation and controls	Field Inspection	N	Periodic		
8) Roof mounted stacks, cooling and electical towers	Field Inspection	N	Periodic		
9) Light fixtures	Field Inspection	N	Periodic		
b. Vibration Isolated Components & Systems					
1) Components and systems isolated using neoprene elements and neoprene isolated floors with built-in or separate elastomeric snubbing devices or resilient perimeter stops	Field Inspection	N	Periodic		
2) Spring isolated components and systems closely restrained using built in or separate elastomeric snubbing devices or resilient perimeter stops	Field Inspection	N	Periodic		
3) Internally isolated systems and supports	Field Inspection	N	Periodic		
4) Suspended vibration isolation equipment including in-line duct devices and suspended internally isolated components	Field Inspection	N	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
c. Distribution Systems		N			
1) Piping and tubing including in-line components	Field Inspection	N	Periodic		
2) Ductwork, including in–line components	Field Inspection	N	Periodic		
3) Electrical conduit and cable trays	Field Inspection	N	Periodic		
4) Bus ducts		N			
5) Plumbing	Field Inspection	N	Periodic		
6) Pneumatic tube transport systems	Field Inspection	N	Periodic		
7) Fire Protection Sprinkler Pipe System	Field Inspection	N	Periodic		
1705.13.5 Architectural Components Special Inspections for Seismic Resistance					
1. Inspection during the erection and fastening of exterior cladding and interior and exterior veneer.	Field inspection		Periodic		
2. Inspection during the erection and fastening of interior and exterior non load bearing walls.	Field inspection		Periodic		
3. Inspection during anchorage of access floors	Field inspection		Periodic		
1705.13.6 Plumbing, Mechanical and Electrical Components Special Inspections for Seismic Resistance					
1. Inspection during the anchorage of electrical equipment for emergency or standby power systems.	Field inspection	N	Periodic		
2. Inspection during the anchorage of other electrical equipment.	Field inspection	N	Periodic		
3. Inspection during installation and anchorage of piping systems designed to carry hazardous materials, and their associated mechanical units	Field inspection	N	Periodic		
4. Inspection during the installation and anchorage of ductwork designed to carry hazardous materials	Field inspection	N	Periodic		
5. Inspection during the installation and anchorage of vibration isolation systems.	Field inspection	N	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
6. Inspection during the installation of mechanical and electrical equipment, including duct work, piping systems and their structural supports, where automatic fire sprinkler systems are installed to verify on of the following:					
a. Minimum clearances have been provided as required by Section 13.2.3 ASCE 7	Field inspection	N	Periodic		
b. A nominal clearance of not less than 3 inches has been provided between fire protection sprinkler system drops and sprigs and; structural members not used collectively or independently to support the sprinklers; equipment attached to the building structure; and other systems piping	Field inspection	N	Periodic		
1705.13.7 Storage Racks for Seismic Resistance					
Steel storage racks 8 feet or greater in height					
1. Materials used, to verify compliance with one or more of the material test reports in accordance with the approved construction documents	Field inspection	N	Periodic		
2. Fabricated storage rack elements.	Field inspection	N	Periodic		
3. Storage rack anchorage	Field inspection	N	Periodic		
4. Completed storage rack system, to indicate compliance with the approved construction documents	Field inspection	N	Periodic		
1705.13.9 Cold-formed Steel Special Bolted Moment Frames					
Inspection during the installation of cold-formed steel special bolted moment frames	Shop and field inspection	N	Periodic		
1705.14.1 Structural Steel Testing and Qualification for Seismic Resistance					
Test structural steel in the seismic force-resisting system in accordance with the quality assurance requirements of AISC 341	Shop (3) and field testing	N	Per AISC 341		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
1705.14.2 Seismic Certification of Nonstructural Components					
Review certificate of compliance for designated seismic system components.	Certificate of compliance review	N	Each submittal		
1705.14.4 Seismic Isolation Systems					
Test seismic isolation system in accordance with ASCE 7 Section	Prototype testing	N	Per ASCE 7		
1705.15 Sprayed Fire-resistant Materials					
1. Verify surface condition preparation of structural members.	Field inspection	N	Periodic		
2. Verify application of sprayed fire-resistant materials.	Field inspection	N	Periodic		
3. Verify average thickness of sprayed fire-resistant materials applied to structural members.	Field inspection	N	Periodic		
4. Verify density of the sprayed fire-resistant material complies with approved fire-resistant design.	Field inspection and testing	N	Per Building Code section 1705.15.5		
5. Verify the cohesive/adhesive bond strength of the cured sprayed fire-resistant material.	Field inspection and testing	N	Per Building Code section 1705.15.6		
1705.16 Mastic and Intumescent Fire-Resistant Coatings					
Inspect mastic and intumescent fire-resistant coatings applied to structural elements and decks, in accordance with AWCI 12-B.	Field inspection	N	Periodic		
1705.17 Exterior Insulation and Finish Systems (EIFS)					
1. Verify materials, details and installations are per the approved construction documents	Field inspection	N	Periodic		
2. Inspection of water-resistive barrier coating over sheathing substrate	Field inspection	N	Periodic		
1705.18 Fire-Resistant Penetrations and Joints					
1. Inspect penetration firestop	Field testing		Per ASTM E 2174		
2. Inspect fire-resistant joint systems	Field testing	N	Per ASTM E 2393		
1705.19 Smoke Control Systems					
1. Leakage testing and recording of device locations prior to	Field testing	N	Periodic		
2. Prior to occupancy and after sufficient completion, pressure difference testing, flow measurements, and detection and	Field testing	N	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES

PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	SERVICE	Y/N	EXTENT	AGENT*	DATE COMPLETED
1705.20 Sealing of mass timber					
1. Inspect sealants or adhesive application where required by Section 703.7	Field testing	N	Periodic		

* INSPECTION AGENTS	FIRM	ADDRESS	TELEPHONE NO.
1.			
2.			
3.			
4.			
5.			

Notes: 1. The inspection and testing agent(s) shall be engaged by the Owner or the Owner's Agent, not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the Building Official prior to commencing work. The qualifications of the Special Inspector(s) and/or testing agencies are subject to the approval of the Building Official and/or the Design Professional.

2. The list of Special Inspectors may be submitted as a separate document, if noted so above.

3. Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.1

4. Observe on a random basis, operations need not be delayed pending these inspections. Perform these tasks for each welded joint, bolted connection, or steel element.

5. NDT of welds completed in an approved fabricator's shop may be performed by that fabricator when approved by the AHJ. Refer to AISC 360, N7.

Circle "Yes" or "No" as appropriate and date this document below:

Are *Requirements for Seismic Resistance* included in the *Statement of Special Inspections*? **Yes**

Are *Requirements for Tornado Resistance* included in the *Statement of Special Inspections*? **Yes**

DATE:

Contractor's Statement of Responsibility

Each contractor responsible for the construction or fabrication of a main wind- or seismic force-resisting system, designated seismic system or a wind- or seismic-resisting component listed in the Statement of Special Inspections (Requirements for Seismic or Tornado Resistance) must submit a Statement of Responsibility, in accordance with the Building Code, Section 1704.4.

Project:_____

Contractor's Name:_____

Address:_____

License No.:_____

Description of building systems and components included in Statement of Responsibility:

_____
_____
_____
_____
_____
_____
_____

Contractor's Acknowledgement of Special Requirements

I hereby acknowledge that I have received, read, and understand the Statement of Special Inspections and Special Inspection program:

I hereby acknowledge that control will be exercised to achieve conformance with the approved construction documents.

_____
Name and Title (type or print)

_____ _____
Signature Date

Contractor's Provisions for Quality Control

Procedures for exercising control within the contractor's organization, the method and frequency of reporting and distribution of reports is attached to this Statement.

Identification and qualifications of the person(s) exercising such control and their position(s) in the organization are attached to this Statement

Fabricator's Certificate of Compliance

Each approved fabricator that is exempt from Special Inspection of shop fabrication and implementation procedures per section 1704.2.5.1 of the Building Code must submit *Fabricator's Certificate of Compliance* at the completion of fabrication.

Project:_____

Fabricator's Name:_____

Address:_____

Certification or Approval Agency:_____

Certification Number:_____

Date of Last Audit or Approval:_____

Description of structural members and assemblies that have been fabricated:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

I hereby certify that items described above were fabricated in strict accordance with the approved construction documents.

_____
Name and Title (type or print)

_____ _____
Signature Date

Attach copies of fabricator's certification or building code evaluation service report and fabricator's quality control manual.

SPECIAL INSPECTION REPORT

(Completed by Special Inspector)

PROJECT NAME / ADDRESS:
DATE OF INSPECTION:
INSPECTION TYPE(S) COVERAGE ☐ CONTINUOUS ☐ PERIODIC TIME BEGINNING INSPECTION: TIME ENDING INSPECTION:
DESCRIBE INSPECTIONS MADE, INCLUDING LOCATIONS:
LIST TESTS MADE:
LIST ITEMS REQUIRING CORRECTIONS, CORRECTIONS OF PREVIOUSLY LISTED ITEMS AND PREVIOUSLY LISTED UNCORRECTED ITEMS: PROVIDE COPIES OF DISCREPANCY NOTICES:
COMMENTS:
TO THE BEST OF MY KNOWLEDGE, WORK INSPECTED WAS IN ACCORDANCE WITH THE APPROVED DESIGN DRAWINGS, AND SPECIFICATIONS, EXCEPT AS NOTED ABOVE.

PRINTED FULL NAME	
NOTE BY "SPECIAL INSPECTOR" OR PROVIDE NAME OF TESTING AGENCY	

SIGNED:	DATE:
CERTIFICATION:	NUMBER:

One copy of this report to remain at job site with the contractor for review upon request.

DISCREPANCY NOTICE No. _____

SPECIAL INSPECTION DISCREPANCY NOTICE

(Completed by Special Inspector)

PROJECT NAME / ADDRESS:		
INSPECTION TYPE(S) COVERAGE ☐ CONTINUOUS ☐ PERIODIC		
AREA INSPECTED	TYPE OF INSPECTION	
APPLICABLE DRAWING SHEET NUMBER(S) AND/OR SPECIFICATION SECTION:		
NOTICE DELIVERED TO: O CONTRACTOR O ENGINEER/ARCHITECT O OWNER	DATE:	TIME:
MAKE THE FOLLOWING CORRECTIONS AND SECURE INSPECTION APPROVAL PRIOR TO PROCEEDING WITH THIS PHASE OF THE WORK.		
PRINTED FULL NAME		
NOTE BY "SPECIAL INSPECTOR" OR PROVIDE NAME OF TESTING AGENCY		
SIGNED:	DATE:	
CERTIFICATION:	NUMBER:	
DATE RE-INSPECTED AND APPROVED AND SIGNATURE OF SPECIAL INSPECTOR:		

One copy of this report to remain at job site with the contractor for review upon request.

MINIMUM SPECIAL INSPECTOR QUALIFICATIONS

Category of Testing and Inspection	Minimum Qualifications (refer to key at end of Table)			
	Shop Inspection	**Field Testing /Inspection**	**Review Submittals**	**Review Testing, Certification, & Lab Reports**
1704.2.5 Inspection of Fabricators				
Pre-cast concrete	A, C, E			
Structural steel construction	C, F, G			
Wood construction	A, N			
Cold formed metal construction	A, N			
1705.2 Steel Construction				
Welding	C, F, G	C, F, G	A	A
High strength bolting, inspection of steel frame joint details		A, C	A	A
1705.2.2, 1705.2.3 and 1705.2.4 Steel Construction other than Structural Steel				
Welding	C, F, G	C, F, G	A	A
Cold-formed Steel Deck		C, F, G	A	A
Open-Web Steel Joist and Joist Girders		C, F, G	A	A
Cold-formed Steel Trusses spanning ≥ 60ft		A, C	A	A
1705.3 Concrete Construction				
Reinforcing placement, cast-in-place bolts, concrete and shotcrete placement and curing operations		A, C, H		
Pre-stressing steel installation		A, C, D, E		
Erection of pre-cast concrete members		A, C, H, Q		
Concrete field testing		A, C, H, I, J		
Review certified mill reports and design mixes			A	
Verify use of required design mix		A, C, H, I, J		
Pre-stressed (pre-tensioned) concrete force application	A, C, E			
Post-tensioned concrete force application		A, C, D, H		
Review of in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs		A, C, D		
Reinforcing steel weldability, reinforcing welding, weld filler material		C, F, G		
Inspection of post-installed anchors in hardened concrete		A, C, S		
1705.4 Masonry				
Review f'_m prior to construction			A	
Mortar joint construction, grout protection and placement, materials proportion, type/size/location of reinforcement, structural elements, anchorage, and connectors		A, C		
Sampling/testing of grout/mortar specimens		A, C, K		
Observe preparation of masonry prisms for testing of compressive strength of masonry, f'_m		A, C, K		
Inspection of welding of reinforcing steel		C, F, G		
1705.5 Wood Construction				
Observe structural panel sheathing, size of framing members, fastener diameter and length, number of fastener lines, and spacing of fastener lines and fasteners for compliance with approved construction documents for the project		A, N		
Metal-plate-connected wood trusses: verify temporary and permanent truss bracing is installed per approved truss submittal package		A, N		

(Table continued on next page)

MINIMUM SPECIAL INSPECTOR QUALIFICATIONS *(continued)*

Category of Testing and Inspection	Minimum Qualifications (refer to key at end of Table)			
	Shop Inspection	**Field Testing /Inspection**	**Review Submittals**	**Review Testing, Certification, & Lab Reports**
1705.6 Soils				
Observe site preparation, fill placement and testing of compaction for compliance with the construction documents for the project		A, C, I, R		
Observe and test bearing materials below shallow foundations for ability to achieve design bearing capacity		A, L		
Review compaction testing for compliance with the construction documents for the project				A
1705.7, 1705.8 & 1705.9, 1705.10 Driven Deep, Cast-in-place Deep, and Helical Pile Foundations				
Observe installation		A, L, I		
Observe load tests		A, I		
1705.12 Special Inspection for Wind Resistance				
Structural wood		A, N		
Cold-Formed steel light-frame construction		A, N		
Inspect roof cladding		A, B, N		
Inspect wall cladding		A, B, N		
1705.13 Special Inspection for Seismic Resistance				
1705.13.1 Structural Steel				
Inspection of structural steel in the seismic force-resisting systems		A, C		
1705.13.2 Structural Wood				
Inspection of structural wood in the seismic force-resisting systems		A, N		
1705.13.3 Cold-Formed Steel Light-Frame Construction				
Inspection of cold-formed steel light-frame construction in the seismic force-resisting systems		A, N		
1705.13.4 Designated Seismic Systems				
Examine designated seismic systems requiring seismic qualification and verify that the label, anchorage or mounting conform to the certificate of compliance		A	A	A
1705.13.5 Architectural Components				
Inspection of exterior cladding, non-load bearing walls, veneer, and access floors		A, B	A, B	A, B
1705.13.6 Plumbing, Mechanical and Electrical Components				
Inspection of installation and anchorage of mechanical and electrical components		A	A	A
1705.13.7 Storage Racks				
Inspection of anchorage of storage racks 8 feet or taller		A		
1705.13.8 Seismic Isolation Systems				
Inspection of seismic isolation systems in seismically isolated structures	A	A		
1705.13.9 Cold-Formed Steel Special Bolted Moment Frames				
Inspection of cold-formed steel special bolted moment frames		A, N		
1705.14 Testing for Seismic Resistance				
Testing designated seismic systems requiring seismic qualification and verify that the label, anchorage or mounting conform to the certificate of compliance		A		
1705.15 Sprayed Fire-Resistant Materials				
Observe surface conditions, application, average thickness and density of applied material, and cohesive/adhesive bond		A, C		

(Table continued on next page)

MINIMUM SPECIAL INSPECTOR QUALIFICATIONS *(continued)*				
Category of Testing and Inspection	**Minimum Qualifications (refer to key at end of Table)**			
	Shop Inspection	**Field Testing /Inspection**	**Review Submittals**	**Review Testing, Certification, & Lab Reports**
1705.16 Mastic and intumescent fire-resistant coatings				
Observe application compliance with AWCI 12-B		A, C		
1705.17 Exterior Insulation and Finish Systems				
Inspect EIFS systems		A, B, C, M		
1705.18 Fire-resistant penetrations and joints				
Inspection of Penetration firestops		A, C, P		
Inspection of Fire-resistant joint systems		A, C, P		
1705.19 Testing for Smoke Control	*See Requirements of Building Code Section 1705.19.2.*			
1705.20 Sealing of Mass Timber		A, C, P		
(Table continued on next page)				

MINIMUM SPECIAL INSPECTOR QUALIFICATIONS *(continued)*

KEY:

A. Arkansas Professional Engineer (AR PE) competent in the specific task area or graduate of accredited engineering/engineering technology program under the direct supervision of an AR PE.
B. Arkansas Registered Architect (AR RA) competent in the specific task area or graduate of accredited architecture/architecture technology program under the direction of an AR RA.
C. International Code Council (ICC) Special Inspector Certification specific to the particular material and testing methodology applicable to each Category of Testing and Inspection listed in the table.
D. Post-tensioning Institute (PTI) Certification, Level 2.
E. Pre-stressed Concrete Institute (PCI) Plant Quality Personnel Certification – Level III.
F. American Welding Society (AWS) Certified Welding Inspector (CWI) or AWS Certified Associate Welding Inspector working under the direct on-site supervision of a CWI.
G. American Society for Nondestructive Testing (ASNT) Level II certification, or a Level III certification if previously certified as a Level II in the particular material and testing methodology applicable to each Category of Testing and Inspection listed in the table.
H. American Concrete Institute (ACI) Concrete Construction Special Inspector.
I. National Institute for Certification in Engineering Technologies (NICET) Level II or higher certification specific to the particular material and testing methodology applicable to each Category of Testing and Inspection listed in the table.
J. ACI Concrete Field Testing Technician with Grade 1 certification or Center for Training Transportation Professionals (CTTP) Certified Concrete Field Testing Technician.
K. American Concrete Institute (ACI) Masonry Field Testing Technician
L. NICET Certified Engineering Technologist (CT) competent in the specific task area.
M. Association of the Wall and Ceiling Industry (AWCI) EIFS Inspector Certification.
N. International Code Council (ICC) Commercial Building Inspector Certification.
O. International Code Council (ICC) Mechanical Inspector Certification.
P. Inspector has passed either the Underwriters Laboratory (UL) Firestop Contractor Program Examination or the Factory Mutual (FM) Firestop Examination.
Q. Pre-stressed Concrete Institute (PCI) Certified Field Auditor
R. Center for Training Transportation Professionals (CTTP) Certified Soil Testing Technician.
S. American Concrete Institute (ACI) Post-Installed Concrete Anchor Installation Inspector

Notes:

1. *The Special Inspector shall meet one of the minimum qualifications listed for the applicable Category of Testing and Inspection.*
2. *Materials testing shall be done by an Approved Testing Agency meeting the requirements of the Building Code Section 1703 and ASTM E 329*.

Section 01 50 00

TEMPORARY FACILITIES
AND CONTROLS

PART ONE - GENERAL

1.1 DESCRIPTION

A. Work included: Temporary facilities and controls required for this Work include, but are not necessarily limited to:

1. Temporary utilities such as heat, water, and electricity.
2. Field office.
3. Sanitary facilities.
4. Enclosures such as tarpaulins, barricades, and canopies.

1.2 REQUIREMENTS OF REGULATORY AGENCIES

A. Comply with National Electric Code.

B. Comply with Federal, State and local codes and regulations and with utility company requirements.

1.3 TEMPORARY ELECTRICITY AND LIGHTING - BY ELECTRICAL CONTRACTOR

A. Electrical Contractor to arrange with utility company, provide service required for power and lighting, and pay all costs for service. Cost of power to be paid by Construction Manager.

B. Electrical Contractor to install circuit and branch wiring, with area distribution boxes located so that power and lighting is available throughout the construction by the use of construction-type power cords.

C. Electrical Contractor to provide adequate artificial lighting for all areas of work when natural light is not adequate for work, and for areas accessible to the public.

1.4 TEMPORARY HEAT AND VENTILATION - BY EACH PRIME CONTRACTOR

A. Provide temporary heat and ventilation as required to maintain adequate environmental conditions to facilitate progress of the Work, to meet specified minimum conditions for the installation of materials, and to protect materials and finishes from damage due to temperature or humidity.

B. Provide adequate forced ventilation of enclosed areas for curing of installed materials, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors or gases.

C. Portable heaters shall be standard approved units complete with controls.

D. Pay all costs of installation, maintenance, operation and removal, and for fuel consumed.

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1.5 TEMPORARY WATER BY PLUMBING CONTRACTOR

A. Plumbing contractor to arrange with utility to provide temporary water service for construction.

B. Install necessary branch piping:

1. Locate taps so that water is available throughout the construction by the use of hoses.
2. Protect piping and fittings against freezing.
3. Construction Manager to pay all utility usage costs.

1.6 TEMPORARY SANITARY FACILITIES - BY CONSTRUCTION MANAGER

A. Provide sanitary facilities.

B. Service, clean, and maintain facilities and enclosures.

1.7 REMOVAL

A. Completely remove temporary facilities and equipment when their use is no longer required.

B. Clean and repair damage caused by temporary installations or use of temporary facilities.

1.8 FIELD OFFICES

A. Construction Manager to provide a field office building adequate in size to accomodate all job related meetings.

B. The entire facility, including furniture, will remain the property of the Construction Manager and shall be removed from the site after completion of the work.

C. Main construction site office to be provided by Construction Manager and to be main office of Construction Manager.

1.9 PROJECT SIGNS

A. Provide 4' x 8' x 3/4" exterior grade plywood on two 8' x 4' x 4' treated wood posts. Paint sign as directed by Architect.

B. Allow no signs or advertising of any kind on the job site except as specifically approved in advance by the Architect.

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PART TWO – PRODUCTS

Not Used.

PART THREE – EXECUTION

Not Used.

END OF SECTION

Section 01 74 23

FINAL CLEANING

PART ONE – GENERAL

1.1 WORK INCLUDED

A. Execute cleaning during progress of the Work and at completion of the Work.

PART TWO - PRODUCTS

2.1 MATERIALS

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

PART THREE - EXECUTION

3.1 DUST CONTROL

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

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

3.2 FINAL CLEANING

A. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces.

B. Wash and shine glazing and mirrors.

C. Polish glossy surfaces to a clear shine.

D. Ventilating systems:

1. Clean permanent filters and replace disposable filters if units are operated during construction.
2. Clean ducts, blowers and coils if units were operated without filters during construction.

E. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds disturbed during construction.

END OF SECTION

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Section 01 77 19

CONTRACT CLOSEOUT

PART ONE - GENERAL

1.1 PRODUCT CLOSEOUT

A. Upon completion of the project, the Contractor shall remove all temporary structures and facilities from the site, and leave the premises in the condition required by the Construction Documents. The Contractor shall notify the Construction Manager, in writing, as to the date when, in his opinion all or a designated portion of the work will be substantially completed and ready for final observation and the punch list to be performed on the building. If the Architect determines that the state of preparedness is as represented, the punch list will promptly be started on the building.

B. The Architect will give written copies of the Punch List to the Construction Manager and Contractor of observed defects. The Contractor shall promptly remedy any defects due to noncompliance of Construction Documents, faulty materials, or workmanship and pay for any damage to other work resulting therefrom.

1.2 FINAL OBSERVATION

A. When defects are remedied as acceptable and upon receipt of signed and dated punch list acknowledging same, Architect shall arrange for final observation with the Owner, Construction Manager and the Architect.

B. Immediately prior to final observation and acceptance, remove protective covers or markings and complete surface treatments, washing or polishing as specified, leaving all interior surfaces, including projections, in such condition that all areas can be occupied and used without further cleaning. (This includes all heat and air conditioning grilles, etc. provided under the Mechanical Work and all electrical fixtures and switch plates, etc., provided under the Electrical Work.)

1.3 PAPER WORK

A. Final payment of the retainage will be withheld until the following documents are delivered to the Architect on a USB flash drive or by link or other electronic method of transferring the files and a printed copy of the as-built drawings as stated in item 3. Files to be organized and clearly labeled. Large files containing multiple documents are to include an index and page numbers indicating location of various sections or documents.

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1. Submittals / Shop Drawings:
   An approved copy of each submittal, manufacturer's brochures, test data, etc., submitted to the Architect for approval during the course of construction shall be included. File names to be 60 characters or less. Longer file names will not be accepted due to issues caused with transferring and opening files.
2. Operation & Maintenance Manuals:
   Include scanned copies of all operation and instruction manuals (not submittals, shop drawings, etc.) for all material, equipment or assemblies furnished or installed as part of this contract. Each manual to be in its own file and clearly labeled.
3. Record Documents / As-Built Drawings:
   Provide, as described in Section 01 78 39, a printed copy of the project record documents, with all dimensions of utility locations, variances from original drawings, etc., clearly documented in red. Each plan sheet to be included, regardless of whether changes were made to that work or not.
4. Project Directory: Complete listing of all subcontractors, mechanics, and material suppliers involved in the work under this contract.
5. Warranties / Guarantees: Submit signed and notarized copies of all manufacturers, mechanics, contractors or supplier warranties required by the contract documents, including Construction Manager's one (1) year warranty. Form and wording of guarantees must be as specified and/or as submitted by the Contractor and approved by the Architect prior to bidding.
6. Lien Waivers: Submit signed and *notarized* lien waivers from all subcontractors, mechanics, and material suppliers involved in the work of this contract. *No partial lien waivers shall be accepted*. Lien Waiver form to be as supplied by the Architect.
7. Asbestos Letter: A letter stating that all materials used in construction are asbestos free. (written by Construction Manager.)
8. AIA Forms:
   1) AIA Document G706 - Contractor's Affidavit of Payment of Debts And Claims *General Contractor to generate & complete*
   2) AIA Document G706A - Contractor's Affidavit of Release of Liens *General Contractor to generate & complete*
   3) AIA Document G707 - Consent of Surety Company to Final Payment *General Contractor to generate & complete*
   4) AIA Document G704* – Certificate of Substantial Completion **Architect to generate* (Signed by Owner, Architect, and Construction Manager)

   AIA Forms can be obtained on-line at https://shop.aiacontracts.com

PART TWO – PRODUCTS

Not Used.

PART THREE – EXECUTION

Not Used.

END OF SECTION

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Section 01 78 39

PROJECT RECORD DOCUMENTS
TO BE KEPT, RECORDED &
UPDATED IN CONSTRUCTION
MANAGER'S OFFICE

PART ONE - GENERAL

1.1 DESCRIPTION

A. Reference: Applicable provisions of the General and Supplementary Conditions and Division 1, General Requirements, govern all work of this Section.

1.2 WORK

A. Maintain at the site for the Owner one record copy of:
   1. Drawings, Specifications, Addenda, Change Orders, and other modifications to the Contract.
   2. Approved Shop Drawings, and Product Data.
   3. Field Test Records.

B. Record actual construction on set of drawings.

1.3 RELATED REQUIREMENTS

A. Submittals - Section 01 33 23

B. Conditions of the Contract

1.4 MAINTENANCE OF DOCUMENTS AND SAMPLES

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

B. Make documents available at all times for inspection by Architect.

1.5 RECORDING

A. Label each document "PROJECT RECORD" in neat large printed letters with felt tip marking pen.

B. Record information concurrently with construction progress.

   1. Do not conceal any work until required information is recorded.

C. Legibly mark drawings to record actual construction:

   1. Depths of various elements of foundation in relation to finish first floor elevation.
   2. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

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3. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
4. Field changes of dimension and detail.
5. Changes made by Field Order or by Change Order.
6. Details not on original contract drawings.

1.6 SUBMITTAL

At Contract Close-out, Record Documents shall be included on the two (2) USB flash drives as requested in Section 01 77 19 - Contract Closeout.

PART TWO – PRODUCTS

Not Used.

PART THREE – EXECUTION

Not Used.

END OF SECTION

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Section 02 41 00

DEMOLITION

PART ONE - GENERAL

1.1 DESCRIPTION

A. Provide all demolition work required to perform the work shown on the Drawings, specified herein and as required for a complete and proper installation.

1.2 INSPECTION

A. Prior to bidding, the Contractor shall visit the job site and determine demolition requirements for the completion of construction. No extra compensation shall be granted for work which the Contractor could have foreseen by close, conscientious investigation of the site. Unforeseen conditions discovered after conscientious investigations shall be immediately brought to the attention of the Architect. Work resulting from such unforeseen conditions shall be performed as directed by the Architect as per the General Conditions of the contract for construction.

PART TWO - PRODUCTS

2.1 DESCRIPTION

A. Provide all materials, labor, equipment and related items necessary to complete the work indicated on drawings and/or specified.

PART THREE - EXECUTION

3.1 DEMOLITION

A. Complete demolition as indicated on the drawings and as required to complete alterations. Inspect all areas of proposed demolition to accurately determine the locations and extent of demolition required. Provide protection against damage to existing appurtenances which are to remain.

B. Take accurate field measurements in locating areas to be demolished. Coordinate demolition work with work of other trades. Provide adjustments in the work as necessary to assure proper installation of new materials in connection with demolitions.

3.2 CUTTING AND PATCHING

A. Execute cutting, fitting or patching of work required to make several parts fit properly, uncover work to provide installation of new work or to remove and replace defective work for Contract Documents conformance.

B. Inspect existing conditions of work including elements subject to movement or damage during demolition and cutting and patching. After uncovered work, inspect conditions affecting installation of new products and existing material to be reinstalled. Do not endanger existing building by cutting except as shown on drawings.

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C. Prior to cutting provide: Shoring, bracing and support as required to maintain structural integrity of Project, protection for other portions of Project, and protection from elements.

D. Restore work which has been cut or removed and install new products to provide completed work in accord with requirements of Contract Documents.

END OF SECTION

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Section 03 11 00

CONCRETE FORMS

PART ONE - GENERAL

1.1 GENERAL CONDITIONS

All work under this section is subject to the General Conditions and Supplementary General Conditions and shall be governed by the requirements therein.

1.2 COOPERATION

This Contractor is cautioned to examine all drawings and specifications relating to other branches of the work, and he shall make proper provisions to receive all other work.

1.3 SCOPE

Shall include all formwork and related items required to complete the work indicated on the drawings and/or specified herein.

1.4 DESIGN OF FORMWORK

Design and engineering of formwork, as well as its construction shall be the responsibility of the Contractor and shall comply with chapters 2 and 3 of ACI-347, and applicable requirements of the controlling local building code.

1.5 NOTICE FOR OBSERVATION BY ARCHITECT

The Contractor shall give the Architect advance notice, 72 hours before excavations or formwork will be ready to be observed by Architect. The Contractor shall also give a 24-hour second notice before excavations or formwork, including reinforcing steel and any other built-in material or equipment, is complete and ready to be observed by Architect.

PART TWO - MATERIALS

2.1 Form material shall be B-B Plyform EXT DFPA for surfaces not exposed to view.

2.2 Form material shall be HDO EXT-DFPA, high-density overlay plywood for exposed architectural concrete.

2.3 Commercially manufactured steel forms are acceptable.

2.4 Form ties shall have plastic cones to facilitate patching.

2.5 Form accessories to be partially or wholly embedded in concrete, such as ties and hangers, shall be commercially manufactured type. Wire is not acceptable. Portion remaining within concrete shall leave no metal within one inch of surface when concrete is exposed to view. Spreader cones on ties shall not exceed one-inch diameter. All form accessories to be used in concrete having a face exposed to weather shall be galvanized.

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PART THREE - EXECUTION

3.1 WORKMANSHIP

A. At contraction, expansion and construction joints, including keyways, neatly joint forms and securely set to exact grade and alignment. Provide sufficient rigidity and strength to resist pressure of concrete without springing, deflecting, or settling.

B. Accurately set edge forms and intermediate screed strips to produce designed elevations and contours in finished surface. Forms shall be sufficiently strong to support vibrating bridge screed or roller pipe screeds if nature of finish specified requires use of such equipment. Align concrete surface to contours of screed strips by use of strike-off templates or approved compacting type screeds.

C. Positive means of adjustment (wedges or jacks) of shores and struts shall be provided and all settlement shall be taken up during concrete placing operation. They shall be securely braced against lateral deflections.

3.2 TOLERANCES

A. Construct formwork so as to insure that concrete surfaces will conform to tolerances of Section 2.4.1, ACI 347.

3.3 PREPARATION OF FORM SURFACES

A. Forms shall be sufficiently tight to prevent leakage of grout or cement paste. Board forms having joints opened by shrinkage of wood shall be swelled until closed by wetting before concrete is placed.

B. Seal plywood and other wood surfaces subject to shrinkage against absorption of moisture from concrete by either a field applied commercial form oil or sealer or a factory applied non-absorptive liner.

C. When steel forms are coated to prevent bond with concrete, it shall be done prior to placing of reinforcement. Excess form coating material shall not be allowed to come in contact with concrete against which fresh concrete will be placed.

D. Clean all form surfaces before re-use.

3.4 REMOVAL OF FORMS

A. Formwork for columns, walls, sides of beams and other parts not supporting weight of concrete may be removed as soon as concrete has hardened sufficiently to resist damage from removal operations.

B. Whenever formwork is removed during curing period, exposed concrete shall be cured by one of the methods specified in Section 03 31 00.

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C. When shores and other vertical supports are so arranged that form facing material may be removed without loosening or disturbing shores and support, facing material may be removed at an earlier age as specified or permitted. Shores and supports shall remain in place until concrete has reached its specified 28 day strength, unless otherwise specified or permitted.

END OF SECTION

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Section 03 15 00

CONCRETE ACCESSORIES

PART ONE - GENERAL

1.1 GENERAL CONDITIONS

All work under this section is subject to the General Conditions and Supplementary General Conditions and shall be governed by the requirements therein.

1.2 COOPERATION

This Contractor is cautioned to examine all drawings and specifications relating to other branches of the work, and he shall make proper provisions to receive all other work.

1.3 SCOPE

Shall include all concrete accessories required to complete the work indicated on the drawings and/or specified herein.

1.4 SUBMITTALS

Contractor shall submit one hard copy (not to be returned) and one electronic copy in PDF format as per Section 01 33 23 of products to be used for approval by the architect.

PART TWO - MATERIALS

2.1 Vapor Barrier: See Specification Section 07 26 16

2.2 Construction Joints: 24 gauge galvanized steel with dowel knockouts, depth to match slab thickness. Longitudinal keys at least 1 ½" deep. Provide stake/keyway interlock continuous at top of keyway. Provide stakes and splices. Acceptable Manufacturers:

1. Key-Loc Joint System by Form-A-Key Products Division
2. Quickey by BoMetals, Inc.
3. Screed Key by Dayton Superior

2.3 Premolded expansion joint material shall be asphalt impregnated expansion joint material to meet ASTM specification D-1751-73. Expansion joint material shall have a “zip strip” or “tear tab” for ease in installation of backer rod and sealant.

2.4 Non-shrink grout shall be Five Star Grout as manufactured by U. S. Grout Corporation or Enduro 50 by Conspec.

2.5 Expansion joint cover refer to Miscellaneous Metals, Section 05 50 00.

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2.6 Dovetail anchors and anchor slots shall be provided along concrete walls with masonry shelves 1'-2" or deeper.

A. Dovetail anchor slots shall be of 24 gage galvanized steel and shall be 1" wide x 1" deep with a 5/8" throat. Space at 24" o.c. horizontal unless noted.

B. Dovetail anchors shall be as per specification Section 04 05 23. Provide at 16" o.c. vertically unless noted.

PART THREE - EXECUTION

3.1 Control joints, expansion joint material and other embedded items shall be positioned accurately and supported against displacement. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids.

3.2 Vapor Barrier. Install under all interior concrete slabs on grade, including ramps and steps. See Section 07 26 16 of Specifications for installation.

3.3 Non-shrink Grout. Place non-shrink grout under all steel bearing conditions, as shown on the drawings.

END OF SECTION

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Section 03 20 00

CONCRETE REINFORCEMENT

PART ONE - GENERAL

1.1 GENERAL CONDITIONS

All work under this section is subject to the General Conditions and Supplementary General Conditions and shall be governed by the requirements therein.

1.2 COOPERATION

This Contractor is cautioned to examine all drawings and specifications as relating to other branches of the work and he shall make proper provisions to receive all other work.

1.3 SCOPE

Shall include all reinforcing required to complete the work indicated on the drawing and/or specified herein.

1.4 SUBMITTALS

Steel Fabricator shall submit one hard copy (not to be returned) and one electronic copy in PDF format as per Section 01 33 23 of detailed shop drawings for approval by the architect on reinforcing bars and anchor bolt setting plans before fabrication shipment. Show all dimensions necessary for reference to contract drawings. Also, wall, beam and column elevations showing placing of reinforcing steel shall be drawn for all concrete wall, beams and columns

PART TWO - MATERIALS

2.1 Metal accessories, including spacers, chairs, ties and other devices necessary for properly assembling, placing, spacing and supporting all reinforcement in place shall be provided.

2.2 Metal reinforcement shall be deformed bars (ACI 318), conforming to one of the following requirements. ASTM Standards for:

A. Billet-steel Bars for Concrete Reinforcement, A615 Latest Revision. Use Grade 60 if not specified.

B. Welded steel Wire Fabric for Concrete Reinforcement, A185 Latest Revision. Provide welded steel wire fabric in sheets.

C. All reinforcing bars shall be clearly imprinted with the mill mark, bar size and steel type.

2.3 Tension Splice Devices

A. Zap Screwlok by Barsplice Products, Inc.

B. Quick-Wedge Mechanical Lap Splices by Erico Products, Inc.

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C. Lenton Taper Threaded Rebar Splices by Erico Products.

PART THREE - EXECUTION

3.1 GENERAL

Metal reinforcement shall not be bent or straightened in a manner that will injure the materials. Bars with kinks and bends not shown on the plans will be rejected. All reinforcement shall be accurately placed as called for and tied securely with wire at intersections and at laps. All reinforcement needed in any one section shall be placed in position and inspected and approved by the Architect before concreting is begun, and every care taken not to disturb or misplace such reinforcing during the concreting operation. There shall not be less than 1-5/8" between bars, and parallel bars shall not be wired together.

3.2 Unless otherwise noted on the drawings, all concrete slabs-on-grade, including floor and walk slabs, shall receive 6 x 6 - W1.4 x W1.4 welded wire fabric. Fabric shall be placed in slabs slightly above center on chairs.

3.3 All design, placement, laps ties, accessories, etc., shall conform to the latest applicable requirements of A.C.I. Code.

A. Fabricating and Placing Tolerances. Fabricate and place reinforcing to conform to tolerances set forth in Section 5.4 of ACI 301.

B. Reinforcing in walls and footings shall be continuous around corners.

C. All tension splices in hairpins and tie beam reinforcing shall be made by mechanical device. All other splices shall have rebar lapped 30 bar diameters or 18” minimum splices unless noted on plans otherwise.

D. Provide 3’-0” long #4 bars at slab corners, as noted on plans.

END OF SECTION

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Section 03 31 00

CAST-IN-PLACE CONCRETE

PART ONE – GENERAL

1.1 GENERAL CONDITIONS

All work under this section is subject to the General Conditions and Supplementary General Conditions and shall be governed by the requirements therein.

1.2 COOPERATION

This Contractor is cautioned to examine all drawings and specifications relating to other branches of the work, and he shall make proper provisions to receive all other work. No structural concrete shall be cut or broken out by any of the trades without written permission from the Architect.

1.3 SCOPE

Shall include all concrete work and related items required to complete the work indicated on the drawings and/or specified herein.

1.4 CHARACTER OF WORK

Concrete shall be structurally sound, dense, free of honeycombs, planes of weakness or other defects and built to exact lines, shapes and levels shown. Concrete not meeting requirements of this specification will be rejected, removed and replaced. Faulty work may be repaired in lieu of removal and replacement only if written approval is given by Architect. The Contractor shall perform all removal, replacement or repair work to the approval of Architect at no expense to Owner.

1.5 The requirements of "Specifications for Structural Concrete for Building" (ACI 301) are a part of these specifications; its provisions shall govern this work except as noted on these Plans and Specifications.

1.6 SUBMITTALS

Contractor shall submit one hard copy (not to be returned) and one electronic copy in PDF format as per Section 01 33 23 of all products to be used and all proposed concrete mixes in accordance to Section 03 31 00 subsection 2.5 for approval by the architect.

PART TWO – MATERIALS

2.1 STORAGE OF MATERIALS

Provide proper space and storage shelter for the storage of materials which may be subject to weather conditions and damage. All lumpy, dirty or damaged cement shall be rejected. All cement and aggregate shall be stored and cared for in such a manner as to avoid inclusion of foreign materials. Frozen or partially frozen aggregates shall not be used.

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2.2 PORTLAND CEMENT

Shall conform to type I/II or type IA/IIA, according to ASTM C150, "Standard Specifications for Portland Cement"; or type IL, according to ASTM C595, "Standard Specifications for Blended Hydraulic Cements."

2.3 AGGREGATE FOR CONCRETE

Shall conform to ASTM "Standard Specifications for Concrete Aggregate" C-33, Latest Revision.

A. Fine aggregate shall be siliceous material and shall be clean, sharp, free from dust, silt, soft particles, vegetable loam, organic impurities, or other deleterious matter.

B. The maximum size of aggregate shall be no larger than one-fifth (1/5) of the narrowest dimension between sides of forms within which concrete is to be cast, nor larger than three-fourths (3/4) of the minimum clear spacing between reinforcing bars, or between reinforcing bars and forms. For unreinforced slabs, the maximum size of aggregate shall not be larger than one-third (1/3) the slab thickness.

C. Coarse aggregate shall consist of crushed stone, gravel or other approved inert materials with similar characteristics or combination thereof, having clean, hard durable, uncoated particles free from deleterious matter. After acceptance of a grading, a variation in the amount passing any sieve size of more than 10 percent of the total will not be permitted, and the grading shall be within the following by weight:

Normal Weight

Passing a 1-1/4" sieve……90 to 100 percent

Passing a 3/8" sieve ……...20 to 55 percent

Passing a No. 4 sieve ……..0 to 10 percent

Passing a No. 8 sieve ……...0 to 5 percent

Concrete Masonry Fill

Passing a 1/2 " sieve……..90 to 100 percent

Passing a 3/8 " sieve ……..40 to 70 percent

Passing a No. 4 sieve …….0 to 15 percent

Passing a No. 8 sieve …….0 to 5 percent

2.4 MIXING WATER

Shall be clean and free from all acid and injurious amounts of vegetable matter, alkalies, or other salts.

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2.5 CONCRETE

A. The proportion of ingredients shall be selected to produce the proper placability, durability, strength, and other required properties. The proportion of ingredients shall be such as to produce a mixture which will work readily into corners and angles of the forms and around reinforcement by the methods of placing and consolidation employed on the work, but without permitting the materials to segregate or excessive free water to collect on the surface. Refer to the Concrete Placement Schedule on the drawings. Mix designs to be used shall meet the following criteria:

Mix design		Slump Ins.	Max. Water-Cement/Ratio*
4,000 psi – with Air-Entrainment		4	0.50
4,000 psi - no Air-Entrainment		4	0.50
3,000 psi - no Air-Entrainment		4	0.53
3,000 psi – Masonry Fill, no Air-Entrainment	**	8	0.53

Mix Design strength listed is the minimum ultimate strength at 28 days
*Water-Cement ratio = #Water/#Cement
** Concrete masonry fill may be mixed in the mason's mixers provided the dry materials are prepackaged and the mix is prepared according to manufacturer's instructions (SpecMix or equal)

B. Admixtures: No concrete additives other than air-entrainment, fly ash and water reducer shall be allowed without written permission of Architect.

1. Air-entraining Admixtures:
   a. Air-entraining admixtures shall conform to Specifications for Air-Entraining Admixtures for Concrete (ASTM C260).
   b. The air content of air-entrained concrete shall conform to requirements set forth in the following table:

Maximum Size Coarse Aggregate, Inches	Air Content Percent by Volume
1-1/2, 2 or 2-1/2	5 +/- 1
3/4 or 1-1/2	6 +/- 1
3/8 or ½	7-1/2 +/-1

2. Fly ash admixture is permitted only under the following conditions.
   a. The fly ash shall meet all of the requirements of ASTM C-618-80 Class C or Class F with the following requirements. The loss on ignition in Table 1 shall not exceed 3%. Compliance to Table 1A shall apply. The amount retained on the 325 sieve in Table 2 shall not exceed 20%. The chemical analysis of the fly ash shall be reported in accordance with ASTM C-114. Quality assurance testing and reports for a minimum of six months shall be submitted by the fly ash supplier. Supplier must be approved by Architect prior to preparing mix design.

b. Concrete containing fly ash shall NOT be used in interior exposed slabs.
c. Concrete containing fly ash shall NOT be placed when anticipated ambient temperature will be less than 60 degrees F. when concrete is placed and for 24 hours after placement.
d. Agent shall submit, and obtain approval for, a concrete mix design without fly ash for each design with fly ash. This concrete mix design without fly ash is to be used when temperature falls below 60 degrees F.
e. Fly ash content shall be no more than 20% of the content of cement (measure by weight).
f. Agent must submit a record of 30 consecutive concrete tests using the mix design with fly ash as per ACI-318, Sec. 5.3.

3. Water Reducer: Shall conform to ASTM (C-494).
4. Contractor is responsible for admixture compatibility in order to produce concrete described in Sub-section 2.5.1 above.

C. The Contractor shall submit, through an approved independent testing laboratory, the proposed concrete mixes to be used prior to placing any concrete on the project. Concrete proportions for these mixes, including water-cement ratio, shall be established with materials to be employed on the basis of:

1. Field experience as per ACI-318, Sec.5.3
2. Where a production facility does not have 30 consecutive tests meeting the requirements of ACI-318, Sec. 5.3, trial batches shall be made. The proposed concrete mixes must be approved by preliminary cylinder tests. These proving tests shall consist of at least 4 cylinders for each specific mix. Control test cylinders shall be made and stored in accordance with ASTM C-31. The average compressive strength of these cylinders shall be 1200 psi greater than the Ult. Strength at 28 days (fc'). This procedure is NOT TO BE USED FOR CONCRETE WITH FLY ASH.
3. The owner shall pay for all design mixes and cylinder tests.

D. Concrete shall be transit-mixed concrete and conform to Mixing and Transportation portion of the ASTM "Standard Specification for Ready-Mixed Concrete", C-94. The time from introduction of water to discharge shall not be more than 45 minutes. The concrete producer shall furnish duplicate delivery tickets with each load of concrete delivered to the project, listing all ingredients and amount of ingredients in the mix, slump and time of introduction of water.

2.6 CURING COMPOUND

A. 1100-Clear as manufactured by W.R. Meadows shall be used on all interior and exterior concrete slabs unless noted on plans or as noted below.

PART THREE- EXECUTION

3.1 INSTALLATION

A. Depositing Concrete
1. Place no concrete until reinforcing steel, pipes, conduits, sleeves, hangers, anchors, waterproofing and other work required to be built into the concrete has been inspected and approved by the Architect.

2. Remove water and foreign matter from forms and excavations. Unless otherwise directed, thoroughly wet wood forms, sand and earth just prior to placing concrete on them. Compact soil under slabs on ground to firm unyielding surface. Place no concrete for foundations on disturbed footing.
3. Transport concrete from mixer to place of final deposit as rapidly as practical by methods which prevent separation of ingredients and displacement of reinforcement, and which avoid rehandling. Deposit no partially hardened concrete. Concrete shall be compacted by mechanical vibration. Care shall be exercised so that concrete shall not be over-vibrated to the extent that segregation of the aggregate will occur.
4. Cold Weather Requirement. When air temperature is 40 degrees F. or below, concrete temperature shall be 60 and 90 degrees F. when placed and shall be maintained at not less than 50 degrees F., for at least 72 hours. Pour no concrete on frozen soil. Cold weather concreting shall be performed according to ACI-306, "Cold Weather Concreting".
5. Hot Weather Concreting. When the temperature rises above 95 degrees F. at any time during the day, the Contractor shall place no concrete without permission of the Architect. When weather conditions warrant, and/or the Architect requires, concrete placement shall cease to be performed according to ACI-305, "Hot Weather Concreting".
6. No water shall be added at the construction site without the permission of the Architect.
7. Conveying of the concrete directly over the steel reinforcement will not be allowed. Raised runways above the top of such reinforcement as well as the top of finished slab shall be required in all places where wheeled conveyers are used.
8. All trench ducts, floor drains, J-boxes, cleanouts, etc., installed in floor slab, shall be preset in required location at correct elevation prior to final concrete pour.
9. All trades with equipment in concrete slab shall be present during pour.

B. Screeds. Use Laser screeds. Wet screeds are not acceptable on slabs on grade. Wood stakes under pipe screeds are not acceptable.

C. Curing and Protection

1. Protect all concrete work and cement finishes against injury from the elements and defacement of any nature during construction operations. Floors shall be protected from face damage, both defacement and chemical.
2. Vertical surfaces of walls and foundations shall be kept formed or wet for a period of seven days after pouring.
3. Unless otherwise specified, curing compound shall be applied to all interior concrete slabs, steps, etc., to meet manufacturer's specifications. Curing compound shall be applied evenly and uniformly when the surface is damp but not wet and can no longer be marred by walking workman.
4. On slabs to receive special floor finishes the slabs shall be moisture cured by one of the following methods for a minimum of 7 days.
    a. Applying a minimum of 1- 1/2" of clean sand over the freshly placed concrete slab. Sand shall be kept wet for 7 days.
    b. Application of absorptive mats of fabric kept continuously wet.

5. Curing compound shall be applied to all exterior concrete slabs, steps, curbs, etc., to meet manufacture's specifications. Apply at a rate of 200 sq. ft. per gallon. Curing compound shall be applied evenly and uniformly when the surface is damp but not wet and can no longer be marred by walking workmen.

3.2 TESTING

A. General

All materials and equipment used in construction of the project shall be subject to adequate inspection and testing in accordance with accepted standards. The laboratory or inspection agency shall be approved by Architect prior to starting concrete operations. At Contractor's expense, a certified ACI technician shall take test cylinders at the job site. The owner shall pay for all other services of the testing agency described in this section unless noted otherwise.

B. Materials of construction, particularly those upon which the strength and durability of the structure may depend, shall be subject to inspection and testing to establish conformance with specifications and suitability for uses intended.

C. Testing Services

1. The designated testing agency shall:
   a. Review Contractor's proposed mix design and materials.
   b. If the proposed mix design meets the quantities and requirements of the specification, the agency shall check test the Contractor's proposed mix design.
   c. Test the Contractor's proposed materials for compliance with the specifications if deemed necessary and with the approval of the Architect.
   d. Secure production samples of materials at plants or stockpiles during the course of work and test for compliance with specifications if deemed necessary and with approval of the Architect.
   e. Conduct strength tests of the concrete in accordance with following procedures:
      (1) Cure specimens from each sample in accordance with "Method of Making and Curing Concrete Compression and Flexure Specimens in the Field" (ASTM C31).
      (2) Test on specimen at 7 days in accordance with "Method of Test for Compressive Strength of Molded Concrete Cylinders" (ASTM C39). The 7-day test shall be at least 60% of the 28-day design strength.
      (3) Test one specimen at 14 days in accordance with "Method of Test for Compressive Strength of Molded Concrete Cylinders" (ASTM C39).
      The 14-day test results shall be at least 80% of the 28-day design strength.
      (4) Test 3 specimens at 28 days in accordance with "Method of Test for Compressive Strength of Molded Concrete Cylinders" (ASTM C39).
      The 28-day test result shall be average of strengths of the 3 specimens.

(5) Make one strength test for each 100 cu. yds. Or fraction thereof for any class of concrete placed in any one day, except that in no case shall a given class be represented by less than five (5) tests. Except for reinforced masonry columns, grade beams, and floor slabs, concrete pours of less than ten yards need not be tested.

f. Report all test results to Architect's Field Representative and Contractor on same day that tests are made.

2. The testing agency may also perform the following additional services if Architect's Field Representative desires, the cost of which will be borne by the Contractor if the methods or the materials fail to meet the above specs.
   a. Check batching and mixing operations to the extent deemed necessary by Architect's Field Representative.
   b. Review the manufacturer's reports of each shipment of cement and reinforcing steel and/or conduct laboratory tests or spot checks of these materials as received.
   c. If average compressive strength of the three 28-day specimens, from a given sample, does not meet the above specifications, the in-place hardened concrete shall be tested. These in-place concrete tests shall be determined by the Architect and shall consist of testing of drilled cores or impact hammer or both. The number of tests and locations shall be determined by the Architect. The drilled cores shall be taken in accordance with "Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete". (ASTM C42). These additional tests will be paid for by the contractor.

D. Authority and Duties of Testing Agency

1. Technicians representing the testing agency shall inspect the materials and the manufacture of concrete and shall report their findings to Architect's Field Representative and the Contractor. When it appears that the material furnished or work performed by the Contractor fails to fulfill specification requirements, the technicians shall direct the attention of the Architect's Field Representative and the Contractor to such failure.
2. The technicians shall not perform other duties for Contractor unless the services are paid for by the Contractor.
3. Work will be checked as it progresses, but failure to detect any defective work or materials shall not in any way prevent later rejection when such defect is discovered, nor shall it obligate Architect's Field Representative to final acceptance.
4. Technicians are not authorized to revoke, alter, relax, enlarge or release any requirements of the specifications, not to approve or accept any portion of work.

E. Responsibilities and Duties of Contractor

1. The use of testing services shall in no way relieve the Contractor of his responsibility to furnish materials and construction in full compliance with the plans and specifications.
2. To facilitate testing services, the Contractor shall:
   a. Prior to concrete operations, provide both the testing agency and concrete supplier with a copy of Section 03 31 00 of the specification.

b. Secure and deliver to Architect or his testing agency without cost, preliminary representative samples of the materials he proposes to use, and which are required to be tested.

c. Submit through testing agency to Architect the Concrete Mix Design he proposes to use, and make written request for approval.

d. During concreting operations at site, provide testing agency with strength test samples according to the following procedures:

(1) Secure concrete samples from batch in accordance with "Method of Sampling Fresh Concrete" (ASTM C172). Note one strength test or sample will include 5 specimens or 5 test cylinders.

(2) Mold 5 specimens from each sample in accordance with "Method of Making and Curing Concrete Compression and Flexure Specimens in the Field" (ASTM C31), and cure under Standard Moisture and Temperature Conditions in accordance with Sections 7.1, 7.2, and 7.3 of ASTM C31.

(3) Make one strength test for each 100 cu. yds. or fraction thereof for any class of concrete placed in any one day, except that in no case shall a given class be represented by less than five (5) tests. Except for reinforced masonry columns, grade beams, and floor slabs, concrete pours of less than ten yards need not be tested.

e. Furnish such casual labor as is necessary to obtain and handle samples at the project or at other sources of material.

f. Advise the testing agency sufficiently in advance of operations to allow for completion of quality tests and for assignments of personnel.

g. Provide and maintain adequate facilities for safe storage and proper curing of concrete test cylinders on the project site for the first 24 hours as required by ASTM C31.

h. Deliver test specimens to laboratory for testing as per ASTM C31. Specimens shall be protected from physical damage, including freezing and drying, during shipping.

i. Furnish copies of mill test report of all shipments of cement to Architect and testing agency if required.

F. Evaluation of Test Results

1. Test results shall be evaluated separately for each specified strength.
2. If the number of tests conducted is less than outlined on Paragraph 3.2.4.2, the Architect has the option to reject the untested concrete or require in-place concrete test. The cost associated with either option will be paid by the contractor.
3. Test results obtained by use of an impact hammer or sonoscope, unless correlated with other test data, shall not be considered conclusive in evaluating strengths of concrete.
4. Evaluation shall be valid only if tests have been conducted in accordance with procedures specified herein.

3.3 CLEANING

Clean all exposed surfaces and adjoining work stains by leakage of concrete, and point all exposed joints in concrete work to the approval of the Architects.

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3.4 CODE REQUIREMENTS

All work, including forms, reinforcing, placing, laps, ties, etc. as well as the aggregate, design, mix, transportation, placing, finishing, curing, protection, etc., as all concrete work, shall conform to the latest published code and recommendations of the American Concrete Institute, which are hereby made a part of this specification as if here copied in their entirety.

END OF SECTION

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Section 03 35 00

CONCRETE FINISHES

PART ONE - GENERAL

1.1 GENERAL CONDITIONS

All work under this section is subject to the General Conditions and Supplementary General conditions and shall be governed by the requirements therein.

1.2 COOPERATION

This Contractor is cautioned to examine all drawings and specifications relating other branches of the work, and he shall make proper provisions to receive all other work.

1.3 SCOPE

Shall include all labor and materials required to complete the work indicated on the drawings and/or specified herein.

1.4 QUALITY ASSURANCE

A. Concrete flatwork shall be performed utilizing high quality techniques conforming to American Concrete Institute Standards provided for by ACI Publication CP-10, Concrete Flatwork Technician and Flatwork Finisher, ACI Publication CCS-1, Concrete Craftsman Series Slabs on Grade.

B. All concrete installation shall be performed by at least one ACI Flatwork Finisher or Technician currently certified with ACI.

C. All projects greater than 10,000 square feet will require at least two ACI Flatwork Finishers or Technicians currently certified with ACI.

1.5 SUBMITTALS

A. Provide ACI certification documentation for all finishers who will be installing concrete prior to starting any concrete operations.

B. Contractor shall submit one hard copy (not to be returned) and one electronic copy in PDF format as per Section 01 33 23 of concrete products to be used for approval by the architect.

1.6 PRE-WORK CONFERENCE

Within two weeks prior to the placement of any finished concrete, a pre-work conference shall be held at the job site with the following in attendance: Architect's Representative, Contractor's Job Superintendent, finishing sub-contractor, and all sub-contractors applying floor coverings and/or special floor finishes. This meeting will serve the following purposes: To discuss plans and specifications and clarify any questions pertaining to concrete finishes and floor coverings, and to transfer ideas as to what the Architect will expect from all trades and ideas that the sub-contractors may have on their portion of the job.

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PART TWO - MATERIALS

2.1 FLOOR SEALER

A. Verify areas to be Sealed Concrete with the Finish Schedule on drawings.

B. Material: MasterKure CC 180WB (formerly "Kure-N-Seal"), as manufactured by BASF or equal.

C. Application: Within one week of substantial completion, apply two coats of sealer in accordance with the manufacturer's printed instructions at a rate of 400 SF/gal.

PART THREE - EXECUTION

3.1 FINISHING CONCRETE

A. Immediately after removing forms, all concrete surfaces shall be inspected and any poor joints, voids, or stone pocket surfaces and other defective areas shall be patched and placed in good condition.

B. All exposed surfaces of foundation walls, retaining wall, interior walls and edges of turned down slabs shall be formed on plywood with a smooth finish. Rub as necessary to remove fins and projections. Fill all voids to leave surface smooth.

C. Concrete with applied coating shall be formed on plywood. Rub as necessary to remove fins and projections. Fill all voids to leave surface smooth and acceptable to receive applied coating.

D. Floor Flatness and levelness of interior slabs: The finished concrete surface shall have a minimum value as specified below measured in accordance to ASTM E 1155. Grind down any surface defects that would telegraph through applied floor covering. Use a "Dipstick" or other approved method for measurement of floor flatness and levelness. Contractor to provide written report to the Architect within 48 hours of completion of each pour.

Surface Areas	Floor Flatness Local F_f	Floor Levelness Local F_L
Slab on grade areas	30	25
Elevated slabs	25	20

E. Exterior steps, porches, walls, etc., shall be smoothed with a steel trowel, followed by a brushed finish for non-slip surface. Steps shall have edges rounded with a steel edging tool.

F. All exterior concrete slabs shall be sloped to provide water drainage. Any exterior concrete that holds water puddles shall be removed and replaced by the Contractor at his expense.

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3.2 SURFACE DEFECTS

Surface defects which do not impair the structural strength shall be carefully cut out and refilled with fresh concrete. Cuts shall not be less than one inch (1") deep and thoroughly wetted just prior to filling with concrete of stiff consistency and mixed approximately the same as the adjoining work. After partial set, compress and rub to produce a finish similar in texture and color to adjoining work.

END OF SECTION

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Section 04 01 20

UNIT MASONRY CLEANING

PART ONE - GENERAL

1.1 DESCRIPTION

A. Work included: Cleaning of all masonry surfaces as shown on the Drawings, specified herein, or needed for a complete and proper installation.

B. Related work described elsewhere:

1.	Masonry Mortaring	Section 04 05 13
2.	Brick Masonry	Section 04 21 13
3.	Contrete Unit Masonry	Section 04 22 00

PART TWO - PRODUCTS

2.1 CLEANING AGENTS

A. All cleaning agents listed are as manufactured by Prosoco, Inc., Kansas City, Kansas or Architect approved equal.

1. Brick veneer (red clay) with mortar – no color: Sure Klean No. 600 detergent.
2. Brick veneer (buff clay) with mortar – no color: Sure Klean Vana Trol cleaner.
3. Masonry with color mortar: Sure Klean Vana Trol cleaner.
4. Colored block: Sure Klean Custom Masonry Cleaner.

B. MURIATIC ACID WILL NOT BE ALLOWED AS A CLEANING AGENT.

PART THREE - EXECUTION

3.1 POINTING

Cut out any defective joints and holes to depth of 3/4 inch in exposed masonry and repoint with mortar.

3.2 CLEANING EXTERIOR SURFACES

A. Clean masonry surface with rough cloth or brush. Clean at end of each day.

B. Clean all exposed exterior masonry after mortar has cured:

1. Clean initially with stiff brushes and water.
2. Allow Architect to inspect initially cleaned surfaces.
3. Where directed by Architect, apply cleaning agent to sample wall area of 20 square feet.
4. Do not proceed with application of cleaning agent without approval of Architect.

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5. When cleaning agent is required:
    a. On block follow block manufacturer's recommendation.
    b. Follow cleaning agent manufacturer's directions.
    c. Rinse surface thoroughly with water following cleaning.
    d. Protect surrounding non-masonry surfaces from exposure to the cleaning agent.

3.3 CLEANING INTERIOR SURFACES

A. Clean exposed interior masonry:

1. Brush surface or rub with rough cloth at end of each day's work.
2. Clean as necessary after mortar has cured with stiff brush dipped in bucket of water.
3. Mop up immediately any water puddling on the floors.

3.4 GENERAL CLEANING

A. At the completion of work, all exposed block shall be cleaned from the top down with a solution of non-staining soap powder and clean water, using stiff fiber brushes for scrubbing. Rinse surface with clean water. Apply solution in strict accordance with the manufacturer's recommendations. No acid for cleaning masonry will be permitted on the job or in trucks on the job.

END OF SECTION

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Section 04 05 13

MASONRY MORTARING

PART ONE - GENERAL

1.1 DESCRIPTION

A. Work included: Provide all material, complete, in place, as shown on the Drawings, specified herein, or needed for a complete and proper installation.

B. Related work specified elsewhere:

1.	Unit Masonry Cleaning	Section 04 01 20
2.	Masonry Accessories	Section 04 05 23
3.	Brick Masonry	Section 04 21 00
4.	Concrete Unit Masonry	Section 04 22 00
5.	Metal Doors and Frames	Section 08 11 00

1.2 QUALITY ASSURANCE

A. Use the same manufacturer's products throughout the project.

B.. Submit manufacturer's certification that materials meet the specification requirements.

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):

1. ASTM C144, Specification for Portland Cement.
2. ASTM C144, Specification for Aggregate for Masonry Mortar.
3. ASTM C207, Specification for Hydrated Lime for Masonry Purposes.

B. Specification for Masonry Structures TMS 402/602-16.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver and store manufactured products in original unopened containers.

B. Store cementitious ingredients in weather-tight enclosures and protect against contamination and warehouse set.

C. Stock pile and handle aggregate to prevent contamination from foreign materials.

D. Keep water free of harmful materials.

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1.5 ENVIRONMENTAL REQUIREMENTS

A. Heat mixing water when air temperature is below 40 degrees F and heat aggregates when air temperature is below 32 degrees F., to assure mortar temperatures between 40 degrees F and 120 degrees F., until used.

B. Produce subsequent mortar batches within ± 10 degrees F. (± 6 degrees C.) of first batch.

C. Do not heat water or sand above 120 F., (50 degrees C.).

PART TWO - PRODUCTS

2.1 MORTAR

A. Materials:

1. Portland Cement: ASTM C150, Type 1.
2. Pre-packaged portland cement, hydrated lime and dried masonry sand meeting specification is acceptable.
3. Hydrated Lime: ASTM C207.
4. Sand: ASTM C144, well screened, clean, hard, sharp siliceous, and free from loam, silt, or other impurities.
5. Water: Clean and free of deleterious amounts of acids, alkalies, oil, or organic materials.
6. Mortar coloring: As required by the Architect.
7. Admixtures: Performance admixtures, except waterproofing, shall not be used without written proof from a recognized testing laboratory to the effect that the bond strength of mortar or grout to which said admixture has been added is not less than that for mortar or grout without addition of said admixture and the written approval of the Owner.

B. Mortar Mix:

1. Proportions by volume:

Mortar Type	Portland Cement	Masonry Cement	Hydrated Lime or Lime Putty	Aggregate Measured in Damp Loose Condition
S	1	None	1	Not less than 2-1/4 and not more than 3 times the sum of volumes of cement and lime used.

2. Measure in container of known volume, not by "Shovelfulls".
3. Provide Dry-Block Integral Water-Repellant admixture at recommended dosage rate for type of mortar being used (exterior walls and interior wet areas only).

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PART THREE - EXECUTION

3.1 INSTALLATION

A. Mechanical:

1. Approved type: Batch type with controlled water quantity.
2. Mixing time: 5 minutes, 2 minutes continuous after water added.

B. Hand-mixing: Only when specifically approved by Architect.

1. Use for small batches only.
2. Use weather tight mixing box.
3. Rake each batch thoroughly and turn over together before adding water until dry mix is an even color throughout the mass.
4. Add water gradually until thoroughly mixed mortar of required plasticity is obtained.

C. General:

1. Keep all equipment and mixing boxes clean.
2. Prepare mortars in batches or volume that will be used before initial set takes place.
3. Transport mortar to point of use within 45 minutes after mixing.
4. Do not re-tamper mortar after it has set.
5. Mortar flow: Mortar of the materials and proportions used in the construction shall have a flow after suction for a one minute of not less than 65 percent of that immediately before suction. The flow shall be determined by the method of the Water Retention Test of the Standard Specifications for Masonry Cement, ASTM C91 if testing is required.
6. Mortar consistency: The mortar shall be as wet a consistency as can be conveniently handled. Mortar which has greatly stiffened or in which the cementing material has started to set shall not be used.

END OF SECTION

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Section 04 05 23

MASONRY ACCESSORIES

PART ONE - GENERAL

1.1 DESCRIPTION

A. Work included: Provide all masonry accessories, complete, in place, as shown on the Drawings as specified herein, and as required for a complete and proper installation.

B. Related work described elsewhere:

1.	Brick Masonry	Section 04 21 13
2.	Concrete Unit Masonry	Section 04 22 00

PART TWO - PRODUCTS

2.1 GENERAL

A. All masonry anchors, ties and wall reinforcement shall be corrosion resistant as manufactured by Hohman & Barnard, Inc., Hauppauge, New York.

B. Metal accessories for use in exterior wall construction to meet local wind load requirements and shall be hot dipped galvanized after fabrication in accordance with ASTM A-153, Class B-2, and local codes.

C. Metal accessories for use in interior wall construction shall be mill galvanized in accordance with ASTM A-641, Class 1, and local codes.

2.2 MASONRY WALL REINFORCEMENT

A. VENEER ATTACHMENT (STUD WALL): (1’4” o.c. Horizontally, 1’4” o.c. Vertically)

Continuous 9 gage longitudinal rod
HB-213 Adjustable Veneer Anchor

B. VENEER ATTACHMENT (MULTI-WYTHE WALL):

Continuous 9 gage longitudinal rod in veneer
(1’4” o.c. vertical spacing)

Backing Wall Reinforcement:

6”, 8”, 10”, 12” Walls:

285 Grip-Lock Ladder, a system that includes pintel and backing wall reinforcing with 9 gage side rods (spaced at 1’4” o.c. vertically).

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C. SINGLE WYTHE WALLS:

6”, 8”, 10”, 12” Walls:

220 Ladder-Mesh with 9 gage side rods (spaced at 1’4” o.c. vertically).

4” wall: One (1) 9 gage rod continuous at 1’4” o.c.

D. SHEAR WALLS:

At Multi-Wythe Walls:	285 Grip-Lok Ladder
At Single Wythe Walls:	220 Ladder-Mesh

Ladder reinforcing at shear walls shall consist of side rods as noted below and horizontal joint reinforcing shall be spaced as below:

6” Wall:	Four 9 gage side rods at 16” o.c. vertically.
8” Wall:	Four 3/16” diameter side rods at 16” o.c. vertically.
10” Wall:	Four 3/16” diameter side rods at 16” o.c. vertically.
12” Wall:	Four 9 gage side rods at 8” o.c.

E. VENEER ATTACHMENT (CONCRETE WALL): (1’4” o.c. horizontally, 1’4” o.c. vertically)

305	24 gage Dovetail Anchor Slot
303 SV	Seismic Notch Dovetail Anchor

F. VENEER ATTACHMENT (STEEL BEAM OR COLUMN): (1’4” o.c. horizontally, 1’4” o.c. vertically)

Continuous 9 gage longitudinal rod in veneer at 1’4” O.C. vertically.

360 Gripstay Channel Slot

364 SV Seismic Notch Gripstay Channel Slot Anchor

2.3 MASONRY WALL FLASHING

A. Provide .020 inch flexible membrane flashing, type HD concealed flashing and membrane waterproofing, as manufactured by Nervastral, Inc., of Greenwich, CT.

2.4 MASONRY CONTROL JOINT MATERIAL

A. #673 Masonry Control Joint by Greenstreak Plastics, Inc., of St. Louis, Missouri.

2.5 CAVITY WALL DRAINAGE SYSTEM

A. 0.4" trapezoidal shaped polyester mesh cavity wall drainage system, MortarNet, as manufactured by Mortar Net USA, Ltd., Burns Harbor, IN or approved equal.

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PART THREE - EXECUTION

3.1 INSTALLATION

A. Joint reinforcement:

1. Place in horizontal joints of unit masonry work as described in Part 2 of Section 04 05 23.
2. Lap joints of 6 inches.
3. Use prefabricated shapes at corners and tees.

B. Ties and anchors:

1. Install mesh ties in horizontal joints of concrete masonry wall 16" O.C. or as shown on the Drawings.
2. Secure anchor brackets vertically to exterior wall, spaced 2'0" o.c. horizontal (min.).
3. Install flexible ties as brick masonry work progresses, spacing 16" o.c. vertical (min.).

C. Flashing:

1. Lap joints 4 inches and seal with mastic.
2. Install continuously in exterior wall masonry perimeter and at all lintels and openings as indicated on the Drawings.

D. Control joints:

1. Secure to masonry wall with masonry nails through flange at existing wall and grout flanges at new walls.

E. Cavity Wall Drainage System:

1. Lay the first 1 or 2 courses of brick at flashing level, then install cavity wall drainage system continuously by placing it against the inside of the openings. No fasteners or adhesives are required, and mortar need not have set.

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Section 04 21 13

BRICK MASONRY

PART ONE - GENERAL

1.1 DESCRIPTION

A. Work included: Provide brick masonry complete, in place, as shown on the Drawings, as specified herein, and as required for complete and proper installation.

B. Related work specified elsewhere:

1.	Unit Masonry Cleaning	Section 04 01 20
2.	Masonry Mortaring	Section 04 05 13
3.	Masonry Accessories	Section 04 05 23

C. Refer to Structural Plans for Seismic Category.

1.2 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):

1. ASTM C 216, Specifications for Facing Brick shall be the minimum standard for brick. In addition, excessive chips or indentations due to manufacturing or handling defects will not be accepted.

B. Brick Institute of American (BIA) Technical Notes.

C. TMS 402/602-16 Specification for Masonry Structures.

1.3 MOCK-UP

A. Prior to proceeding with masonry work, erect a 4'0" x 4'0" sample wall panel. Panel shall include 4" brick, 1" insulation, masonry wall reinforcing, thru-wall masonry flashing, caulked control joint and weep holes. Remove rejected panel and erect new panel until workmanship is approved.

1. Erect on jobsite away from the building foundation.
2. Clean panel thoroughly and provide temporary cover as required to keep panel dry at all times.
3. The approved panel shall be the standard of comparison for all masonry work on the project.
4. The approved panel shall remain in place and not be altered, moved or destroyed until all masonry work is completed, or until removal is authorized by the Architect.

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1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Store brick off ground to prevent contamination by mud, dust or materials likely to cause staining or other defects.

B. Cover materials when necessary to protect from elements.

C. Protect reinforcement from elements.

1.5 JOB CONDITIONS

A. Cold weather installation: Do not erect masonry units when ambient temperature has dropped below 45 degrees F., unless it is rising, and at no time when it has dropped below 40 degrees, F., except by written permission of Architect.

B. Cold weather protection: Protect in-place masonry construction from being exposed to temperatures 32 degrees F. or below for 24 hours after erection.

C. Hot weather conditions: Protect masonry construction from direct exposure to wind and sun where erected in an ambient air temperature of 99 degrees F. in the shade with relative humidity less than 50 percent.

D. Protection of Work:

1. During erection, cover tops of exterior walls with strong waterproof membrane at end of each day.
2. Prevent grout or mortar from staining the face of masonry to be left exposed or painted.

PART TWO - PRODUCTS

2.1 BRICK

A. Facing brick: ASTM C 216 and C 652, FBS Type, meeting SW requirement, Standard Modular size, 35% maximum percent voids.

B. Solid brick required for rowlock courses and other locations shown.

C. Brick selection: As selected by the Architect.

2.2 MORTAR

A. Refer to Section 04 05 13.

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2.3 BRICK ALLOWANCE

A. The following allowance figure shall cover the direct purchase price to the Contractor. All applicable taxes, unloading and handling charges, labor, installation costs, overhead, profit and other expenses shall be included in the Contract Sum and not in the allowance.

$950.00 per thousand.

PART THREE - EXECUTION

3.1 PREPARATION

A. Wet brick to nearly saturated, surface dry conditions:

1. Immerse brick to depth of one inch in water.
2. The rate of absorption of water and the time of laying shall not exceed 0.7 ounce per brick per minute when partially immersed on its flat side.

B. Clean reinforcement and place as specified in Section 04 05 23 and/or as shown on the Drawings.

C. Do not proceed with construction of brick masonry without Architect's approval of sample panel.

D. Secure anchors, ties, joint reinforcement, and in-wall flashing as specified in Section 04 05 23 and/or as shown on the Drawings.

E. At exterior brick and block walls, the brick and block shall be laid separately.

3.2 GENERAL ERECTION REQUIREMENTS

A. Pattern bond: Lay masonry in standard running bond except for Rowlock and Soldier courses shown on the Drawings. No batts shall be laid as headers or in the exposed face of walls, except for closures when approved by the Architect.

B. Joining fresh masonry to partially set masonry:

1. Remove loose brick and mortar.
2. Clean and lightly wet exposed surface of set masonry.
3. Stop off horizontal run of masonry by racking back one half length of unit in each course.

C. Tooling:

1. Tool exposed joints when "thumb-print" hard with a round joiner slightly larger than width of joints.
2. Trowel-point or concave-tool exterior joints below grade.
3. Flush-cut all joints not tooled.

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D. Flashing:

1. Clean surface of masonry smooth and free from projections which might puncture the flashing.
   a. Place the flashing material on bed of mortar.
   b. Cover the material with mortar.
   c. Seal with mastic at all laps in flashing and everywhere drawings show flashing applied to vertical face of walls.

E. Weep holes:

1. Provide weep holes in head joints in first course immediately above the flashing material by placing and leaving sash cord in joints.
2. Maximum spacing: 32” o.c.
3. Keep weep holes and area above the flashing free of mortar droppings.

F. Sealant recesses:

1. Leave joints around outside perimeters of exterior door frames, window frames, and other wall openings:
   a. Depth: uniform 3/4 inch.
   b. Width: 1/4 inch to 3/8 inch.

G. Control joints:

1. Keep clean from all mortar and debris.
2. Locate at maximum spacing of 24'0" apart or spacing as indicated on the Drawings, whichever is less.

H. Cutting brick:

1. Cut exposed brick with motor-driven saw or by other methods which provide cuts that are straight and true.

I. Mortar joint thickness:

1. 3/8 inch nominal.

3.3 BRICK MASONRY

A. Brick installation:

1. Lay brick plumb and true to lines with level courses.
2. Lay with completely filled mortar joints.
3. Do not furrow bed joints.
4. Butter ends of brick with sufficient mortar to fill head joints.
5. Rock closures into place with head joints thrown against two adjacent brick in place.
6. Do not pound corners and jambs to fit stretcher units after they are set in position. Where an adjustment must be made after mortar has started to harden, remove mortar and replace with fresh mortar.

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B. Air space between walls:

1. Keep space clean of mortar droppings, mortar protrusions, and debris as work progresses.

C. Bond: All bond shall be kept plumb and uniform. When necessary to build portions of walls to higher level than adjacent portions, tooth courses. Provide sufficient "Line Blocks" to maintain level bed joints. Layout all face coursing before setting to minimize cutting closures or the jumping of bond.

D. Built-in work: Coordinate work with that of other trades so that all connecting work shall be properly installed. Build in panel boxes, anchors, grounds flashing and all other necessary incidental work.

3.4 CLEANING

A. Cut out any defective joints and holes in exposed masonry and repoint with mortar.

B. Clean all exposed unglazed brick and concrete masonry. Refer to Section 04 01 20.

C. Clean mortar boxes at the end of each day's work.

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Section 04 22 00

CONCRETE UNIT MASONRY

PART ONE - GENERAL

1.1 DESCRIPTION

A. Work included: Provide all concrete unit masonry, complete, in place, as shown on the Drawings, specified herein, or needed for a complete and proper installation.

B. Related work described elsewhere:

1.	Concrete for Footings and Foundations	Division Three
2.	Unit Masonry Cleaning	Section 04 01 20
3.	Masonry Mortaring	Section 04 05 13
4.	Masonry Accessories	Section 04 05 23
5.	Painting	Section 09 91 00

C. Refer to Structural Plans for Seismic Category.

D. Reference standards:

1. Standard Specification TMS 402/602-16.

1.2 QUALITY ASSURANCE

A. Qualifications of workmen:

1. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
2. Provide one skilled journeyman mason who shall be present at all times during execution of this portion of the Work and who shall personally direct all work performed under this Section.

1.3 MOCK-UP

A. Prior to proceeding with the masonry work, erect a 4'0" x 4'0" sample wall panel. Panel shall include 12" block, masonry wall reinforcing and caulked control joint if block is for exterior use. Remove rejected panel and erect new panel until workmanship is approved.

1. Erect on jobsite away from the building foundation.
2. Clean panel thoroughly and provide temporary cover as required to keep panel dry at all times.
3. The approved panel shall be the standard of comparison for all masonry work on the project.
4. The approved panel shall remain in place and not be altered, moved or destroyed until all masonry work is completed, or until removal is authorized by the Architect.

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1.4 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

C. Cold weather: Do not erect concrete masonry units when ambient temperature has dropped below 45 degrees F., unless it is rising, and at no time when it has dropped below 40 degrees F. except with written permission of the Architect.

PART TWO - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. All concrete masonry units shall meet or exceed the minimum specifications of the ASTM Standard C-90. In addition a letter from the block supplier shall be submitted to the Architect stating that no blocks cured less than 28 days will be shipped to this job.

B. Minimum compressive strength of concrete masonry unit = 2000 psi for M or S type mortar used and 2,650 psi for N type mortar used.

C. All masonry units above grade shall be lightweight unit masonry with a density of 108 pcf or less.

D. Manufacture all units with exterior exposure and/or interior wet areas with integral water repellant admixture equal to Dry-Block Integral Water-Repellant Admixture for block.

E. Mortar: Refer to Section 04 05 13.

F. Provide round corner blocks (1” radius) at window sills, one side of block at door jambs, and all 90 degree outside corners, including exposed corners of block.

2.2 OTHER MATERIALS

A. All other materials not specifically described but required for a complete and proper installation of the work of this Section, shall be as selected by the Contractor subject to the approval of the Architect.

PART THREE - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

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3.2 COORDINATION

A. Carefully coordinate with all other trades to ensure proper and adequate interface of the work of other trades with the work of this Section.

3.3 GENERAL

A. Lay only dry masonry units using standard running bond, setting units plumb, true to line, and with level courses accurately spaced.

B. Use masonry saws to cut and fit masonry units. Make cut outs as small and true as possible so that cover plates will totally cover masonry opening.

C. Locate electrical boxes so that bottom of box is in line with a masonry joint unless shown otherwise on the Drawings.

D. Solidly mortar spaces around built-in items in faces of exterior walls so that masonry fill insulation will not escape from the cavities.

E. Where noted on the Drawings, fill voids in blocks and reinforced bond beams with 3,000 psi concrete masonry fill.

F. Ensure cavities in masonry units of exterior walls are completely free of mortar bulges and droppings to allow free flow of masonry fill insulation as masonry is erected.

G. Fill solidly with mortar all spaces in jambs of hollow metal frames abutting mortar.

H. Fill hollow masonry units receiving anchor bolts for plates completely with 3,000 psi concrete masonry fill.

3.4 FACE JOINTS.

A. Horizontal and Vertical:

1. Nominal thickness: 3/8 inches.
2. Construct uniform joints.
3. Shove vertical joints tight.
4. Strike joints flush in surfaces to be plastered, stuccoed, covered with ceramic tile, or other surface applied finish other than paint.
5. Tool joints in exposed or to be painted surfaces when thumbprint hard to a smooth "C" joint with the intersections smooth and neat. Brush & rejoint.
6. Remove mortar protruding into cells of cavities to be reinforced or filled.

3.5 CLEANING

A. Leave work and surrounding surfaces clean and free of mortar spots and droppings.

B. Clean mortar boxes at the end of each day's work.

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3.6 MASONRY CONTROL JOINTS

A. Locate exterior masonry control joints at max spacing of 24'0" o.c. unless indicated differently on the Drawings. Locate interior control joints so that the maximum length of straight masonry wall is 24'0".

3.7 PROTECTION OF WALLS

A. Cover top of masonry walls and partitions at end of each day's work with waterproof membrane. Protect all concrete blocks from the weather by covering during storage and after laying in the walls. Before using blocks they shall be dried down to a moisture content of approximately the average air dry condition to which the finished walls will be exposed.

END OF SECTION

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Section 04 73 23

CAST STONE MASONRY

PART ONE - GENERAL

1.1 SECTION INCLUDES

A. Architectural Cast Stone Masonry Veneers

1.2 RELATED SECTIONS

A. Section 04 01 20 – Unit Masonry Cleaning

B. Section 04 05 13 – Masonry Mortaring.

C. Section 04 05 23 – Masonry Accessories.

E. Section 05 50 00 – Structural Steel Framing: loose steel lintels.

F. Section 07 92 00 – Joint Sealants.

1.3 REFERENCES

A. American Concrete Institute (ACI).

B. American Society for Testing and Materials (ASTM):

1. ASTM C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units
2. ASTM C 270, Standard Specification for Mortar for Unit Masonry.
3. ASTM C 482, Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement.

C. Building Materials Evaluation Commission.

D. International Code Council (ICC):

1. ES Report.
2. UBC Standard No. 14-1, Kraft Waterproof Building Paper.

F. Masonry Standards Joint Committee (MSJC) of The Masonry Society.

G. Underwriters Laboratories (UL):

1. Classification File Number.
2. UL 723, Standard for Safety for Surface Burning Characteristics of Building Materials

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1.4 SUBMITTALS

A. Reference Section 01 33 23 - Shop Drawings, Product Date & Samples; submit following items:

1. Product Data: Manufactured masonry and application materials including mortar color charts, and water resistive barrier.
2. Samples: Panel containing full-size samples of specified manufactured masonry showing full range of colors and textures complete with specified mortar.
   a. Actual size of masonry sample approximately 12 by 12 inches (300 by 300 mm).
3. Quality Assurance/Control Submittals:
   a. Qualifications:
      1) Proof of manufacturer qualifications.
      2) Proof of installer qualifications.
   b. Certificates: ICC-ES Report.
   c. Test Reports for physical properties.
   d. Manufacturer's Installation Instructions.

B. Closeout Submittals: Reference Section 01 77 19 – Contract Closeout; submit following items:

1. Maintenance Instructions.
2. Special Warranties.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer having sufficient plant facilities to produce the shapes, quantities and size of Products required in accordance with the project schedule.

B. Installer: Company or person specializing in commercial masonry work with documented experience in installation of manufactured masonry including minimum five (5) projects within 400 mile radius of this project.

C. Mock-up: Supply sufficient quantity of full size building stone units for use in constructing mock-up panel.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver cast stone units in protective film. Prevent damage to units.

B. Lift skids with proper and sufficiently long slings or forks with protection to prevent damage to units. Protect edges and corners.

C. Store units in a manner designed to prevent damage and staining of units.

D. Stack units on timbers or platforms at least 3 inches above grade.

E. Place polyethylene or other plastic film between wood and other finished surfaces of units when stored for extended periods of time.

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F. Cover stored units with protective enclosure if exposed to weather.

G. Do not use salt or calcium-chloride to remove ice from masonry surfaces.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain materials and ambient temperature in area of installation at minimum 40 degrees F (4 degrees C) prior to, during, and for 48 hours following installation.

PART TWO – PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Northfield Block
1. Address: 3400 E. Bungalow Road, Morris, IL 60450
2. Phone: 800-358-3003
3. Website: www.echelonmasonry.com.
4. Distributed by Antique Brick & Block, Little Rock, AR, 501-375-0060.

2.2 MATERIALS

A. General / Appearance: High-density, pre-finished architectural concrete block meeting the requirements of ASTM C1634. Manufactured to achieve the look of natural stone by incorporating all-natural aggregates.

1. Basis of Design Product: Cordova Stone™ concrete masonry units, from Echelon.
2. Color:
   a. As selected from manufacturers standard color range.
3. Dimensions:
   a. 4 inches x 16 inches x 24 inches. Locations and installation pattern as noted in the Contract Drawings.
   b. 4 inches x 16 inches x 48 inches. Locations and installation pattern as noted in the Contract Drawings

B. Mortar: 1:1:6 Portland cement-hydrated lime-sand mix, as specified in Section 04 05 13 – Masonry Mortaring.

C. Wall Ties and Anchorages: as specified in Section 04 05 23 – Masonry Accessories.

D. Joint Sealants and Backer Rods: non-staining type, as specified in Section 07 92 00 – Joint Sealants.

E. Flashing, Vents, and Masonry Accessories: as specified in Section 04 05 23 – Masonry Accessories.

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PART THREE – EXECUTION

3.1 EXAMINATION

A. Verify site conditions are ready to receive work.

B. Inspect materials for fit and finish prior to installation. Do not set unacceptable units.

C. Beginning of installation means acceptance of existing conditions.

3.2 CUTTING MASONRY UNITS

A. Cut masonry units to length with a masonry splitter.

B. Dress split end to match face when exposed in wall.

3.3 WETTING MASONRY UNITS

A. Where the ambient air temperature exceeds 100°F or exceeds 90°F with a wind velocity greater than 8 mph, pre-wet building stone units.

B. Lay wetted units when surface dry.

3.4 COURSING

A. Place masonry to lines and levels indicated.

B. Maintain masonry courses to uniform width. Make vertical and horizontal joints equal and of uniform thickness.

C. Lay building stone units in random bond pattern, to the following percentage ratio, described from smallest to largest sized units: 40:40:20.

D. Maintain mortar joint thickness of 3/8 inch.

E. Tool mortar joints by compacting the surface when thumbprint hard, to a concave finish.

3.5 PLACING AND BONDING

A. Lay masonry in full bed of mortar, properly jointed with other work. Buttering corners of joints, and deep or excessive furrowing of mortar joints are not permitted.

B. Fully bond intersections, and external corners.

C. Do not adjust masonry units after laying. Where resetting of masonry is required, remove, clean units and reset in new mortar.

D. Install lintels as scheduled.

E. Install wall ties and anchorages as specified in Section 04 05 23.

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F. Install flashings, vents, and masonry accessories as specified in Section 04 05 23.

3.6 SITE TOLERANCES

A. Erect masonry within the tolerances described in TMS 602, PART 3.3F.

3.7 FIELD QUALITY CONTROL

A. Architectural Inspection: Architect will inspect installed masonry and reject masonry that is chipped, cracked, or blemished (streaked, stained or otherwise damaged), as described below.

1. Masonry will be inspected to be free of cracks or other blemishes on the finished face or front edges of the masonry units exceeding 3/8 inch or that can be seen from a distance of 20 feet.
2. Units shall exhibit a texture approximately equal to the approved sample when viewed under diffused daylight illumination at a 20 foot distance.
3. Minor chipping resulting from shipment and delivery shall not be grounds for rejection. Minor chips shall not be obvious under diffused daylight illumination from a 20 foot distance.
4. Efflorescence will not be cause for rejection.
5. Make good rejected masonry as directed by Architect.

3.8 ADJUSTING AND CLEANING

A. Clean masonry units as specified in Section 04 01 20.

3.9 PROTECTION

A. Protect units from damage resulting from subsequent construction operations.

B. Use protection materials and methods which will not stain or damage units.

C. Remove protection materials upon Substantial Performance of the Work, or when risk of damage is no longer present.

END OF SECTION

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Section 05 12 00

STRUCTURAL STEEL

PART ONE - GENERAL

1.1 GENERAL CONDITIONS

All work under this section is subject to the General Conditions and Supplementary General Conditions and shall be governed by the requirements therein.

1.2 SCOPE

This section shall include the furnishing and erection of all structural steel. No structural steel members shall be cut or altered by any of the trades, without written permission from the Architect.

1.3 DISCRETIONARY STEEL ALLOWANCE

This contractor shall provide a cash allowance of $15,000 for fabrication, re-fabrication and erection of steel. This is to be used at the discretion of the Architect and only with the Architect's written approval. This steel is not for Miscellaneous or Structural Steel detailed on plans. If any portion of this allowance is not used, the cost of which will be refunded to the Owner.

1.4 VERIFY DIMENSIONS

General Contractor shall field verify existing dimensions prior to fabrication of structural steel.

1.5 SHOP DRAWINGS

Steel fabricator shall submit one hard copy (not to be returned) and one electronic copy in PDF format as per Section 01 33 23 of detailed and checked shop drawings for approval by the Architect. All drawings shall clearly show location and sizes of all material, all building dimensions and elevations pertinent to the structure, and any other miscellaneous technical and erection data required for approval and construction. These shop drawings must be approved by the Architect before fabrication and shipment. PARTIAL SUBMITTALS WILL NOT BE ACCEPTED UNLESS APPROVED IN ADVANCE WITH THE ARCHITECT.

1.6 INSPECTION OF FABRICATORS

A. Approved fabricators are not required to have special inspections as required by Section 1704.2.5 of the IBC 2021 code.

B. Fabricators that are in good standing members of AISC are considered approved. Other fabricators not members of AISC shall submit the fabricator's written procedural and quality control manual and periodic auditing of fabrication practices to an approved special inspection agency for review prior the start of fabrication. This shall be at the fabricator's expense.

C. Approved fabricators shall submit a certification of compliance found in Section 01 45 33 "Special Inspections" to the building official at the completion of fabrication.

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D. All fabricators that are not approved shall undergo special inspection as required by Section 1704.2.5 of the IBC 2021.

PART TWO - MATERIALS

2.1 STRUCTURAL STEEL SHALL CONFORM TO THE FOLLOWING:

A. Wide flange shapes and WT sections: High-Strength, Low-alloy, Columbium-Vanadium Steels of Structural Quality, ASTM A 992 Fy=50 ksi.

B. Angles, round bars, and channels: Specifications for Structural Steel, ASTM A572, Fy=50 ksi.

C. Plates less than ½" thick: ASTM A36, Fy=36 ksi.

D. Bars and Plates ½" Thick and Greater: ASTM A-572, Fy=50 ksi.

E. Steel pipe: Specification for Hot-Formed Welded Seamless Carbon Steel Structural Tubing, ASTM A500 Grade C (Fy = 46ksi).

F. Steel tubing: Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes ASTM A500 Grade C (Fy = 50 ksi).

2.2 FASTENERS SHALL CONFORM TO THE FOLLOWING:

A. Arc-welding electrodes: American Welding Society "Specifications for Iron and Steel Arc-Welding Electrodes", latest addition, Type E70XX

B. Bolts

1. Bolts for wood blocking: Specification for Carbon Steel Externally and Internally Threaded Standard Fasteners, ASTM A307.
2. Bolts for main structural connections or bolts not otherwise specified:
   a. Specification for High Strength Bolts for Structural Steel Joints Including Suitable Nuts and Plain Hardened Washers, ASTM A325 Type N. Include suitable nuts and plain hardened washers, or
   b. Standard Specification Twist Off Type Tension Control Structural Bolt/Nut/Washer Assembly ASTM F-1852-08. 120/105 Min. tensile strength.
3. Anchor Bolts: ASTM A307. Minimum washer size & thickness per Table 14-2 of the Fourteenth Edition of the AISC Manual.

C. Sleeve Anchors in Masonry: Federal Specifications A-A-1922A.

D. Expansion Anchors in Concrete and Grouted CMU:

1. In concrete: ICC-ES AC193. Acceptable anchors are Hilti KWIK Bolt-TZ2 (ICC-ESR-4266) or Simpson Strong-Bolt 2 (ICC-ES ESR-3037) or Powers Power-Stud+SD2 (ICC-ES-ESR 2502) or Powers Power Stud+SD1 (ICC-ES-ESR 2818)
2. In Solid Grouted Concrete Masonry Units: ICC-ES AC01. Acceptable anchors are Hilti KWIK Bolt 1 (IAPMO ER-677) or Simpson Strong-Bolt 2 (IAPMO-ES ER240) or Dewalt Power –Stud+SD1(ICC-ES-ESR 2966)

E. Screw Anchors in Concrete, Grouted CMU, and Hollow CMU:

1. In concrete: ICC-ES AC193. Acceptable anchors are Hilti KWIK HUS-EZ and KWIK HUS-EZ I (ICC-ESR-3027), Hilti KWIK-X Dual Action Anchor (ICC-ESR-5065), Simpson Titen HD and Titen HD Rod hanger (ICC-ESR-2713), or DEWALT SCREW BOLT+ (ICC-ES-ESR 3889).
2. In Solid Grouted Concrete masonry Units: ICC-ES AC106. Acceptable anchors are Hilti KWIK HUS-EZ (ICC-ESR-3056), Simpson Titen HD (ICC-ESR-1056), or DEWALT SCREW BOLT+ (ICC-ES-ESR 4042)
3. In Hollow Concrete Masonry Units: Acceptable anchors are Hilti KWIK-CON+ or Simpson Titen HD (ICC ES ESR 1056).

F. Adhesive Anchors:

1. In Unreinforced Masonry Units: ICC-ES AC60. Acceptable adhesives are Hilti HIT-HY 270 (ICC-ESR-4144), Simpson ET-HP (ICC-ES ESR-3638), Simpson AT (ICC-ES ESR-1958), or DEWALT AC100+GOLD (ICC-ES-4105). Steel anchor element shall be Hilti HAS-V-36 or ASTM F1554 Grade 36 continuously threaded rod.
2. In Concrete Masonry Units: ICC-ES AC58. Acceptable adhesives are Hilti HIT-HY 270 (ICC-ESR-4143), Simpson SET-XP (IAPMO UES-ER 265), Simpson AT-XP (IAPMO UES-ER 281), DEWALT AC100+GOLD (ICC-ES-ESR 3200), or approved equal. For unreinforced masonry units, use Plastic Mesh Screen Tube per Manufacturer recommendations. Steel anchor element shall be Hilti HAS-V-36, ASTM F1554 Grade 36, or ASTM A193, Grade B6, B8, or B8M continuously threaded rod.
3. In concrete: ICC-ES AC308. Acceptable anchors are Hilti HIT-HY 200 V3 fast cure (ICC-ESR-4868), Hilti HIT-RE 500 V3 slow cure (ICC-ESR-3814), Simpson SET-3G (ICC-ESR-4057), Simpson AT-XP (IAPMO UES-ER263), DEWALT Pure 220+, EPOXY SYSTEM Standard Cure – (ICC-ES-ESR 5144), DEWALT AC 200+, ACRYLIC SYSTEM fast cure – (ICC-ES ESR 4027) (Use with DEWALT Dust X system with Hollow drill bit for OSHA compliance), or approved equal. Steel anchor element shall be Hilti HAS-V-36, ASTM F1554 Grade 36, or ASTM A193, Grade B6, B8, or B8M continuously threaded rod. Store all anchoring products in strict accordance with manufacturer's recommendations.

G. Undercut Anchors:

1. In Concrete: ICC-ES AC193. Acceptable anchors are Hilti HDA (ICC-ESR-1546), Simpson Torq-cut (ICC-ESR-2705), or DEWALT CCU+ Undercut anchor (ICC-ES-ESR-4810).

2.3 CONNECTOR SHALL CONFORM TO THE FOLLOWING:

A. Headed Stud Shear Connectors: ASTM A108, Fy=51ksi, Fu=65 ksi minimum ultimate tensile strength. Studs shall be solid fluxed attached with appropriate stud gun capable of meeting the strengths set forth in Table 1.11.4 AISC Specification.

B. Headed Concrete Anchors: ASTM A108, Fy=49 ksi, Fu=65ksi minimum ultimate tensile strength.

C. Threaded Studs: ASTM A108, Fy=49ksi, Fu=61 ksi minimum ultimate tensile strength.

2.4 MECHANICAL EQUIPMENT FRAMES

All mechanical equipment frames or miscellaneous steel required to complete the mechanical equipment installation shall be provided and detailed by the structural steel fabricator. The mechanical equipment contractor shall provide all necessary weights and dimensions to the structural steel fabricator. Shop drawings for mechanical and equipment frames must be submitted and accepted by the Architect.

2.5 FABRICATION

A. Workmanship and fabrication shall be in accordance with AISC "Specification, Design, Fabrication and Erection of Structural Steel for Buildings" and with the following outline.

B. Welding shall be in accordance with the "Standard Code for Arc Welding in Building Construction" of the American Welding Society.

C. All structural steel shall be kept free of mud and dirt. Any dirty or muddy steel shall be washed clean.

D. Bearing surfaces shall be planed to true beds. Abutting surfaces shall be closely fitted.

E. All columns and bearing stiffeners shall be milled to give full bearing over the cross section. Column base plates 2” or less in thickness may be used without planing. It will not be necessary to plane bottom surfaces of plates or grout beds.

F. There shall be no splices (shop or field, bolted or welded) along structural steel members other than at locations shown on plans.

G. This Contractor shall be responsible for design and fabrication of all "simple framed" member connections unless detailed on plans. "Rigid framed" connections shall be fabricated as detailed on plans. Design and fabrication of connections shall meet the requirements of AISC Specifications.

H. Bolted connections shall meet AISC Specification for Structural Joints using ASTM A325 Type N; UNO on plans.

I. Fascia girders and other steel requiring accurate alignment shall be provided with slotted holes and/or washers for aligning the steel accurately.

2.6 PAINTING

A. Deliver paint to shop and job in original sealed containers clearly marked with the manufacturer's name and identifying brand number or name. Use paint as prepared by the manufacturer without thinning or other admixture.

B. All structural steel shall be shop painted as follows:

1. Apply one coat of standard oxide primer (DFT = 3mil) to all surfaces of steel work.
2. Do not apply shop paint within 2" of surfaces to be field welded.
3. Do not apply shop paint to steel to be fire-proofed.
4. Exposed steel shall not have piece marks applied with bleed through type markers.

PART THREE - EXECUTION

3.1 ERECTION

A. Erection shall include the setting of all columns and bases and erection of all structural steel as called for under the contract for furnishing and delivery of structural steel, but shall not include the setting of loose lintels (to be set by mason).

B. Set column bases and beam plates 12” x 12” and larger to accurate elevations approximately 1” clear of masonry on steel wedges and/or bolts as indicated on drawings. These will be grouted by the mason who will also set small beam plates. Wooden wedges shall not be used. Set anchor bolts to be concreted in by the mason.

C. See the drawings and general notes for field connections.

D. Field errors shall not be corrected by burning except with the permission of the Architect.

E. Brace and guy all structural members until all connections are made.

F. After erection, touch up all injuries to priming coat and all others where field welding is done. Bolt heads and nuts shall be touched up in field. Use same material as specified for shop coat.

3.2 WELDING

A. Welding in shop and field shall be done by operators who have been previously qualified by tests as prescribed in the American Welding Society, "Standard Qualification Procedure." All operators must have successfully passed the welding qualification tests within a 24-month period preceding erection. The Architect shall be provided a copy of the welding qualification test for each operator at no additional cost to the Owner.

B. Equipment to be of a type which will produce proper current so that operator may produce satisfactory welds. Welding machine shall be of 200-400 ampere, 25-40 volt capacity.

C. Electrodes shall be suitable for positions and other conditions of intended use in accordance with the instructions with each container.

D. Field welding shall be done by direct current.

E. Technique of welding employed, the appearance and quality of welds made and methods of correcting defective work shall conform to American Welding Society "Code for Arc Welding in Building Construction", Section 4, "Workmanship".

F. Surfaces to be welded shall be free from loose scale, rust, grease, paint and other foreign material except that mill scale withstanding vigorous wire brushing may remain. A light film of linseed oil may likewise be disregarded. Joint surfaces shall be free from fins and tears.

G. No welding shall be performed when temperature of the base metal is lower than 0 degrees F. At temperatures between 32 degrees F. and 0 degrees F., the surfaces of all areas within 3” of a point where a weld is started shall be heated until they are too hot to touch before welding is started.

H. Finished members shall be true to line and free from twists, bends, and open joints.

3.3 QUALITY CONTROL OF WELDING

A. All testing and visual inspection of welds shall be performed by a qualified welding inspector certified in accordance with the "American Welding Society (AWS) and the "American Society of Non-Destructive Testing (ASNT)".

B. Proper fit up and alignment of members shall be in accordance with AWS before welding is performed.

C. Visual Inspection

1. All field and shop full penetration welds specified in the contract documents shall be visually inspected. Welds not passing visual inspections shall be tested and included as part of percentage of welds required to be tested. If the amount of welds not passing visual inspection exceeds the percentage associated with the testing requirements, the contractor shall pay for the testing of welds exceeding the required percentage.
2. All fillet welds used in field connections of vertical lateral braces shall be visually inspected. Welds not passing inspection due to defects shall be tested and/or repaired at no cost to the owner. Welds not passing inspection due to inadequate size and length shall be repaired as required.

D. Testing Procedures

1. Full penetration welds: Radiographic, ASTM E94 or ultrasonic, ASTM E164 testing.
2. Fillet welds: Magnetic Particle testing
3. Headed Shear Studs: AS per AWS D1.1 Section 7

E. Testing Requirements

	Item Tested	Percentage Tested
1.	Fillet welds for field beam to column connections.	20%
2.	Fillet welds for field beam to beam connections.	20%
3.	Headed Stud Connections	100%

F. Assurances

1. Welds not passing the testing procedures shall be cut out, replaced and retested at no additional cost to the owner.
2. If 20% or more of fillet welds tested for field beam and column connections fail testing procedures, an additional 20% of welds shall be tested at no cost to the owner. If 20% of these tests fail, all beam to column connections shall be tested.
3. If 20% or more of fillet welds tested for field beam to beam connections fail testing procedures, an additional 20% of welds shall be tested at no cost to the owner. If 20% of these tests fail, all beam to beam connections shall be tested.
4. All headed shear stud connections not passing testing shall be replaced and retested at no cost to the owner.

3.4 TESTS

A. Laboratory tests. Methods of testing shall be according to the following:

STRUCTURAL STEEL- ASTM A572. Two tension tests from each melt. Two bend tests from each melt.
STEEL ELECTRODES – ASTM A-233. As directed.

B. Shop and Field Tests. All field and shop welders shall be tested and certified by an approved testing laboratory. The American Welding Society Operator Qualification test shall be used as a basis of qualification.

All field and shop operators shall qualify for the following:

Type of Weld	Position of Welding
Groove	Horizontal
Groove	Vertical
Groove	Overhead
Fillet	Vertical
Fillet	Overhead

C. The Architect's Representative may require strap cuts from welds in any supporting member to withstand nick-break test. If strap fails to meet requirements, Contractor shall replace strap cut from member at no charge to Owner. If strap does meet requirements, the Architect shall pay expenses of having metal replaced. In event strap fails, the welder shall be discharged.

3.5 OBSERVATION

The work shall be observed in the shop and the field. The Contractor shall give proper notice and allow full facilities for this observation. Notify Architect 48 hours prior to shipping structural steel.

END OF SECTION

PART ONE - GENERAL

1.1 SECTION INCLUDES

A. Applicable requirements of Condition of Contract and General Requirements apply to Work specified in this section.

B. Work included:

1. Provide steel roof deck.

C. Related work specified elsewhere:

1. Structural Steel: Section 05 12 00
2. Metal Fabrications: Section 05 50 00 (Bearing plates and angles).
3. Metal Building Systems: Section 13 34 19

1.2 QUALITY ASSURANCE

A. Metal deck shall be designed in accordance with the latest edition of the Steel Deck Institute's (SDI) - "Specifications and Commentary for Steel Roof Deck."

B. The roof deck shall be designed, manufactured and installed to meet Factory Mutual Class I construction.

1.3 REFERENCE STANDARDS

A. AISI - "Specification for the Design of Cold-Formed Steel Structural Members."

B. ASTM A572 - Structural Steel.

C. ASTM A924-94 - Steel Sheet, Zinc-Coated, Galvanized coating process by the Hot-Dip Process.

D. ASTM 653-94 steel, cold-formed sheet, carbon, structural quality.

E. ASTM A611 - Steel, Cold-Rolled Sheet, Carbon, Structural.

F. AWS D1.1 - Structural Welding Code.

G. AWS D1.3 - Specification for Welding Sheet Steel in Structures.

H. SDI - "Design Manual for Composite Decks, Form Decks and Roof Decks."

I. AISC - Manual of Steel Construction.

J. SDI - Diaphragm Design Manual.

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1.4 SUBMITTALS

A. Decking fabricator shall submit one hard copy (not to be returned) and one electronic copy in PDF format as per Section 01 33 23 of checked shop drawings to the architect for review of general conformance to the design concept Erection Drawings shall show type of deck, shop finish, accessories, method of attaching, edge details, deck openings and reinforcement, and sequence of installation.

1.5 STORAGE

A. Store materials off ground with one end elevated on wood sleepers to provide drainage. Protect deck from elements with a waterproof covering and ventilate to avoid condensation.

PART TWO - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Vulcraft A Division of Nucor Corporation.
United Steel Deck, Inc. Summit, N.J.
New Millennium Steel Deck

2.2 MATERIALS

A. Sheet steel shall conform to ASTM A611 Grade C, D or E (for prime painted decks) and ASTM A653-94, structural quality (for galvanized decks) and have a minimum yield strength of 33,000 PSI.

B. Bearing Plates and/or Angles shall be ASTM A572 steel.

C. Welding Methods and Materials shall conform to AWS D1.1 and AWS D1.3.

D. Steel Closure Strips, Ridge and Valley Plates, and Related Accessories shall be a minimum of 22 gage sheet steel of required profiles and sizes.

E. Finish:
Shop Primer shall be acrylic medium gray.
Touch-up primer shall be compatible with manufacturer's primer.

F. Mechanical fasteners shall be Teks as manufactured by Builds, St. Charles Road, Elgin, Illinois, 60120. Selection of Teks fasteners not specified herein shall be in accordance with the manufacturer's recommendations.

2.3 FABRICATION

A. Steel deck shall have formed ribs of the type, finish, dimension and gage as shown on Drawings.

B. Fabricate deck in lengths to have three continuous spans or more whenever possible. Fabricate sheets to lap a minimum of 2" over supports at ends. Lap joints required where roof pitch changes due to the deck support elevations.

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C. Design steel decking in accordance with SDI "Design Manual for Composite Decks, Form Decks, and Roof Decks." The maximum working stress shall not exceed 20,000 PSI. The maximum working stress shall in no case exceed the maximum yield strength of the steel divided by 1.65. The deflection of the Deck under design live load shall not exceed L/240 of the span. Minimum thickness of material supplied shall be within 5% of the design thickness.

D. Section properties used in determining stress and deflection shall be calculated in accordance with the latest edition of the Steel Deck Institute's "Design Manual for Floor Decks and Roof Decks."

E. Provide fabricated roof sump pan of 14 gage sheet steel, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, watertight. Typical at all roof drains.

F. Provide 6" closure strip where changes in deck direction occur. Closure shall be same gauge as deck.

PART THREE - EXECUTION

3.1 INSTALLATION

A. On steel support members provide 1-1/2" minimum bearing. Align and level on supports.

B. Fasten steel deck units to structural supports using Hex washer head Teks or spot welds according to manufacturers' specifications and direction layouts and as specified herein. Decks thinner than .0280 inches shall be welded using 16 ga. welding washers with a 3/8" diameter hole. Side lap connections shall be screwed.

C. Attach ridge and valley plates and steel cant strips directly to the steel deck where shown on the Drawings to provide a finished surface for the application of insulation and roofing.

D. Cutting of openings through the deck less than 16 square feet in area, and all skew cutting shall be performed in the field.

E. Arc spot welds (puddle welds) to supports shall have a diameter of 5/8" minimum, or an elongated weld of 3/8" minimum width and 3/4" minimum length. Weld metal shall penetrate all layers of deck material at end laps and have adequate fusion to the supporting members. Welding shall be done in accordance with the American Welding Society Standard "Specification for Welding Sheet Steel in Structures", AWS D1.3.

F. Fastening of deck to supports and side laps.

1. Deck ends at building perimeter: 6" o/c
2. Deck end laps: 6" o/c (min.)
3. Deck sides at building perimeter and deck side laps: Deck units with spans greater than five feet shall be fastened at mid-span or at 36" intervals whichever is smaller.
4. See drawings for requirements beyond these minimum requirements.

G. At ends of decks or where changes of deck direction occur, fasten at each flute. Furnish and install adequate closures and fasten to both sides at 18" o.c.

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H. Accessories shall be fastened to supports or deck with mechanical fasteners at not over 6" o.c. and at all corners and ends.

I. Position roof sump pans with flange bearing on top surface of deck. Screw at each deck flute.

3.2 CLEAN UP AND FINAL ADJUSTMENTS

A. Touch up surface coating damage and abrasions using a paint compatible with primer paint and/or specially formulated for use with galvanized steel.

B. Installation holes shall be sealed with a closure plate 2 gauges thicker than deck and mechanically fastened to deck. Steel deck with holes visible from below will be rejected. Deck units that are bent, warped, or damaged in any way which would impair the strength and appearance of the deck shall be removed from site.

C. Steel decking work and accessories, when complete, shall be solid, smooth, and uniform in appearance.

D. Remove any unused steel deck, edge trimmings, screws, weld washers, butt ends of welding electrodes and other debris from completed installation.

END OF SECTION

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Section 05 36 00

COMPOSITE STEEL DECK

PART ONE - GENERAL

1.1 SECTION INCLUDES

A. Applicable requirements of Conditions of Contract and General Requirements apply to Work specified in this section.

B. Work included:

1. Provide composite steel deck and accessories for forming of concrete floors.

C. Related work specified elsewhere:

1. Cast-In-Place Concrete: Section 03 31 00
2. Concrete Reinforcement: Section 03 20 00
3. Concrete Formwork: Section 03 11 00
4. Structural Steel: Section 05 12 00
5. Metal Fabrications: Section 05 50 00 (Bearing plates and angles).

1.2 QUALITY ASSURANCE

A. Composite steel deck shall be designed in accordance with the latest edition of the Steel Deck Institute's (SDI) "Specifications and Commentary for Composite Steel Floor Deck."

1.3 REFERENCE STANDARDS

A. AISI - "Specification for the Design of Cold-Formed Steel Structural Members."

B. ASTM A653-94 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.

C. ASTM A525 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

D. AWS D1.1 - Structural Welding Code.

E. AWS D1.3 - Specification for Welding Sheet Steel in Structures.

F. SDI - "Design Manual for Composite Decks, Form Decks, Roof Decks."

G. AISC - "Manual of Steel Construction."

H. ASCE - "Specifications for the Design and Construction of Composite Slabs and Commentary on Specifications for the Design and Construction of Composite Slabs."

I. SDI - Diaphragm Design Manual.

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1.4 SUBMITTALS

A. Decking fabricator shall submit one hard copy (not to be returned) and one electronic copy in PDF format as per Section 01 33 23 of checked shop drawings to the architect for review of general conformance to the design concept. Shop Drawings shall show type of deck, shop finish, accessories, method of attaching, edge details, deck openings and reinforcement, and sequence of installation.

1.5 STORAGE

A. Store materials off ground with one end elevated on wood sleepers to provide drainage. Protect deck from elements with a waterproof covering and ventilate to avoid condensation.

PART TWO - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Vulcraft A Division of Nucor Corporation.

2.2 MATERIALS

A. Composite steel floor deck shall be fabricated from steel sheet conforming to ASTM A611 Grades C and D or A653-94 (or equal) having a minimum yield strength of 50 KSI.

B. Bearing Plate and/or Angles refer to Section 05 50 00.

C. Welding Methods and Materials shall conform to AWS D1.1 and AWS D1.3.

D. Steel Closure Strips, Wet Concrete Stops, Multiple Cell Headers, Cover Plates and Related Accessories shall be a minimum of 22 gage sheet steel of required profiles and sizes.

E. Finish:

1. The finish, as shown on the plans, is to be:
    a. Galvanizing shall conform to the requirements of ASTM A653-94 coating class G60.
    b. Phosphatized and painted over cleaned steel with the exposed side only painted. The side in contact with the concrete is to be phosphatized only. Paint is to be a baked-on acrylic primer.
    c. If fireproofing is to be applied the paint shall be compatible with fireproofing materials.
    d. Touch-up primer shall be compatible with manufacturer's primer.

F. Mechanical fasteners shall be Teks as manufactured by Buildex, St. Charles Road, Elgin Illinois, 60120. Selection of Teks fasteners not specified herein shall be in accordance with the manufacturer's recommendations.

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G. The deck manufacturer shall have performed or have witnessed by a Registered Engineer, a sufficient number of tests on the composite deck/slab system to have determined load/deflection characteristics and the mode of failure under uniform or symmetrically placed point loads. Based on the test data the design load capacity shall be established by either elastic flexural analysis or ultimate strength analysis based on shear bond failure or flexural failure.

2.3 FABRICATION

A. Steel Deck shall have formed ribs of the type, finish, dimension and gage shown on Drawings.

B. The Composite Steel deck units shall serve as a form, total positive reinforcement, and partial temperature reinforcement for the concrete slab.

C. Deck shall be capable of supporting uniform design loads as indicated on the Drawings. Structural capacity of deck sections shall be established from section properties computed in strict accordance with the latest edition of the "Steel Deck Institute Design Manual". The maximum working stress shall not exceed the yield strength divided by 1.65. Minimum thickness of material supplied shall be within 5% of design thickness. The deflection of the deck under design live load shall not exceed 1/360 of the span.

D. Fabricate deck in lengths to have three continuous spans or more whenever possible. Fabricate Deck to butt ends allowing for a maximum of 1/8" gap.

E. Bearing lengths shall be established in accordance with the latest edition of the Steel Deck Institute's "Design Manual for Composite Decks, Form Decks and Roof Decks and shall be consistent with the deck capacity established in paragraph 2.3.4.

PART THREE - EXECUTION

3.1 INSTALLATION

A. Deck and accessories shall be installed in accordance with the manufacturer's shop and erection drawings. Minimum bearing shall not be less than 1-1/2 inches.

B. Fasten steel deck units to structural supports using Hex washer head Teks or arc spot welds according to manufacturer's specifications and erection layouts and as specified herein. Side lap connections shall be screwed or button punched depending on deck profile.

C. Level and align cellular deck intended for electrical raceways and mechanical piping within 1/8 inch horizontally and vertically. Butt ends, allow for maximum 1/8 inch gap. Install sheet steel covers over gaps wider than 1/8 inch. Tape seal joints watertight.

D. Arc spot welds (puddle welds) to support shall have a diameter (weld nugget) of 5/8" minimum. Weld metal shall penetrate all layers of deck material at end laps and have adequate fusion to the supporting members. Welding shall be done in accordance with the American Welding Society Standard "Specification for Welding Sheet Steel in Structures", AWS D1.3.

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E. Fastening of deck to supports and side laps.

1. Deck ends at building perimeter: 12" o/c (36/4 min.)
2. Deck end laps: 12" o/c (36/4 min.)
3. Deck sides at building perimeter and deck side laps: Deck units with spans greater than five feet shall be fastened at midspan or at 36" intervals whichever is smaller.
4. See drawings for requirements beyond these minimum requirements.

F. At ends of decks or where changes of deck direction occur, fasten at 18" o.c. Furnish and install adequate closures and fasten to both sides at 18" o.c.

G. Cutting of openings through the deck less than 16 square feet in area, and all skew cutting shall be performed in the field.

H. Install sheet steel strip closures at all floor edge upturned to thickness of slab to contain wet concrete. Provide closures of sufficient strength to remain in place during concrete placement without distortion.

I. Install sheet closures and angles flashing to close openings between deck and walls, columns, and openings.

J. Accessories shall be fastened to supports or deck with mechanical fasteners per manufacturer's recommendations.

3.2 CONSTRUCTION LOADS

A. Composite steel floor deck units shall serve as a form to support the slab weight and construction loading of 20 psf uniform load.

B. If heavier construction loads are required, allowable unshored spans shall be reduced accordingly by installation of temporary shoring.

C. When required, composite steel floor deck units shall be temporarily shored in accordance with the deck manufacturers Shoring Tables. Shoring shall be designed in accordance with applicable local and state building code regulations. Shoring shall remain in place until the concrete flooring attains a minimum of 75% of the concrete design compressive strength and removal is subject to the approval of the Engineer.

D. Concentrated loads and impact loads during erection and construction shall be avoided. Before the slab is poured, form deck shall be planked in all areas to prevent damage to units.

3.3 CLEAN UP AND FINAL ADJUSTMENTS

A. Touch up surface coating damage and abrasions using a paint specially formulated for use with galvanized steel. For painted deck use paint compatible with manufacturer's primer.

B. Installation holes shall be sealed with a closure plate 2 gages thicker than deck and mechanically fastened to deck. Steel deck with holes visible from below will be rejected or sealed. Deck units that are bent, warped, or damaged which would impair the strength and appearance of the deck shall be removed from site.

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C. Steel decking work and accessories, when complete, shall be solid, smooth, and uniform in appearance.

D. Remove any unused steel deck, edge trimmings, screws, weld washers, butt ends of welding electrodes, and other debris from completed installation.

END OF SECTION

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Section 05 41 00

LIGHTGAGE METAL FRAMING

PART ONE - GENERAL

1.1 SCOPE

Provide design, fabrication, erection, and connections of all structural lightgage studs shown on the Contract Drawings and specified herein.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS:

Structural Steel: Section 05 12 00
Gypsum Wallboard: Section 09 21 00

1.3 QUALITY ASSURANCE

A. Qualifications of manufacturer: products used in the work of this section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable by the Architect.

B. Design of the structural lightgage studs, joists,connections and accessories shall be provided by the lightgage metal stud manufacture. The design shall be performed by a Registered Professional Engineer licensed in the State of Arkansas. The design shall meet the requirements of the wind and seismic loadings shown on plan or provided herein. Refer to drawings for additional requirements.

C. Inspection and Quality Control;

1. Contractor shall provide effective full time quality control over all fabrication and erection activities.
2. As directed by Architect, owner's testing agency may inspect the maintenance of a quality control program including spot checking weldments and welding procedures in accordance with A.W.S. standards.
3. Inspection responsibility for quality control shall remain with contractor.

D. Standards

1. Work shall meet the requirements of the following standards.
   a. American Iron and Steel Institute (A.I.S.I.) "Design of Cold Formed Steel Structural Members," 1986 with 1989 amendments.
   b. American Welding Society (A.W.S.) D.1.3, 1981 "Structural Welding Code-Sheet Steel".
   c. American Society for Testing and Materials (A.S.T.M.)
   d. American Institute of Steel Construction (A.I.S.C.) "Manual of Steel Construction," 9th edition.
   e. 2021 International Building Code with Arkansas Amendments.

2. The most stringent requirements shall govern in conflicts between specified codes and standards.

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1.4 SUBMITTALS General: Submit one hard copy (not to be returned) and one electronic copy in PDF format as per Section 01 33 23 of the design calculations, fabrication and erection shop drawings and product data to the architect for approval.

A. Product Data: Submit copy of installation instructions for each item of lightgage framing and accessories.

B. Shop Drawings: Drawings shall show framing member indicating size and gage designations, number, type, location and spacing. Indicate supplemental bracing, accessories, and details as may be required for proper installation.

C. Design calculations and shop drawings shall be submitted with the Engineer's seal and signature.

1.5 PRODUCT DELIVERY AND STORAGE:

A. Protect metal framing units from rusting and damage. Deliver to the project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type, location and spacing. Indicate supplemental bracing, accessories, and details as may be required for proper installation.

PART TWO - PRODUCTS

2.1 MANUFACTURERS: Clark, Dietrich Building Systems, Marino, or approved equal.

2.2 METAL FRAMING

A. Systems Components: With each type of metal framing required, provide manufacturer's standard steel runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories as indicated and as recommended by manufacturer for applications indicated, as needed to provide a complete metal framing system.

B. Material and Finishes

1. All galvanized studs and joists shall be formed from steel that corresponds to the minimum requirements of 1986 A.I.S.I. standards with 1989 amendments.
2. All galvanized studs, joists, track, bridging and accessories shall be formed from steel having a galvanized coating meeting the requirements of ASTM A653.
3. Structural studs, joists, track, shall be color coded for appropriate material thickness. A sign shall be posted adjacent to material stockpile clearly depicting which color corresponds to the material thickness. All studs, joists, track, etc. shall be stamped by manufacturer with size.
4. Lightgage framing materials 54 mil. (16 gage) and thicker shall have a yield stress Fy=50 ksi. All lightgage framing materials 43 mil. (18 gage) and lighter shall have a yield stress Fy=33 ksi.
5. Minimum stud thickness for exterior walls, 43 mil.
6. Track sizes gage to match stud sizes and gage.
7. Structural lightgage members shown on drawings are called out based on industry standard nomenclature.
8. Fasteners: Provide nuts, bolts, washers, screws, and other fasteners with corrosion-resistant plated finish.
9. Electrodes for welding: Comply with AWS Code and as recommended by stud

manufacturer.

10. Galvanizing Repair: Where galvanized surfaces are damaged, prepare surfaces and repair in accordance with procedures specified in ASTM A 780.

C. Deflection Connections shall be as required by criteria noted on the drawings.

2.3 FABRICATION

A. General

1. Framing components may be prefabricated into panels prior to erection. Fabricate panels plumb, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated panels in a manner to prevent damage or distortion in any members in the assembly.
2. Fabricate units in jig templates to hold members in proper alignment and position and to assure consistent component placement.
3. Splices in axially loaded studs shall not be permitted.

B. Fastenings.

1. Attach similar components by self-drilling screws or welding. Attach dissimilar components by welding, bolting, or screw fasteners, as standard with the manufacturer.
2. Wire taping of framing components is not permitted.
3. Welds shall be performed by operators qualified in accordance with section 6.0 of the American Welding Society's "Structural Welding Code-Sheet Metal" (AWS D1.3-81). All welds shall be touched up with zinc rich paint.

C. Fabrication Tolerances:

1. Fabricate units to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8" in 10'.
2. Axially loaded studs shall have full bearing inside track web (1/16" max. gap), prior to stud and track attachment. Studs shall be ordered long and cut in the field. Stud lengths are to be determined using laser equipment.

PART THREE - EXECUTION

3.1 INSTALLATION: Install metal framing systems in accordance with manufacturers printed or written instructions and recommendations, and final shop drawings.

A. Runner tracks: Install continuous tracks sized to match studs. Align tracks accurately to the layout at base and top of studs. Secure tracks as recommended by the stud manufacturer for the type of construction involved, except do not exceed 16" o.c. spacing for nail or power-driven fasteners, nor 12" o.c. for the other types of attachment. Provide fasteners at corners and ends of tracks.

B. Fasteners: (Unless noted otherwise on shop drawings).

1. Light gage metal to light gage metal: Kwik-Pro Self Drilling by Hilti. No 8-18 PPH for 18 gage metal. No. 10-16 PPH for 16 gage, 14 gage and 12 gage. Minimum of two screws per connection.

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2. Light gage metal to steel. Kwik-Pro Self Drilling by Hilti. No. 12-24 HWH. Drill through light gage into steel, 16” o.c. maximum spacing.
3. Light gage to Concrete: DX Powder Actuated Fastener by Hilti. DX Fastener X-DNI Domed Head Nail .145 inch and minimum penetration of 1 1/8 inch. 16” o.c. maximum spacing.
4. Wood to light gage: Minimum of No. 8x1 inch bugle head screws.

C. WALL STUDS: Space studs at maximum16” o.c.

1. Secure studs to top and bottom runner tracks by either welding or screw fastening at both inside and outside flanges.
2. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements. Provide minimum of 10” from end of stud to start of first punchcut at top and bottom.
3. Where stud system abuts structural columns or walls, anchor ends or stiffeners to supporting structure.
4. Install supplementary framing, blocking and bracing in the metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with the stud manufacturer's recommendations and industry standards in each case, considering the weight or loading resulting from the items supported.
5. Frame wall openings larger than 2' square with double stud at each jamb of frame except where more than two are either shown or indicated in manufacturer's instructions. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of wall. Secure studs system wall opening frame in manner indicated.
6. Frame both sides of expansion and control joints, as shown for the wall system, with a separate stud; do not bridge the joint with components of the stud system.
7. Install horizontal bridging of 54 mil. “U” channel in stud system, spaced (vertical distance) at not more than 4 ft o.c.
8. Temporary bracing shall be provided until erection is completed.

D. HEADERS: Locate in elevation and horizontal spacing as shown on plans.

1. Punchouts in webs of joists and headers shall be placed a minimum of 10” clear from the face of the supporting wall.
2. Provide blocking and strapping per drawing.

E. ERECTION TOLERANCES:

1. Bolt or weld wall panels (at both horizontal and vertical junctures) to produce flush, even, true-to-line joints.
2. Maximum variation in plane and true position between prefabricated assemblies should not exceed 1/16".

3.2 FIELD PAINTING: Touch-up shop-applied protective coating damaged during handling and installation. Use galvanizing repair paint for galvanized surfaces.

END OF SECTION

Section 05 50 00

METAL FABRICATIONS

PART ONE - GENERAL

1.1 SCOPE

1.1.1 Work included: Provide miscellaneous metal work, complete, including:

a. Pipe railings and handrails.
b. Steel supports for work of other trades.
c. Miscellaneous metal steel attachments, anchors, plates, angles, etc.
d. Anchors, angles, bolts, expansion shields for items in this section only, and other accessories shown in details and/or required for the complete installation of all work.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

Cast-in-Place Concrete Section 03 31 00

1.3 SUBMITTALS

1.3.1 Comply with provisions of Section 01 33 23.

1.3.2 Product Data: Submit for products used in miscellaneous metal fabrications, including paint products and grout.

1.3.3 Shop drawings: Submit shop drawings for the fabrication and erection of all assemblies of miscellaneous metal work. Include plans, elevations, sections, and details of fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other sections.

1.4 PROJECT CONDITIONS

1.4.1 Field Measurements:

a. Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.
b. Where field measurements cannot be made without delaying work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

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PART TWO - PRODUCTS

2.1 MATERIALS

2.1.1 Metal surfaces, general: For metal fabrications exposed to view upon completion of work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, and roughness.

a. Miscellaneous Steel Bars, Rods and Shapes: ASTM A36, A283, A108, A663, A501, and A575, as applicable.
b. Pipe: ASTM A53 black finish steel pipe, standard weight (Schedule 40).
c. Bolts and Nuts: ASTM A307, Grade A. High strength bolts: ASTM A 325. Hot-dip galvanize all items in accordance with ASTM A 153.
d. Expansion Bolts Wedge Anchors: Ramset "Trubolt" or Hilti "Kwik Bolt".
e. Adhesive Anchors: Hilti "HVA".
f. Expansion Shields: F.S. FF-S-325.
g. Anchor Bolts: Furnish and deliver to site, anchor bolts and other items to be embedded in concrete. Provide necessary shop details and diagrams for concrete forms and, if required, provide templates to insure proper and accurate locations and setting of anchor bolts.
h. Toggle Bolts: Tumble-wing type F.S. FF-B-588 type, class and style as required.
i. Lock Washers: F.S. FF-W-84, helical spring type carbon steel.
j. Welding Rods and Electrodes: Select in accordance with AWS specifications for metal alloy to be welded.
k. Miscellaneous Items: Furnish bent or otherwise custom fabricated bolts, plates, z-clips, anchors, hangers, dowels and other miscellaneous steel shapes as required for framing and supporting work and for anchoring or securing work to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Section 06 10 00.
l. Shop Paint: Lead free, alkyd primer; Tnemec 10-99, Southern coatings Enviro-Guard 1-2900, or approved equal, meeting performance requirements of F.S. TT-P-86, and passing ASTM B117 after 500 hours. Primer selected must be compatible with finish coats of paint. Coordinate selection of metal primer with finish paint requirements specified in Section 09 91 00.
m. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 except containing no asbestos fibers.
n. Non-shrink Nonmetallic Grout: Master Builders "Masterflow 713", Euclid "Euco N.S. Grout", L&M "Crystex", or U.S. Grout "Five Star Grout", or Sonneborn "Sonogrout", or W.R. Meadows "Sealtight 588 Grout".
o. Expansion Joint Covers as manufactured by Balco, Wichita, Kansas or approved equal.

1. Type GFP plain plate saddle type aluminum cover (4" wide)
2. GC-2 wall/floor cover

2.2 FABRICATIONS, GENERAL

2.2.1 Workmanship: Use materials of size and thickness shown or, if not shown, of required size and thickness to produce strength and durability in finished product. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use type of materials shown or specified for various components of work.

2.2.2 Form exposed work true to line and level with accurate angles and surfaces and straight, sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise shown. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

2.2.3 Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.

2.2.4 Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown, or if not shown, Phillips flat-head (countersunk) screws or bolts. Provide for anchorage of type shown, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use. Cut reinforce, drill and tap miscellaneous metalwork as indicated to receive finish hardware and similar items.

2.2.5 Shop painting:

a. Shop paint miscellaneous metal work, except concealed metal work, members or portion of members to be embedded in concrete or masonry, surfaces and edges to be field welded, and galvanized surfaces, unless otherwise specified.
b. Remove scale, rust and other deleterious materials before applying shop coat. Clean off heavy rust and loose mill scale in accordance with SSPC SP-2 or SSPC SP-3.
c. Remove oil, grease and similar contaminants in accordance with SSPC SP-1.
d. Immediately after surface preparation, brush or spray on primer in accordance with manufacturer's instructions, and at rate to provide uniform dry film thickness of 2.0 mils for each coat. Use painting methods which will result in full coverage of joints, corners, edges, and exposed surfaces.

2.3 MISCELLANEOUS METAL FABRICATIONS

2.3.1 Pipe Railings and Handrails:

a. Fabricate of standard weight steel pipe to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of pipe, post spacings, and anchorage, but not less than that required to support structural loads.
b. Interconnect railing and handrail members of butt-welding or welding with internal connectors.
c. Form changes in direction by insertion of prefabricated elbow fittings, by radius bends, by mitering at elbow bends, or by bending.
d. Provide wall returns at ends of wall-mounted handrails.
e. Close exposed ends of pipe by welding 3/16" thick steel plate in place or by use of prefabricated fittings.
f. Brackets, flanges, fittings, anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnections of pipe and attachment of railings and handrails to other work. Furnish inserts and other anchorage devices for connecting railings and handrails to concrete.
g. Prime as specified in this section.

2.3.2 Steel supports: Provide structural steel lintels, channels, braces, angles, etc. as indicated and assemble as detailed. Secure all connections to provide rigid supports for all items required including supports not specifically specified in other sections.

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2.3.3 Mechanical equipment frames: All mechanical equipment frames or miscellaneous steel required to complete the mechanical equipment installation shall be provided and detailed by the steel fabricator. The mechanical equipment contractor shall provide all necessary weights and dimensions to the steel fabricator.

PART THREE - EXECUTION

3.1 PREPARATION

3.1.1 Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to site.

3.1.2 Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from water and concrete entry.

3.2 INSTALLATION

3.2.1 Fastening to in-place construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications or frames to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

3.2.2 Cutting, fitting, placement: Perform cutting, drilling and fitting required for installation. Set metal fabrication accurately in location, alignment and elevation; with edges and surfaces level, plumb, true, and free of rack; measured from established lines and levels.

3.2.3 Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:

a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
b. Obtain fusion without undercut or overlap.
c. Remove welding flux immediately.
d. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

3.2.4 Setting loose plates:

a. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom of surface of bearing plates.
b. Set loose leveling and bearing plates on wedges, or other adjustable devices. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with edge of bearing plate before packing with grout.

3.2.5 Steel pipe railings and handrails: Set pipe in concrete in non-corrosive pipe sleeves with non-shrink grout or anchor to supports as indicated or required by project conditions. Secure handrails to wall with wall brackets and end fittings.

3.3 TOUCH UP SHOP PAINTING

3.3.1 Immediately after erection, clean field welds, bolted connections and abraded areas of shop paint, and paint exposed areas with same materials as used for shop painting.

END OF SECTION

Section 06 06 00

LUMBER

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide all wood, nails, bolts, screws, framing anchors, and other rough hardware, and all other items needed for rough and finished carpentry in this Work but not specifically described in other Sections of these Specifications.

1.1.2 Related work described elsewhere:

1. Rough Carpentry Section 06 10 00
2. Finish Carpentry Section 06 20 00

1.2 QUALITY ASSURANCE

1.2.1 Standards: Comply with all pertinent codes and regulations, and with the standards listed in this Section or as described by the National Grading Rule as published by the Southern Pine Inspection Bureau.

1.2.2 Conflicting requirements: In the event of conflict between pertinent codes and regulations and the requirements of the referenced standard or these specifications, the provisions of the more stringent shall govern.

1.3 SUBMITTALS

Make all proposals for substitution in strict accordance with the provisions of Section 01 33 23 of these Specifications.

1.4 PRODUCT HANDLING

1.4.1 Protection:

1. Use all means necessary to protect lumber materials before, during, and after delivery to the job site, and to protect the installed work and materials of all other trades.
2. Deliver the materials to the job site and store, all in a safe area, out of the way of traffic, and shored up off the ground surface.
3. Identify all framing lumber as to grades, and store all grades separately from other grades.
4. Protect all metal products with adequate waterproof outer wrappings.
5. Use extreme care in the off-loading of lumber to prevent damage splitting, and breaking of materials.

1.4.2 Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

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PART TWO - PRODUCTS

2.1 GRADE STAMPS

2.1.1 Framing lumber: Identify all framing lumber by the grade stamp of Southern Yellow Pine or West Coast Lumber.

2.1.2 Plywood: Identify all plywood as to species, grade, and glue type by the stamp of the American Plywood Association.

2.1.3 Other: Identify all other materials of this Section by the appropriate stamp of the agency listed in the reference standards, or by such other means as are approved by the Architect.

2.2 MATERIALS

All materials, unless otherwise specifically approved in advance by the Architect, shall meet or exceed the following:

Item:	Description:
Plates (in contact with concrete or masonry)	Pressure-treated Southern Pine
Studs and headers	Southern Pine #2 KD or Spruce #1
All other framing members	Southern Pine #2 KD
Plywood – concealed decking	C-D with exterior glue, group 4 30/12
Plywood – interior finish	A-B with one side sanded
Pressure-treated wood	Wolman CCA preservative by the Koppers Co. Pressure impregnated in accordance with AWPA Standard C-2 (or approved equal)
Steel hardware	ASTM 47 and A36 (use galvanized at exterior locations)
Machine bolts	ASTM A307
Lag bolts	Federal Spec. FF-B-561
Nails	Common (except as noted), Federal Spec. FF-N-1-1 (use galvanized at exterior locations)

2.3 OTHER MATERIALS

All other materials, not specifically described but required for a complete and proper installation as indicated on the Drawings, shall be new, suitable for intended use, and subject to the approval of the Architect.

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PART THREE - EXECUTION

3.1 DELIVERIES

3.1.1 Stockpiling: Stockpile all materials sufficiently in advance of need to ensure their availability in a timely manner for this work.

3.1.2 Delivery schedule: Make as many trips to the job site as are necessary to deliver all materials of this Section in a timely manner to ensure orderly progress of the total work.

3.1.3 Wood roof cants shall be cut 4 x 4 treated wood in maximum 8' lengths.

3.2 COMPLIANCE

Do not permit materials not complying with the provisions of this Section of these specifications to be brought onto or to be stored at the job site. Immediately remove from the job site all non-complying materials and replace them with materials meeting the requirements of this Section.

END OF SECTION

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Section 06 10 00

ROUGH CARPENTRY

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Install all wood framing indicated on the Drawings or required for a complete and operable facility.

1.1.2 Related work described elsewhere:

1.	Concrete Formwork	Section 03 11 00
2.	Lumber	Section 06 06 00
3.	Installation of Wood Doors and Frames	Section 06 20 00

1.2 QUALITY ASSURANCE

1.2.1 Qualifications of workers: Provide sufficient workmen and supervisors 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 construction involved and the materials and techniques specified.

1.2.2 Rejection: In the acceptance or rejection of rough carpentry, the Architect will make no allowance for lack of skill on the part of workmen.

1.3 PRODUCT HANDLING

1.3.1 Protection:

1.3.1.1 Store all materials in such a manner as to ensure proper ventilation and drainage, and to protect against damage and the weather.

1.3.1.2 Keep all materials clearly identified with all grade marks legible. Keep all damaged material clearly identified as damaged, and store separately to prevent its inadvertent use.

1.3.1.3 Do not allow installation of damaged or otherwise non-complying materials.

1.3.1.4 Use all means necessary to protect the installed work and materials of all other trades.

1.3.2 Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART TWO - PRODUCTS

Refer to Section 06 06 00 – LUMBER

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PART THREE - EXECUTION

3.1 INSPECTION

Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 WORKMANSHIP

3.2.1 General: All rough carpentry shall produce joints true, tight, and well nailed, with all members assembled in accordance with the Drawings and with all pertinent codes and regulations.

3.2.2 Selection of lumber pieces:

3.2.2.1 Carefully select all members. Select individual pieces so that knots and obvious defects will not interfere with placing bolts or proper nailing or making connections.

3.2.2.2 Cut out and discard all defects which will render a piece unable to serve its intended function. Lumber may be rejected by the Architect, whether or not it has been installed, for excessive warp, twist, bow, crook, mildew, fungus, or mold, as well as for improper cutting and fitting.

3.2.3 Shimming: Do not shim sills, joists, short studs, trimmers, headers, lintels, or other framing components.

3.3 TREATED LUMBER

3.3.1 General: Use only treated lumber for all wood bucks and nailing grounds (other than Foundation grade Redwood) in, or in contact with, concrete.

3.3.2 Treatment:

3.3.2.1 Treat all wood, as called for on Drawings and in the specifications by spraying with the preservative specified in Section 06 06 00.

3.3.2.2 Perform all treatment in strict accordance with the published recommendations of the manufacturer of the treatment preservative.

3.4 BLOCKING

3.4.1 Blocking:

3.4.1.1 Install all blocking required to support all items of finish, to include, but not limited to, all door stops, towel or grab bars, wall hung shelving, etc., and to cut off all concealed draft openings, both vertical and horizontal, between ceiling and floor areas.

3.4.1.2 Where treated blocking is in contact with metal structure, angles, roof deck, etc., blocking shall be wrapped in 15 lb. building felt.

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3.5 INSTALLATION OF PLYWOOD

3.5.1 Placement:

3.5.1.1 Place all plywood with face grain perpendicular to supports and continuously over at least two supports, except where otherwise specifically indicated on the Drawings.

3.5.1.2 Center joints accurately over supports. Unless otherwise specifically shown on the Drawings, stagger the end joints of plywood panels to achieve a minimum of continuity of joints.

3.5.2 Protection of plywood: Protect all plywood from moisture by use of all required waterproof coverings until the plywood has in turn been covered with the next succeeding component or finish.

3.6 FASTENING

3.6.1 Nailing: Do all nailing without splitting wood. Pre-bore as required. Replace all split members.

3.6.2 Bolting: Drill holes 1/16 inch larger in diameter than the bolts being used. Drill straight and true from one side only. Bolt threads shall not bear on wood. Use washers under head and nut where both bear on wood; use washers under all nuts.

3.6.3 Screws: For lag screws and wood screws, pre-bore same diameter as root of thread; enlarge holes to shank diameter for length of shank. Screw, do not drive, all lag screws and wood screws.

3.7 CLEANING UP

3.7.1 General: Keep the premises in a neat, safe, and orderly condition at all times during execution of this portion of the Work, free from accumulations of sawdust, cut ends, and debris.

3.7.2 Sweeping:

3.7.2.1 At the end of each working day, and more often if necessary, thoroughly sweep all surfaces where refuse from this portion of the Work has settled.

3.7.2.2 Remove the refuse to the area of the job site set aside for its storage.

3.7.2.3 Upon completion of this portion of the Work, thoroughly broom clean all surfaces.

END OF SECTION

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Section 06 20 00

FINISH CARPENTRY

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide all finish carpentry needed for a complete and proper installation including, but not necessarily limited to:

1. Fitting and installing all wood doors.
2. Installing all finish hardware.

1.1.2 Related work described elsewhere:

1.	Furnishing Wood Doors	Section 08 14 29
2.	Furnishing Finish Hardware	Section 08 71 00

1.2 QUALITY ASSURANCE

1.2.1 Qualifications of personnel:

1.2.1.1 Throughout progress of the work of this Section, provide at least one person who shall be thoroughly familiar with the specified requirements, completely trained and experienced in the necessary skills, and who shall be present at the site and shall direct all work performed under this Section.

1.2.1.2 In actual installation of the Work of this Section, use adequate number of skilled workmen to ensure installation in strict accordance with the approved design and the approved recommendations of the material's manufacturers.

1.2.1.3 Qualifications of finish hardware adjuster: Provide the services of an AHC member of Door and Window Institute, or an equally qualified individual approved in advance by the Architect.

1.3 PRODUCT HANDLING

1.3.1 Protection: Use all means necessary to protect the materials of this Section before, during, and after installation, and to protect the work and materials of all other trades.

1.3.2 Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART TWO - PRODUCTS

2.1 FASTENERS

2.1.1 Fasteners shall be the appropriate size finish or casing nails and/or screws.

2.1.2 Bright finish nails may be used for interior work and smooth finish galvanized casing nails used for exterior work. Heads of all nails shall be counter-sunk and holes filled.

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2.1.3 Screws shall be the appropriate size and finish with flat counter-sinking heads installed flush with finish surface unless designated to be counter-sunk and holes filled.

2.2 LUMBER

2.2.1 Trim and finish lumber: Wood fascias, door frames, shelving and all other trim and finish lumber shall be B or better Southern Yellow Pine or West Coast Fir in corresponding grade.

2.2.2 Moisture content: Moisture content for rough framing lumber shall not exceed 19%. Moisture content for trim and finish lumber shall not exceed 14%.

2.2.3 Protection of lumber: All lumber in contact with concrete or masonry or where called for on the drawings shall be given a pressure treatment against deterioration by "wolmanizing" or a similar and approved equal treatment.

2.2.4 Hardwood plywood: All plywood used to be installed as shown on the drawings. Provide grades 2-2 interior birch plywood where surfaces are exposed. 2-3 grade birch plywood may be used at all grades where one side is not exposed. Exposed plywood to be suitable for a smooth paint or stained surface.

2.2.5 Softwood plywood: PS20; custom grade in accordance with AWI; maximum moisture content of 8% for interior work and 12 percent for exterior work. Woodwork called to be painted shall be "C" or better white pine, Ponderosa pine or as otherwise noted.

2.3 PROTECTION

2.3.1 All work and materials shall be protected from weather, grease, stain, abuse, etc., after erection by temporary shielding or covering.

2.3.2 See Painting, Section 09 91 00, for priming requirements before erection and immediately thereafter.

PART THREE - EXECUTION

3.1 INSPECTION

Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF WOOD DOORS

3.2.1 Initial inspection of doors: Prior to start of installation of each door, carefully inspect the door and verify:

1. That the door furnished is the proper door for the opening, as described on the Door Schedule in the Drawings.
2. That the door is in sound condition, unblemished, without warp, twist, bow, or other attributes causing it to be rejected upon installation.

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3.2.2 Handling: Carry wood doors, do not drag them. Use extreme care in handling to prevent damage.

3.2.3 Fitting: Trim all wood doors as necessary to provide a uniform clearance of between 1/8" and 3/16" at jambs and head, and a uniform clearance at the threshold or floor to properly clear the floor covering described on the Finish Schedule in the Drawings.

3.2.4 Installing: For each door, verify the hardware type as described on the Door Schedule in the Drawings and verify that hardware actually supplied is the hardware specified. Using only the specified hinges or butts, and the proper equipment for the purpose, install the door into the opening with the following hinge or butt locations throughout the Work:

1. Top hinge or butt:	The center of the hinge or butt not more than 11" below the top of the door;
2. Bottom hinge or butt:	The center of the hinge or butt not more than l3" above the finish floor;
3. Intermediate hinge, butt or pivot:	Equidistant between top and bottom hinge, butt or pivot.

3.2.5 Finishing:

3.2.5.1 With fine sandpaper, working only in direction of the grain of the wood, remove all rough edges resulting from door trimming and leave the installed door in condition to receive its final finish.

3.2.5.2 Carefully touch-up all trimmed surfaces, applying a finish equal in all respects to the finish specified in Section 09 91 00.

3.3 INSTALLATION OF OTHER FINISH HARDWARE

3.3.1 Location: Using only the specified finish hardware, and the proper equipment for the purpose, install all other finish hardware in the following locations throught the Work:

1. Door pulls or plates:	Centered 40 5/16” above the finish floor.
2. Door closing devices:	Install and adjust in strict accordance with the templates and printed instructions supplied by the manufacturer of the devices. Insofar as practicable, doors opening to or from halls or corridors shall have the closer mounted on the room side of the door.
3. Extension lever flush bolts:	In the edge of the door. Center to bolt fronts 12” from bottom and 12” from top edge of the door.
4. Kick plates:	On single-acting doors with kick plate on push side. On double-acting doors with kick plate on both sides.
5. Mortise dead-lock strike:	Center 60” above the finish floor.
6. Knob lock and knob latch strikes:	Center 40 5/16” above the finish floor.
7. Panic bolt cross bars:	Align in horizontal position with top and bottom bolts and rods aligned vertically. Install the centerline of strike 40 5/16” above finish floor.
8. Push plates:	Centered 48” above the finish floor.
9. Other hardware items:	Install as directed not described above.

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3.3.2 Anchoring: Anchor all components firmly into position for long life under hard use. Use only the anchoring devices furnished with the hardware item, unless otherwise specifically directed.

3.4 WORKMANSHIP

3.4.1 All items of finish carpentry shall be installed with the latest practices and methods to accomplish a first class installation.

3.4.2 Any finish work showing hammer marks, open cut joints, joints that are not mitered, etc., or defects in material will be rejected and replaced at no additional cost to Owner.

3.4.3 All work shall be done by workmen who are skilled in the trade. Nails shall be set and holes filled.

3.5 INSPECTION, ADJUSTMENT, AND REPORTING

3.5.1 General: Inspect each item of installed finish hardware. Verify that each such item has been installed in strict accordance with the manufacturer's recommendations, is in proper condition, and functions in its intended manner.

END OF SECTION

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Section 07 19 00

WATER REPELLANTS

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide all materials, complete, in place, as shown on the drawings, specified herein or needed for a complete and proper installation.

1.1.2 Related work described elsewhere:

1.	Masonry Mortaring	Section 04 05 13
2.	Brick Masonry	Section 04 21 13
3.	Unit Masonry Cleaning	Section 04 01 20

PART TWO - PRODUCTS

2.1 WATER REPELLANTS

Water seal: Prime-A-Pell 200 one coat water repellent by Chemprobe Corp., Garland, Texas, or Siloxane by Prosoco, Kansas City, Kansas or approved equal.

PART THREE - EXECUTION

3.1 CLEANING

In strict accordance with Section 04 01 20 – Unit Masonry Cleaning.

3.2 APPLICATION

3.2.1 Spray on to manufacturer's recommended coverage. Apply evenly until surface is wet without run down.

3.2.2 Application to be made in a dry atmosphere with ambient temperature of product and surface being treated above 40 degrees F.

3.3 FINISHING

All adjacent materials, windows, doors, etc., shall be wiped clean before drying.

3.4 GUARANTEE

Provide a five year manufacturer’s written guarantee.

END OF SECTION

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Section 07 21 00

THERMAL INSULATION

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide all building insulation required for this work including, but not necessarily limited to:

1. Fiberglass batt insulation above ceilings.
2. Wall cavity insulation.
3. Roof insulation.

1.2 PRODUCT HANDLING

1.2.1 Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.

1.2.2 Delivery and storage: Deliver materials to the job site, and store in a safe dry place with all labels intact and legible at time of installation.

1.2.3 Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART TWO - PRODUCTS

2.1 INSULATION MATERIALS

2.1.1 Rigid insulation in exterior masonry wall cavities: 1” and 2” foil faced polyisocyanurate sheathing by RMax or equal. Board is to be pre-cut in 16” tall pieces and installed between masonry wall reinforcing.

2.1.2 6" fiberglass batt insulation: R-19 (unfaced) fiberglass batt insulation as manufactured by Owens-Corning or approved equal installed in walls. Insulation shall be secured and supported as required.

2.1.3 Sound attenuation batts: Shall match thickness of walls where called for on drawings as manufactured by Owens-Corning or approved equal. Provide 4 inch sound attenuation batts above ceilings.

2.1.4 Rigid roof insulation: Polyisocyanurate as manufactured by Manville Sales Corp., Denver, CO, or approved equal. Thickness and taper, if required, as shown on drawings.

2.2 OTHER MATERIALS

All other materials, not specifically described but required for a complete and proper installation of the Work of this Section, shall be as selected by the Contractor subject to the approval of the Architect.

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PART THREE - EXECUTION

3.1 INSPECTION

Examine the areas and conditions under which work of this Section will be installed. Correct Conditions detrimental to proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

3.2.1 Roof Insulation: Install loose laid strictly following roofing manufacturer's recommendations.

3.2.2 Sound batt insulation: Install in all interior walls to 8" above ceiling and above ceilings 2'0" on each side of all interior walls. Attach sound batts to stud walls either with acoustical sealant applied to gypsum board or by opening flanges of batt insulation and attaching to metal studs with drywall screws.

3.3 VERIFICATION

Upon completion of the installation in each area, visually inspect and verify that all insulation is complete and properly installed.

END OF SECTION

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Section 07 25 00

WEATHER BARRIER

PART ONE – GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide air barrier/weather resistant barrier over exterior of wall sheathing at all locations regardless of whether or not indicated on drawings to protect exterior sheathing and interior walls.

1.2 REFERENCES

A. ASTM International

1. ASTM C920; Standard Specification for Elastomeric Joint Sealants
2. ASTM C1193; Standard Guide for Use of Joint Sealants
3. ASTM D882; Test Method for Tensile Properties of Thin Plastic Sheeting
4. ASTM D1117; Standard Guide for Evaluating Non-woven Fabrics
5. ASTM E84; Test Method for Surface Burning Characteristics of Building Materials
6. ASTM E96; Test Method for Water Vapor Transmission of Materials
7. ASTM E1677; Specification for Air Retarder Material or System for Framed Building Walls

1.3 SUBMITTALS

A. Refer to Section 01 33 23 – Shop Drawings, Product Data & Samples.

B. Product Data: Submit manufacturer current technical literature for each component.

C. Samples: Weather Barrier Membrane, minimum 8-1/2 inches by 11 inch.

D. Quality Assurance Submittals:

1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.
2. Manufacturer Instructions: Provide manufacturer's written installation instructions.

1.4 QUALITY ASSURANCE

A. Qualifications

1. Installer shall have experience with installation of commercial weather barrier assemblies under similar conditions.
2. Installation shall be in accordance with weather barrier manufacturer's installation guidelines and recommendations.
3. Source Limitations: Provide commercial weather barrier and accessory materials produced by single manufacturer.

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1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver weather barrier materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.
B. Store weather barrier materials as recommended by weather barrier manufacturer.

PART TWO - PRODUCTS

2.1 MANUFACTURER

A. Tyvek as manufactured by DuPont Building Innovations; Wilmington, Delaware or Architect approved equal.

2.2 MATERIALS

A. High-performance, spunbonded polyolefin, non-woven, non-perforated, weather barrier and related assembly components.

B. Performance Characteristics:

1. AATCC–127, Water Penetration Resistance, exceeded at 280.
2. TAPPI T–460, Gurley Hill (sec/100cc) Air infiltration at >1500 seconds.
3. ASTM E 96 Method B(g/m2–24hr.)Water vapor transmission of 200.
4. TAPPI T-41D, Basis weight of 2.7oz/yd.
5. ASTM E96 Method B, Water Vapor Transmission, 28 perms.
6. ASTM E1677, Air Retarder Material Standard Specification, Type I air barrier.

2.3 ACCESSORIES

A. Seam Tape: 3 inch wide.

B. Fasteners:

1. For steel frame construction: DuPont™ Tyvek® Wrap Cap Screws, DuPont Weatherization Systems. 1 5/8" rust resistant screws with 2" diameter plastic cap.
2. For wood frame construction: DuPont™ Tyvek® Wrap Caps, DuPont Weatherization Systems. Nails with large heads or plastic washers.

C. Sealants

1. Polyurethane or elastomeric sealants.

D. Adhesives:

1. Provide adhesive recommended by weather barrier manufacturer.

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2.4 FLASHING SYSTEMS

2.4.1 Self-adhered flashing systems for use at window and door openings.

A. DuPont™ Flex Wrap

B. DuPont™ StraightFlash

C. DuPont™ Thru-Wall Flashing

PART THREE – EXECUTION

3.1 EXAMINATION

A. Verify substrate and surface conditions are in accordance with weather barrier manufacturer recommended tolerances prior to installation of weather barrier and accessories.

3.2 I INSTALLATION

A. Install weather barrier over exterior face of exterior wall substrate in accordance with manufacturer recommendations.

B. Install weather barrier prior to installation of windows and doors.

C. Start weather barrier installation at a building corner, leaving 6-12 inches of weather barrier extended beyond corner to overlap.

D. Install weather barrier in a horizontal manner starting at the lower portion of the wall surface with subsequent layers installed in a shingling manner to overlap lower layers. Maintain weather barrier plumb and level.

E. Sill Plate Interface: Extend lower edge of weather barrier over sill plate interface 3-6 inches. Secure to foundation with elastomeric sealant as recommended by weather barrier manufacturer.

F. Window and Door Openings: Extend weather barrier completely over openings.

G. Overlap weather barrier

1. Exterior corners: minimum 12 inches.
2. Seams: minimum 6 inches.

H. Weather Barrier Attachment:

1. Attach weather barrier to studs through exterior sheathing. Secure using weather barrier manufacturer recommended fasteners, space 12 -18 inches vertically on center along stud line, and 24 inch on center, maximum horizontally.

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3.3 SEAMING

A. Seal seams of weather barrier with seam tape at all vertical and horizontal overlapping seams.

B. Seal any tears or cuts as recommended by weather barrier manufacturer.

END OF SECTION

Section 07 26 16

UNDER SLAB VAPOR
BARRIER/RETARDER

PART ONE - GENERAL

1.1 DESCRIPTION

A. Work included: Provide vapor barrier, seam tape, mastic, pipe boots, and detail strip required for this work including, but not necessarily limited to:

1.2 RELATED WORK DESCRIBED ELSEWHERE

A. Cast-In-Place Concrete Section 03 31 00

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM E 1745-09 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete slabs.
2. ASTM E 154-99 (2005) Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
3. ASTM E 96-05 Standard Test Methods for Water Vapor Transmission of Materials.
4. ASTM F 1249-06 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
5. ASTM E 1643-09 Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

B. American Concrete Institute (ACI)

1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

1.4 SUBMITTALS

1.4.1 General: Comply with provisions of Section 01 33 23.

1.4.2 Manufacturer's data: Within 30 calendar days after award of the Contract, submit:

A. Complete materials list of all items proposed to be furnished and installed under this Section.

B. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.

C. Manufacturer's recommended installation procedures.

D. Independent laboratory test results showing compliance with ASTM and ACI Standards. The manufacturer's recommended installation procedures, when approved by the Architect, will become the basis for inspecting and accepting or rejecting actual installation procedures used on the Work.

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PART TWO - PRODUCTS

2.1 MATERIALS

A. Vapor barrier products:

1. Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC., (877) 464-7834
2. Acceptable material/manufacturers:
   a. Yellow Guard, Poly America, Grand Prairie, TX
   b. Viper Vaporcheck II, Peioria, ILL
3. Architect approved equal.

B. Vapor barrier shall have all the following qualities:

1. Maintain permeance of less than 0.01 Perms [grains/(ft^2 · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
2. Other performance criteria:
   a. Strength: ASTM E1745 Class A.
   b. Thickness: 15 mils minimum
3. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1
4. Warranty: (a) compliance with the designated ASTM E1745 classification, and (b) no manufacturing defects in the product for, at least, the Life of the Building.

2.2 ACCESSORIES

A. Vapor barrier accessories:

1. All accessories by Stego Industries LLC., (877) 464-7834 or Architect approved equal.
   a. Seams: Stego tape
   b. Sealing penetrations of vapor barrier:
      1) Stego mastic and tape
   c. Perimeter/terminated edge seal:
      1) Stego Crete Claw (textured tape)
      2) Stego Term Bar
      3) StegoTack Tape (double-sided sealant tape)
      4) One-sided seaming tape is not a recommended method of sealing at the terminated edge.
   d. Penetration Prevention: Beast Foot
   e. Vapor Barrier-Safe Hand Screed System: Beast Screed

PART THREE - EXECUTION

3.1 PREPARATION

A. Ensure that subsoil is approved by Architect or Geotechnical Engineer.

1. Level and compact base material.

B. Contact vapor barrier manufacturer to schedule a pre-construction meeting and to coordinate a review, in-person or digital, of the vapor barrier installation.

3.2 INSTALLATION

A. Install vapor barrier in accordance ASTM E1643.

1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, water stops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.
   a. Seal vapor barrier to the entire slab perimeter using manufacturer's textured tape with a surface that creates a mechanical seal to freshly-placed concrete, per manufacturer's instructions.

   OR

   b. Seal vapor barrier to the entire perimeter wall or footing/grade beam with manufacturer's double-sided tape, or both termination bar and double-sided tape, per manufacturer's instructions. Ensure the concrete is clean and dry prior to adhering tape.
3. Overlap joints 6 inches and seal with manufacturer's seam tape.
4. Apply seam tape/textured tape/double-sided tape to a clean and dry vapor barrier.
5. Seal all penetrations (including pipes) per manufacturer's instructions.
6. Avoid the use of stakes driven through vapor barrier by utilizing screed and forming systems that will not leave punctures in the vapor barrier.
7. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.

END OF SECTION

Section 07 42 93

METAL SOFFIT

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Provide metal soffit system including all accessories, complete, in place, as shown on the Drawings, specified herein, and needed for a complete and proper installation.

1.2 QUALITY ASSURANCE

1.2.1 Qualifications of Manufacturers: Products used in the work of this Section shall be produced by Manufacturers regularly engaged in manufacture of similar products and with a history of successful production acceptable to the Architect.

1.2.2 Qualifications of Installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.

1.3 SUBMITTALS

1.3.1 General: Comply with provisions of Section 01 33 23.

1.3.2 Product data: Within 30 calendar days after award of the contract, submit:

A. Manufacturer's specifications and other data required to demonstrate compliance with specified requirements.

B. Manufacturer's recommended installation procedures which, when approved by the Architect, shall become the basis for inspecting and accepting or rejecting actual installation procedures used on the Work.

C. Complete materials list of all items proposed to be furnished and installed under this Section.

D. Shop drawings and sufficient dimensional data to enable proper co-ordination of installation of concealed items of support.

1.5 PRODUCT HANDLING

1.5.1 Protection: Use all means necessary to protect materials of this Section before, during and after installation and to protect work and materials of all other trades.

1.5.2 Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

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PART TWO - PRODUCTS

2.1 GENERAL

All soffit panels, trim pieces and accessories shall be as manufactured by Fabral, 3449 Hempland Rd., Lancaster, PA 17604-4608, or Architect approved equal.

2.2 SOFFIT PANELS

Provide solid or vented (as shown on drawings) Posi-Lock Soffit Panels roll formed to a depth of 3/16" and effective width of 14" with a V-groove at 4-3/4" on center. Furnish with interlocking design to hide fasteners.

2.3 FINISH

Provide Kynar PVDF resin fluorescarbon coating with epoxy primer, factory applied coating. Furnish the manufacturers non-prorated twenty (20) year warranty against cracking, checking, peeling, or losing adhesion. Color shall be selected from manufacturer's nine standard colors.

2.4 STRUCTURAL FRAMING

Provide .050" aluminum structural framing members as shown on details. Hat section 1-3/4" high, 2" base and 1-1/8" crown and channel section 1-1/4" high x 1" wide; fastened at intersections with two 1/4" x 3/4" tek screws each side per connection.

2.5 ACCESSORIES

A. Hat section furring strip/stringers, roll formed .050" aluminum 3005-H281, 1-3/4" high, 2" base x 1-1/8" crown.

B. Custom brake formed trim accessories with protective strippable coating for field brake forming of .032" aluminum.

C. Black 1" thick EPDM top and bottom closure strips.

D. Aluminum hold down clips.

E. Splice kits (if needed).

F. Shelf drips and corner caps as required.

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PART THREE - EXECUTION

3.1 Installation of soffit shall follow printed manufacturer's recommendations as approved by the Architect.

3.2 Erect the entire installation straight and true in accordance with standard construction procedures as approved by the Architect.

3.3 All surfaces shall be cleaned thoroughly prior to acceptance of building.

END OF SECTION

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Section 07 50 00

SINGLE PLY (MECHANICALLY FASTENED) ROOF SYSTEM

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Install insulation, blocking, metal and single ply mechanically fastened roof membrane as shown on the plans, including, but not limited to:

1. Single ply mechanically fastened roofing.
2. Twenty (20) year roof guarantee with no monetary limit.
3. All flashing shall be included in roof guarantee and shall be by roof manufacturer.
4. Roof shield protection pads where shown on roof plan.

1.1.2 This specification is written using the Duro-Last, Inc., Mechanically Fastened Roofing System, .050 white membrane using manufacturer's recommended fastening method. Provide Twenty (20) Year Warranty.

Acceptable manufacturers:

1. Carlisle Sureflex (60 mil)
2. Sika Sarnafil S327 (60 mil)
3. Johns Manville JM PVC (60 mil)
4. Firestone PVC (60 mil)
5. GAF EverGuard (60 mil)

1.2 QUALITY ASSURANCE

1.2.1 Qualifications of manufacturer: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.

1.2.2 Qualifications of roofing contractor: The roofing contractor and his personnel shall be currently approved by the manufacturer of the approved products as qualified to install the materials of this Section and shall have installed a minimum of 250,000 sq. ft. of warranted installation jobs and a minimum of three (3) years of the manufacturer’s materials.

1.2.3 Qualifications of installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.

1.2.4 Roofing inspections: Make all required notifications and secure all required inspections by the manufacturer of the approved materials to facilitate issuance of the specified roof guarantee.

1.3 SUBMITTALS

1.3.1 General: Comply with the provisions of Section 01 33 23.

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1.3.2 Product data: Within 30 calendar days after award of Contract, submit:

1. Sample copy of manufacturer's Twenty (20) Year Guarantee.
2. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.
3. Manufacturer's recommended methods of installation.

The manufacturer's recommended methods of installation, when approved by the Architect, will become the basis for inspecting and accepting or rejecting actual installation procedures used on the Work.

1.4 PRODUCT HANDLING

1.4.1 Delivery and storage:

1.4.1.1 Deliver all packaged materials to the job site in their original unopened containers with all labels intact and legible at time of inspection.

1.4.1.2 Store materials, except membrane, between 60 degrees F and 80 degrees F. If exposed to lower temperature, restore to proper temperature before using.

1.4.1.3 Store materials, except membrane, in dry area and protect. Damaged materials shall be replaced at Contractor's expense.

1.4.2 Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.

1.4.3 Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

1.5 GUARANTEE

The applicator shall provide to the Owner a written Twenty (20) Year Guarantee from the manufacturer, cost of which shall be paid by the applicator. The manufacturer's standard written Twenty (20) Year Guarantee shall cover labor and material necessary to effect watertightness. There shall be no monetary limit to the amount of this guarantee including, if necessary, the removal and replacement of the entire roofing membrane and flashing assembly, for the period of the guarantee. This guarantee does include damage to any of the other building components or building contents with no exclusions for ponding water, biological growth or consequential damages. The Contractor shall furnish an additional two (2) year guarantee on material and workmanship.

PART TWO - PRODUCTS

2.1 GENERAL

2.1.1 Membrane: Reinforced, .050" minimum thickness (white), scrim.

2.1.2 Sealant: As supplied by manufacturer.

2.1.3 Flashing: As recommended by manufacturer, use .055 inch thick EP based membrane for stacks and corners.

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2.1.4 Fasteners: Number and type shall equal or exceed the minimum requirements of manufacturer. Field verify type and length of fastener required prior to bid.

2.1.5 Nailers: Pressure treated, #2 or better lumber.

2.1.6 Roof shield protection pads: 1/4" x 2’0” x 4’0” PVC (gray) protection pads at all walkways and under treated wood 4 x 4's.

2.1.7 All sheets of membrane, curb flashings, and pipe flashings must be reinforced and prefabricated from the manufacturer.

PART THREE - EXECUTION

3.1 SUBSTRATE PREPARATION

Fill all depressions and cracks with new insulation material to allow no opening greater than 1/4" and no ponding of water on new roofing.

3.2 NAILER INSTALLATION

Install nailers at perimeter of roof and around all penetrations, anchor at 3'-0" o.c. with anchor sufficient to resist 175 lb. force in any direction. Provide 1/2" vent space at ends of nailers. Nailer height shall match insulation.

3.3 INSULATION INSTALLATION

3.3.1 Insulation shall be installed in accordance with the insulation manufacturer's current published specifications and recommendations for use with a mechanically fastened roofing system.

3.3.2 Insulation shall be secured to the roof deck in accordance with the insulation manufacturer's requirements.

3.3.3 Insulation shall be neatly cut to fit around penetrations and projections.

3.3.4 Open joints shall be repaired with insulation materials.

3.4 MEMBRANE INSTALLATION

3.4.1 Seams shall be made by overlapping the membrane a minimum of two inches. This applies to a seam in the field area of the roof and to a seam at the flashings.

3.4.2 Seams are to be made with two independent seals formed by solvent or heat welding, and the subsequent sealing of the overlap edge with manufacturer's recommended sealant.

3.4.3 Welded seams are to be checked for continuity and integrity and sealed with manufacturer's recommended sealant the same day.

3.5 FASTENER INSTALLATION

3.5.1 The membrane shall be secured using the manufacturer's recommended method.

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3.5.2 Fastener layout patterns vary. Refer to fastener layout charts issued by manufacturer for the applicable pattern.

3.5.3 Fasteners and corresponding discs shall be installed so that they are tightly secured.

3.5.4 Discs are to be installed so that they seat flat on the substrate.

3.6 FLASHING INSTALLATION

3.6.1 Flashings shall be installed in accordance with standard manufacturer's standard details.

3.6.2 Transitions are required at all peaks, valleys and slope intersections where the net change in slope exceeds 1" in 12".

3.6.3 Install flashings around the entire roof perimeter and at all projections and penetrations.

3.6.4 Base flashing shall extend a minimum of 8" up vertical surfaces.

3.6.5 All flashings and terminations shall be securely fastened in the plane of the roof deck with fasteners recommended by manufacturer. Any substitution of recommended fasteners must be accepted in writing by manufacturer.

3.6.6 Fasteners and roofing nails used to secure flashings to wood nailers shall be galvanized metal or corrosion resistant material, with a head diameter of not less than 3/8", and with fastener penetration into the wood nailer of at least 3/4".

3.6.7 Flexible membrane flashings shall be installed in accordance with standard manufacturer's details. Other details and securement methods must be accepted in writing by manufacturer.

3.7 GENERAL

3.7.1 When installing the Mechanically Fastened Roofing System in cold weather, liquids such as solvents, sealants, etc., shall be stored at warmer temperatures until just prior to use to facilitate the installation.

END OF SECTION

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Section 07 60 00

FLASHING AND SHEET METAL

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Furnish and install the metal flashing and other sheet metal work as shown and called for on the drawings, as specified herein and as required to prevent penetration of water through the roof or exterior walls of the building and permit the proper control of discharged water.

1.2 QUALITY ASSURANCE

1.2.1 Standards: All flashings/edge metals shall meet ANSI/SPRI ES-1 as required by the International Building Code shall be applicable standard for method and quality work under this Section.

1.2.2 Qualifications of Manufacturer: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.

1.2.3 Qualification of Installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.

1.3 SUBMITTALS

1.3.1 General: Comply with the pertinent provisions of Section 01 33 23.

1.3.2 Product data: Submit the following to the Architect for approval:

1. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.

1.4 PRODUCT HANDLING

1.4.1 Protection: Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed work and materials of all other trades.

1.4.2 Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

1.5 GUARANTEE

1.5.1 The roofing contractor shall include the sheet metal flashing and trim in conjuction with the roofing guarantee as required in Section 07 50 00. The guarantee shall warrant all roofing and sheet metal flashing and trim to be weathertight and free from defects in materials or workmanship for a period of twenty (20) years (see roofing guarantee) from the date of final acceptance.

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PART TWO - PRODUCTS

2.1 SHEET METAL

2.1.1 All metal edge and drainage components shall be as manufactured by Exceptional Metals, Saginaw, Michigan, or Architect approved equal.

2.1.2 Metal edge components shall be selected from manufacturer's standard details for fascia, coping, edge and termination.

2.1.3 Aluminum gutters and downspouts shall be fabricated as long as practical. Profile for gutters shall be manufacturer's standard. Gutters shall have a closed face. Concealed clips and straps for all gutters and downspouts shall be spaced not to exceed 6'0" o.c. Secure downspouts with straps at the top and bottom and in between as may be required to insure a proper installation. Provide expansion joints in gutters not to exceed 32'0" o.c.

2.1.4 Colors shall be selected from manufacturer's standard Kynar finish colors.

2.2 NAILS, RIVETS AND FASTENERS

2.2.1 Nails, rivets and fasteners shall be same material as metal to secured or shall be of durable compatible materials which are regularly recommended for the intended use. Nails shall be No. 10 gauge (.1019" diameter) or larger, needle point and long enough to penetrate wood 1" or masonry and concrete 2".

2.3 MATERIALS

2.3.1 Solder: Shall conform to ASM specification B32, Composition 50% tin and 50% lead.

2.3.2 Flux: Rosin, muriatic acid neutralized with zinc or an approved brand of soldering paste.

2.3.3 Bituminous Plastic Cement: Shall conform to Federal Specification SS-C-153, Type I. It shall be delivered in the manufacturer's original sealed containers.

PART THREE - EXECUTION

3.1 INSPECTION

3.1.1 Surface Conditions: Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. Do not proceed with sheet metal installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 INSTALLATION

3.2.1 Install the work of this Section in strict accordance with the recommendations of the manufacturer as approved by the Architect.

3.3.1 Securely anchor in place by approved screw fastener.

END OF SECTION

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Section 07 84 00

FIRESTOPPING

PART ONE – GENERAL

1.1 SECTION INCLUDES

A. Firestopping of through penetrations in rated assemblies.

B. Firestopping of construction gaps.

1.2 RELATED SECTIONS

A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including but not limited to:

1.	Cast-In-Place Concrete	Section 03 31 00
2.	Masonry	Division Four
3.	Joint Sealants	Section 07 92 00
4.	Gypsum Board Assemblies	Section 09 21 00
5.	Mechanical	Division Twenty Three
6.	Electrical	Division Twenty Six

1.3 REFERENCES

A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2000a.

B. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2000a.

C. ASTM E 814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2000.

D. ASTM E 1399 - Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems; 1997 (Reapproved 2000).

E. ASTM E 1529 - Standard Test Methods for Determining Effects of Large Hydrocarbon Pool Fires on Structural Members and Assemblies; 2000.

F. ASTM E 1725 - Standard Test Methods for Fire Tests of Fire-Resistive Barrier Systems for Electrical System Components; 1995 (Reapproved 2001).

G. UL 1479 - Standard for Fire Tests of Through-Penetration Firestops; 1994.

H. UL 1709 - Rapid Rise Fire Tests of Protection Materials for Structural Steel; 1994.

I. ANSI/UL 2079 - Tests for Fire Resistance of Building Joint Systems; 1998.

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1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 23.

B. Shop Drawings: For each different firestopping configuration, provide the following:

1. Listing agency's detailed drawing showing opening, penetrating items, and firestopping materials, identified with listing agency's name and number or designation, fire rating achieved, and date of listing.
2. Identify which rated assembly each system is to be used in.
3. Any installation instructions that are not included on the detailed drawing.
4. For proposed systems that do not conform strictly to the listing, submit listing agency's drawing marked to show modifications and stamped approved by firestop system manufacturer's fire protection engineer.

C. Product Certificates: Submit certificates signed by firestop system manufacturer certifying that materials furnished comply with requirements.

D. Product Data: Manufacturer's data sheets on each material to be used in firestop system systems, including:

1. Listing numbers of systems in which each product is to be used.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.

E. Installer's Qualification Documentation.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Firm who is qualified by having experience, staff, and training to install the specified products, and who:

1. Is acceptable to or licensed by manufacturer.
2. Can provide a list of completed projects as evidence of experience; include project name and address, Owner's name and address, and Architect's name and phone number.

B. Pre-Installation Meeting: Conduct a meeting at the project site to discuss installation conditions and requirements; require the attendance of all relevant installers.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products until ready for installation in manufacturer’s original unopened packaging, legibly marked with manufacturer’s name and product identification, date of manufacture, lot number, shelf life, listing agency’s classification marking, curing time, and mixing instructions if applicable.

B. Store and handle in such a manner as to prevent deterioration or damage due to moisture, temperature changes, contaminants, and other causes; follow manufacturer’s instructions.

1.7 PROJECT CONDITIONS

A. Coordinate construction and cutting of openings so that each particular firestop system may be installed in accordance with its listing, including sizing, sleeves, and penetrating items.

B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install firestopping under environmental conditions outside manufacturer's absolute limits.

C. Provide ventilation as required by firestopping manufacturer, including mechanical ventilation if required.

PART TWO – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers shall be 3M Fire Protection Products, Inc., SpecSeal Firestop Products, Hilti, Inc. or Architect approved equal.

B. Single Source: All instances of a specific firestop system shall be made using products of the same manufacturer; where multiple installers (e.g. different subcontractors) are responsible for installation of firestopping, all installers shall use the same system made by the same manufacturer.

2.2 MATERIALS

A. Scope:

1. Rated Assemblies: Provide installed firestopping that limits the spread of fire, heat, smoke, and gasses through otherwise unprotected openings in rated assemblies, including walls, partitions, floors, roof/ceilings, etc.
2. Construction Gaps: Provide installed firestopping that limits the spread of fire, heat, smoke, and gasses through otherwise unprotected gaps between adjacent rated assemblies, including:
    a. Building expansion joints in walls and floors.
    b. Interior walls to floor/roof deck above.
    c. Intersection of floors and exterior walls.

PART THREE – EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Conduct tests according to manufacturer's written recommendations to verify that substrates are free of oil, grease, rolling compounds, incompatible primers, loose mill scale, dirt and other foreign substances capable of impairing bond of firestopping.

C. Verify that items penetrating fire rated assemblies are securely attached, including sleeves, supports, hangers, and clips.

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D. Verify that openings and adjacent areas are not obstructed by construction that would interfere with installation of firestopping, including ducts, piping, equipment, and other suspended construction.

E. Verify that environmental conditions are safe and suitable for installation of firestopping.

F. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Prepare substrates in accordance with manufacturer's instructions and recommendations.

B. Install masking and temporary coverings as required to prevent contamination or defacement of adjacent surfaces due to firestopping installation.

3.3 INSTALLATION

A. Install in strict accordance with manufacturer's detailed installation instructions and procedures.

B. Install so that openings are completely filled and material is securely adhered.

C. Where firestopping surface will be exposed to view, finish to a smooth, uniform surface flush with adjacent surfaces.

D. After installation is complete, remove combustible forming materials and accessories that are not part of the listed system.

E. Repair or replace defective installations to comply with requirements.

F. At each through penetration, attach identification labels on both sides in location where label will be visible to anyone seeking to remove penetrating items or firestopping.

G. Clean firestop materials off surfaces adjacent to openings as work progresses, using methods and cleaning materials approved in writing by firestop system manufacturer and which will not damage the surfaces being cleaned.

H. Notify authority having jurisdiction when firestopping installation is ready for inspection; obtain advance approval of anticipated inspection dates and phasing, if any, required to allow subsequent construction to proceed.

I. Do not cover firestopping with other construction until approval of authority having jurisdiction has been received.

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3.4 PROTECTION

A. Protect installed systems and products until completion of project; where subject to traffic, provide adequate protection board.

B. Touch-up, repair or replace damaged systems and products before Substantial Completion.

END OF SECTION

Section 07 92 00

JOINT SEALANTS

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Throughout the Work, caulk and seal all joints where shown on the Drawings and elsewhere as required to provide a positive barrier against passage of air and passage of moisture.

1.1.2 Related work described elsewhere:

A. Adhere strictly to the caulking and sealant details shown on the Drawings.

1.2 QUALITY ASSURANCE

1.2.1 Qualifications of Manufacturers: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to Architect.

1.2.2 Qualifications of installers:

1.2.2.1 Proper caulking and proper installation of sealants require that installers be thoroughly trained and experienced in the necessary skills and thoroughly familiar with the specified requirements.

1.2.2.2 For caulking and installation of sealant throughout the Work, use only personnel who have been specifically trained in such procedures and who are completely familiar with the joint details shown on the Drawings and the installation requirements called for in this Section.

1.3 SUBMITTALS

1.3.1 General: Comply with provisions of Section 01 33 23.

1.3.2 Manufacturers data: Within 30 calendar days after award of the Contract, submit:

A. A complete materials list showing all items proposed to be furnished and installed under this Section.

B. Sufficient data to demonstrate that all such materials meet or exceed the specified requirements.

C. Specifications, installation instructions, and general recommendations from the materials manufacturer showing procedures under which it is proposed that the materials will be installed.

Upon approval by the Architect, the proposed installation procedures will become the basis for inspecting and accepting or rejecting actual installation procedures used on the Work.

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1.4 PRODUCT HANDLING

1.4.1 Deliver and storage: Deliver all materials of this Section to the job site in the original unopened containers with all labels intact and legible at time of use. Store only under conditions recommended by the manufacturers. Do not retain on the job site any material which has exceeded the shelf life recommended by its manufacturer.

1.4.2 Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.

1.4.3 Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART TWO - PRODUCTS

2.1 EXTERIOR VERTICAL APPLICATIONS

2.1.1 Metal to masonry: MasterSeal NP 1 as manufactured by BASF, Shakope, MN or approved equal. Color shall be as selected by the Architect from manufacturer's standard colors.

Masonry to masonry, precast to masonry and E.I.F.S. to masonry: MasterSeal NP 2 as manufactured by BASF, Shakope, MN or approved equal. Color shall be as selected by the Architect from manufacturer’s standard colors.

2.2 EXTERIOR HORIZONTAL APPLICATIONS

2.2.1 MasterSeal SL 2 as manufactured by BASF, Shakope, MN or approved equal. Color shall be as selected by the Architect from manufacturer’s standard colors.

2.3 INTERIOR VERTICAL APPLICATIONS

2.3.1 MasterSeal NP 1 as manufactured by BASF, Shakope, MN or approved equal. Color shall be as selected by the Architect from manufacturer’s standard colors.

2.4 INTERIOR HORIZONTAL APPLICATIONS

2.4.1 At all interior floor joints MasterSeal SL1 as manufactured by BASF, Shakope, MN or approved equal. Color shall be as selected by the Architect from manufacturer’s standard colors.

2.5 JOINT BACKING

Furnish " Backer-Rod" by BASF Products or approved equal.

2.6 OTHER MATERIALS

All other materials, not specifically described but required for complete and proper caulking and installation of sealants, shall be first quality of their respective kinds, new, and as selected by the Contractor subject to the approval of the Architect.

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PART THREE - EXECUTION

3.1 INSPECTION

Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

3.2.1 Steel surfaces:

3.2.1.1 Steel surfaces in contact with sealant shall be sandblasted or, if sandblasting would not be practical or would damage adjacent finish, the metal shall be scraped or wire-brushed to remove mill scale.

3.2.1.2 Use solvent to remove oil and grease, wiping the surfaces with clean rags.

3.2.1.3 Remove protective coatings on steel by sandblasting or by a solvent that leaves no residue.

3.3 INSTALLATION OF BACKUP MATERIAL

Use only the backup material recommended by the manufacturer of the sealant and approved by the Architect for the particular installation, compressing the backup material 25% to 50% to secure a positive and secure fit. When using backup of tube or rod stock, avoid lengthwise stretching of the material. Do not twist or braid hose or rod backup stock.

3.4 PRIMING

Use only the primer recommended by the manufacturer of the sealant and approved by the Architect for the particular installation. Apply the primer in strict accordance with the manufacturer's recommendations as approved by the Architect.

3.5 BOND-BREAKER INSTALLATION

Install an approved bond-breaker where recommended by the manufacturer of the sealant and where directed by the Architect, adhering strictly to the installation recommendations as approved by the Architect.

3.6 INSTALLATION OF SEALANTS

3.6.1 General: Prior to start of installation in each joint, verify the joint type according to the details in the Drawings, and verify that the required proportion of width of joint to depth of joint has been secured.

3.6.2 Equipment: Apply sealant under pressure with hand or power-actuated gun or other appropriate means. Guns shall have nozzle of proper size and shall provide sufficient pressure to completely fill joints as designed.

3.6.3 Masking: Thoroughly and completely mask all joints where the appearance of sealant on adjacent surfaces would be objectionable.

3.6.4 Installation of sealant: Install the sealant in strict accordance with the manufacturer's recommendations as approved by the Architect, thoroughly filling all joints to the recommended depth.

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3.6.5 Tooling: Tool all joints to the profile shown on the Details in the Drawings.

3.6.6 Cleaning up:

3.6.6.1 Remove masking tape immediately after joints have been tooled.

3.6.6.2 Clean adjacent surfaces free from sealant as the installation progresses. Use solvent or cleaning agent as recommended by the sealant manufacturer.

END OF SECTION

Section 08 11 00

METAL DOORS AND FRAMES

PART ONE – GENERAL

1.1 DESCRIPTION

1.1 Work included: Provide all standard and non-standard steel doors and steel door frames, complete in place, not specifically described in other Sections of these Specifications but indicated on the Drawings or otherwise required for a complete and operable facility.

1.1.2 Related work described elsewhere:

1.	Wood Doors	Section 08 14 29
2.	Door Hardware	Section 08 71 00
3.	Glazing	Section 08 80 00
4.	Painting	Section 09 91 00

1.2 CODES AND REFERENCES

1. 1.2.1 ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. FEMA P-361 2015/2021 – Design and Construction Guidance for Community Safe Rooms.
15. ICC 500 – 2014/2020 ICC/NSSA Standard for the Design and Construction of Storm Shelters.
16. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
17. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
18. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

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1.3 QUALITY ASSURANCE

1.3.1 Qualifications of manufacturer: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.

1.3.2 Qualifications of installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3.3 Single source: All work of this Section shall be produced by a single manufacturer unless otherwise approved by the Architect.

1.3.4 *Storm Shelter Openings:* Provide complete door systems for hurricane or tornado storm shelters, and other areas of refuge, complying and tested according to ICC 500 (2014/2020), ICC/NSSA Standard for the Design and Construction of Storm Shelters.

1. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

1.4 SUBMITTALS

1.4.1 General: Comply with provisions of Section 01 33 23.

1.4.2 Manufacturer's data: Within 30 calendar days after award of the Contract, submit:

1. Complete materials list of all items proposed to be furnished and installed under this Section.
2. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.
3. Shop Drawings showing details of each frame type, elevations of each door design type, details of all openings, and all details of construction, installation, and anchorage.
4. Manufacturer's recommended installation procedures.

The manufacturer's recommended installation procedures, when approved by the Architect, will become the basis for inspecting and accepting or rejecting actual installation procedures used on the Work.

1.5 PRODUCT HANDLING

1.5.1 Protection: Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed work and materials of all other trades.

1.5.2 Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

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PART TWO - PRODUCTS

2.1 STEEL DOORS (NON-LABELED)

Steel doors to be manufactured by Curries Manufacturing, Inc., Mason City, Iowa, or approved equal.

2.1.1 Model: Curries 707 Series Doors. Core materials for doors to be expanded polystyrene for insulated doors, permanently bonded to the inside of each face sheet.

2.1.2 Facesheets: Full flush 18 gauge cold rolled steel, stretcher-levelled quality of flatness.

2.1.3 Vertical edges of doors to have an exposed center seam.

2.1.4 Hinge and lock rail reinforcements: Hinge and lock rail shall be reinforced with a one piece full height 14 gauge channel. Both hinge and lock channels to be welded to each face sheet of the door.

2.1.5 Doors shall have a veveled (1/8” in 2”) lock edge and square hinge edge.

2.1.6 Finish to be phosphatized inside and out and factory coat of prime paint.

2.1.7 Top and bottom channels: 16 gauge top and bottom channels welded to door skins at 4" centers.

2.1.8 Closer reinforcement: Box type factory installed, 14 gauge.

2.1.9 Other reinforcement: All hardware shall have factory installed reinforcement as required for hardware specified and as approved by the Architect.

2.1.10 Glazing system: GBST steel in factory primed finish.

2.1.11 Channel fillers: Screw applied steel tap cap in toilet stall and exterior doors only.

2.1.12 Astragal: Overlapping, 14 gauge material.

2.2 STEEL FRAMES

Steel frames to be as manufactured by Curries Manufacturing, Inc., Mason City, Iowa, or approved equal.

2.2.1 Construction: 16 gauge in frame depths as detailed. Frames to be mitered, face welded and ground smooth. Plaster guards to be provided at all hinge and strike locations.

2.2.2 Hinge reinforcement: 7 gauge with a minimum of 4 projection welds per reinforcement.

2.2.3 Strike reinforcement: 14 gauge with tubulated screw holes.

2.2.4 Surface mounted hardware reinforcement: Min. 14 gauge.

2.2.5 Frame to be prepared for 4-1/2" x 4-1/2" standard weight or heavy weight hinges and strike plate as required for hardware specified.

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2.2.6 Anchors: Masonry or stud anchors at max. 24 inches o.c., suitable to specified wall conditions and as approved by the Architect.

2.2.7 Silencers: Three per strike jamb and two per head on double swing frames. Punch frames to receive silencers.

2.2.8 Finish: Factory installed one coat of rust inhibitive primer.

2.3 HOLLOW METAL DOOR AND SHUTTER ASSEMBLIES FOR STORM SHELTERS

A. General: Provide complete tornado or hurricane storm shelter resistant assemblies constructed, test, and listed/labeled to resist the design pressures for components and cladding and missile impact resistance as described in ICC 500 (2014/2020), ICC/NSSA Standard for the Design and Construction of Storm Shelters.

1. Door and shutter systems, tested and complying with ICC 500 (2014/2020) and FEMA P-361 (2015/2021), Design and Construction Guidance for Community Safe Rooms and supported by third party test results.
2. Sheets fabricated on exterior openings from commercial quality hot dipped zinc coated steel complying with ASTM A924 A60. Gauges to be in accordance with manufacturers tested assemblies.
3. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
4. Top Edge: Reinforce top of doors with a continuous steel channel extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached and welded in place with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
6. Replaceable Glass System: Provide a field replaceable glass system certified to UL10C and ICC 500 2014 and 2020. Glass shall be Vetrotech Ultimax 90, 2-3/16” thick available in 10” x 10” or 4” x 25” sizes fire rated up to 90-minutes with a 227 psf design pressure for hurricane and 284 psf design pressure for tornado openings and a 15 lb. 2 x 4 at 100mph impact resistance.

B. Manufacturers Basis of Design:

1. CECO Door Products (C) - StormPro Series.
2. Curries Company (CU) - StormPro Series.
3. Steelcraft (S).

2.4 FRAMES FOR STORM SHELTERS

A. General: Subject to the same compliance standards and requirements as standard hollow metal frames, provide complete tornado or hurricane storm shelter resistant assemblies tested and labeled as complying with ICC 500 (2014/2020) and FEMA P-361 (2015/2021) and supported by third party test listings.

1. Fabricate exterior frames from 14 gauge hot dipped zinc coated steel that complying with ASTM designations A924 A60.
2. Manufacturers Basis of Design:
   a. CECO Door Products (C) - StormPro Series.
   b. Curries Company (CU) - StormPro Series.

2.5 FIRE RATED DOOR ASSEMBLIES

2.5.1 All labeled fire door assemblies to be of a type which have been classified and listed in accordance with the latest edition of NFPA80 and tested in compliance with NFPA-252, UL-10B, and UBC-7-2. A physical label to be affixed to the fire door at an authorized facility. Embossed labels are acceptable on standard three sided door frames.

2.5.2 For openings required to be fire rated exceeding limitations of labeled assemblies, submit manufacturer's certification that each door and frame assembly has been constructed to conform to design, materials, and construction equivalent to requirements for labeled construction.

2.6 FABRICATION

2.6.1 General:

2.6.1.1 Fabricate steel door and frame units to rigid, neat in appearance and free from defects, warp or buckle. Accurately form metal to required sizes and profiles.

2.6.1.2 Wherever practicable, fit and assemble units in the manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at the site.

PART THREE - EXECUTION

3.1 INSPECTION

Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

3.2.1 General: Install hollow metal units and accessories in accordance with manufacturer's data, and as specified herein.

3.2.2 Placing frames:

3.2.2.1 Comply with the provisions of Standard 100 of the Steel Door Institute, unless otherwise indicated.

3.2.2.2 Except for frames located at in-place concrete or masonry openings, place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.

3.2.2.3 In masonry construction, locate wall anchors at 24" o.c. at hinge and strike levels. Building-in of anchors and grouting of frames will be performed under provisions of Division 4 of these Specifications.

3.2.2.4 At in-place concrete or masonry construction, set frames and secure to adjacent construction with machine screws and masonry anchorage devices. If attached with screws, provide "Z" fillers at each screw location to prevent collapse or distortion of frame when screws are tightened.

3.2.2.5 When installed in prepared openings in concrete or masonry construction, install sealant between frame and concrete or masonry in compliance with the requirements of Section 07920.

3.2.2.6 Place 5/8" glazing stops where required and screw at 12" o.c. maximum.

3.2.3 Door installation:

3.2.3.1 Fit doors accurately in their respective frames, within clearances specified in S.D.I. 100.

3.3 ADJUST AND CLEAN

3.3.1 Final adjustments: Check and readjust operating finish hardware items in hollow metal work just prior to final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames which are warped, bowed or otherwise damaged.

3.3.2 Prime coat touch-up: Immediately after erection, sand smooth all rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

END OF SECTION

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Section 08 14 29

WOOD DOORS

PART ONE - GENERAL

1.1 DESCRIPTION

A. Work included: Furnish and deliver to the job site all wood doors, factory prefinished, indicated on the Drawings, specified herein, or needed for a complete and proper installation.

B. Related work described elsewhere:

1.	Installing Wood Doors	Section 06 20 00
2.	Standard Steel Frames	Section 08 11 00
3.	Door Hardware	Section 08 71 00
4.	Glazing	Section 08 80 00

1.2 QUALITY ASSURANCE

A. Qualifications of manufacture: All wood doors shall meet the requirements of the industry standard WDMA I.S.1-A or AWS classifications. Fire doors shall also bear the UL label for the designated rating.

1.3 SUBMITTALS

A. General: Comply with the provisions of Section 01 33 23.

B. Product data: Within 30 calendar days after award of Contract, submit:

1. Complete materials list showing all items proposed to be furnished and delivered under this Section.
2. Sufficient data to demonstrate that all such items meet or exceed the specified requirements.
3. A copy of the guarantee proposed to be furnished.

1.4 WARRANTY

A. Upon delivery of the doors of this Section to the job site, and as a condition of their acceptance, deliver to the Architect two copies of an agreement written on the door manufacturer's standard form, signed by the door manufacturer and the Contractor agreeing to replace or repair defective doors which have warped (bow, cup, or twist) or which show photographing of construction below in wood veneer faces, as defined in WDMA Standard Door Warranty, except the WDMA provision for refunding the price received by the door manufacturer for any defective door shall not apply. The warranty shall also include refinishing and reinstalling which may be required due to repair or replacement of defective doors. Warranty shall be in effect for the lifetime of the building.

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1.5 PRODUCT HANDLING

A. Protection:

1. Protect the materials of this Section during transit, storage, and handling to prevent deterioration, damage, and soiling.
2. Package each door at the factory in a separate heavy paper-type carton. Mark each carton for location to correspond with opening number on the Drawings.
3. Replacements: In the event of damage, immediately make all repairs and replacements necessary to approval of the Architect and at no additional cost to the Owner.

PART TWO - PRODUCTS

2.1 GENERAL

A. Manufacturer: All doors are to be manufactured by Graham Wood Doors, Mason City, Iowa or approved equal. Size and thickness as shown on the Drawings.

B. Face: Premium grade, rotary cut, select white birch with matching veneers on all vertical stiles. 1/50" veneer thickness, grade A veneer. All doors shall be factory prefinished. Finish shall be as selected by the Architect from the manufacturers standard finishes.

C. Rails: 1-1/8" minimum top and bottom rails. 1-3/8" minimum hinge and lock stiles. Stiles and rails shall be laminated strand lumber. Stiles are to have a minimum 1/4" solid edge to match face veneer. Tape veneer not allowed.

D. Fixed Panels: All transom and plenum panels shall have continuous matched grain with the operating door veneer.

E. Standards: Doors to meet or exceed WDMA Industry Standard I.S. 1-A Series Type P.C. for non-fire rated doors, Type FD 1-1/2, 1, or 3/4 for fire rated doors, and type SR for sound rated doors.

2.2 NON-FIRE RATED WOOD DOORS

A. PC5 Particleboard Core. Core shall be fully bonded. Drop-in cores not allowed.

2.3 FIRE RATED DOORS (IF REQUIRED)

A. Mineral Core FD-90, FD-60, and FD-45 as required. Refer to door schedule for exact types required. All fire doors to meet the requirements of the current building code. Provide concealed intumescent as standard on minderal core doors.

2.4 GLAZED OPENINGS

A. Metal stops and frames shall be factory primed and removable for painting (according to Section 09 91 00 - Painting) and installation of glazing by glazing contractor.

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2.5 BLOCKING

A. Non-Rated and 20 Minute Doors:

1. Provide 5” top-rail blocking at doors indicated to have closers.
2. Provide 5” mid-rail blocking at doors indicated to have exit devices.

B. Fire Rated Doors over 20 Minutes:

1. For mineral core doors, provide composite blocking with improved screw holding capability approved for use in doors of fire ratings indicated as necessary to eliminate need for through-bolting hardware and as follows:
   a. Provide 5” top rail blocking.
   b. Provide 5” bottom rail blocking at doors indicated to have kick, mop, or armor plates.
   c. Provide 4 1/2” x 10” lock blocks.
   d. Provide 5” mid-rail blocking, at doors indicated to have exit devices.

2.6 FABRICATION

A. Factory fit doors to suit frame opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with requirements of NFPA 80 for fire rated doors.

B. Factory machine doors for hardware that is not surface applied. Comply with the final hardware schedules, door frame shop drawings, DHI A115-W series standards and hardware templates.

1. Coordinate locations with metal frames.
2. Machine metal astragals for hardware, sized to openings.

PART THREE - EXECUTION

3.1 DELIVERY

A. Deliver the work of this Section to the job site in a timely manner to permit orderly progress of the total Work.

3.2 INSTALLATION

A. Installation of the Work of this Section is described in Section 06 20 00.

END OF SECTION

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Section 08 41 00

ENTRANCES AND STOREFRONT

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide all aluminum entrances and storefront complete, in place, as indicated on the Drawings, specified herein, or otherwise needed for a complete and proper installation of the Work of this Section.

1.1.2 Related work described elsewhere:

1.	Brick Masonry	Section 04 21 13
2.	Concrete Unit Masonry	Section 04 22 00
3.	Joint Sealants	Section 07 92 00
4.	Glazing	Section 08 80 00

1.1.3 This specification is written using Kawneer Co., Inc. products. Acceptable manufacturers (following Kawneer Co., Inc. specifications for manufacturing):

1. Tubelite, Walker, MI
2. Oldcastle, Atlanta, GA
3. EFCO, Monett, MO
4. Manko, Manhattan, KS
5. YKK

1.2 QUALITY ASSURANCE

1.2.1 Qualification of manufacturer: Use products in the work of this Section produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.

1.2.2 Qualifications of installers: Use skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.

1.2.3 Source Limitations: Obtain aluminum framed storefront and doors through one source from a single manufacturer.

1.3 SUBMITTALS

1.3.1 General: Comply with the requirements of Section 01 33 23.

1.3.2 Prompt data: No later than 30 calendar days after award of the contract, submit:

1. Complete materials list of all items proposed to be furnished and installed under this Section.
2. Sufficient data to demonstrate compliance with all specified requirements.
3. Shop Drawings of the entire installation.
4. Samples of the specified finish.

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5. Manufacturer's recommended methods of installation which, when approved by the Architect, will become the basis for inspecting and accepting or rejecting actual installation methods used on the job.

1.4 PRODUCT HANDLING

1.4.1 Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.

1.4.2 Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART TWO – PRODUCTS

2.1 ENTRANCE UNIT

Series 500 (wide stile):

2.1.1 Materials: Extrusions shall be 6063-T6 alloy and temper (ASTM B 221 alloy G.S. 10A-T5). Fasteners, where exposed, shall be aluminum, stainless steel or plated steel in accordance with ASTM A 164. Perimeter anchors shall be aluminum or steel, providing the steel is properly isolated from the aluminum. Glazing gaskets shall be EPDM elastomeric extrusions. Major portions of the door stiles shall be .125" (3.2) in thickness and glazing molding shall be .050" (1.2) thick.

2.1.2 Finish: All exposed framing surfaces shall be free of scratches and other serious blemishes using a multi-stage cleaning process to remove organic and inorganic surface soils and residual oxides. The cleaned and treated substrate shall be primed with Fluroprime to a thickness of .2 - .4 mils using Valspar approved factory application methods. The Fluropon paint system shall be factory applied and oven baked.

2.1.3 Hardware: Refer to Section 08 71 00 – Door Hardware.

2.1.4 Fabrication: The door stile and rail face dimensions of the 500 entrance door will be as follows:

DOOR	VERTICAL STILE	TOP RAIL	BOTTOM RAIL
500	5 - 1/32"	5 - 1/32"	10”

Corner construction shall consist of mechanical clip fastening, SIGMA deep penetration and fillet welds. Glazing stops shall be snap-in type with EPDM glazing gaskets.

The door weathering on the single acting offset pivot shall be Kawneer Sealair weathering. The door bottom rail will be weathered with an EPDM blade gasket sweep strip applied with concealed fasteners.

2.2 STOREFRONT

Series Tri-fab 451T (2" x 4 1/2") with center set glazing:

2.2.1 Materials: Extrusions shall be 6063-T6 alloy and temper (ASTM B221 alloy G.S. 10A-T5). Fasteners, where exposed, shall be aluminum, stainless steel or zinc plate steel in accordance with ASTM A164. Perimeter anchors shall be aluminum or steel, providing the steel is properly isolated from the aluminum. Glazing gaskets shall be EPDM elastomeric extrusions. Single acting entrance frame weathering shall be a non-porous, polymeric material.

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2.2.2 Finish: All exposed framing surfaces shall be free of scratches and other serious blemishes using a multi-stage cleaning process to remove organic and inorganic surface soils and residual oxides. The cleaned and treated substrate shall be primed with Fluroprime to a thickness of .2 - .4 mils using Valspar approved factory application methods. The Fluropon paint system shall be factory applied and oven baked.

2.2.3 Fabrication: The framing system shall provide for flush glazing on all sides with no projecting stops. Vertical and horizontal framing members shall have a nominal face dimension of 1-3/4" (44.5 mm). Overall depth shall be 4" (101.6 mm). All exterior face members will be seamless. Entrance framing members shall be compatible with glass framing in appearance and single acting entrance frames shall include the Sealair positive barrier weathering.

PART THREE - EXECUTION

3.1 ENTRANCE UNIT

3.1.1 Installation: All jambs, head and sill track shall be set in correct locations as shown in the details and shall be level, square, plumb and in alignment with other work in accordance with the manufacturer's installation instructions and approved shop drawings. All joints between framing and the building structure shall be sealed in order to secure a watertight installation.

3.1.2 Protection and cleaning: After installation, the General Contractor shall adequately protect exposed portions of aluminum surfaces from damage by grinding and polishing compounds, plaster, lime, acid, cement, or other contaminants. The General Contractor shall be responsible for final cleaning.

3.2 STORE FRONT

3.2.1 Installation: All glass framing shall be set in correct locations as shown in the details and shall be level, square, plumb and in alignment with other work in accordance with the manufacturer's installation instructions and approved shop drawings. All joints between framing and the building structure shall be sealed in order to secure a watertight installation.

3.2.2 Protection and cleaning: After installation, the General Contractor shall adequately protect exposed portions of aluminum surfaces from damage by grinding and polishing compounds, plaster, lime, acid, cement, or other contaminates. The General Contractor shall be responsible for final cleaning.

END OF SECTION

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Section 08 54 00

STORM SHELTER THERMAL
WINDOW SYSTEMS

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide all shelter thermal window systems complete in place, as indicated on the Drawings, specified herein, or otherwise needed for a complete and proper installation of the work of this Section.

1.2 QUALITY ASSURANCE

1.2.1 Qualification of manufacturer: Use products in the work of this Section produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.

1.2.2 Qualifications of installers: Use skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

1.3.1 General: Comply with the requirements of Section 01 33 23.

1.3.2 Prompt data: No later than 30 calendar days after award of the contract, submit:

1. Complete materials list of all items proposed to be furnished and installed under this Section.
2. Sufficient data to demonstrate compliance with all specified requirements.
3. Shop Drawings of the entire installation.
4. Samples of the specified finish.
5. Manufacturer's recommended methods of installation which, when approved by the Architect, will become the basis for inspecting and accepting or rejecting actual installation methods used on the job.

1.4 PRODUCT HANDLING

1.4.1 Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.

1.4.2 Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

1.5 WARRANTY

1.5.1 Warranty Period: One (1) year from date of Substantial Completion.

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PART TWO - PRODUCTS

2.1 COMPOSITE WINDOWS

2.1.1 Provide StormDefend storm shelter windows, as manufactured by Insulgard Security Products or Architect approved equal. Window system is designed and certified for use in tornado safe rooms/storm shelters meeting FEMA P361-15 and ICC 500-2020 standards.

2.1.2 6” framing system with 2” thick TOR-GARD 30-IG glass.

2.1.3 Provide factory-applied AAMA 611 anodized and AAMA 2605 PVDF finishes.

PART THREE - EXECUTION

3.1 INSPECTION

Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 ERECTION

All windows shall be set true and plumb by skilled mechanics in prepared openings and securely anchored in place in accordance with detailed approved shop drawings and approved manufacturer's instructions.

3.3 ADJUSTING AND CLEANING

3.3.1 Make final adjustment after installation is complete to see that ventilator operation, locking mechanism, and screen installation and removal procedures are as intended by the manufacturer.

3.3.2 Just prior to final inspection, remove labels from glass panes and thoroughly clean all glass and aluminum surfaces of all stains, dirt, oils and other foreign matter. Clean mortar stains immediately after the mortar gets on surfaces.

3.3.3 Sealants are specified under Section 07 92 00. Use G.E. Silpruf or equal. Vulcum is not acceptable.

END OF SECTION

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SECTION 08 71 00
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for aluminum and wood doors.

B. Thresholds.

C. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

A. Section 08 41 00 – Entrances and Storefront.

B. Section 08 14 29 - Wood Doors.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. 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; 2026.

C. BHMA A156.1 - Standard for Butts and Hinges; 2025.

D. BHMA A156.2 - Bored and Preassembled Locks and Latches; 2022.

E. BHMA A156.3 - Exit Devices; 2025.

F. BHMA A156.4 - Door Closers and Pivots; 2024.

G. BHMA A156.5 - Cylinders and Input Devices for Locks; 2020.

H. BHMA A156.6 - Standard for Architectural Door Trim; 2021.

I. BHMA A156.7 - Template Hinge Dimensions; 2022.

J. BHMA A156.16 - Standard for Auxiliary Hardware; 2023.

K. BHMA A156.21 - Thresholds; 2025.

L. BHMA A156.22 - Standard for Gasketing; 2021.

M. BHMA A156.28 - Standard for Recommended Practices for Mechanical Keying Systems; 2023.

N. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.

O. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames; 2006.

P. DHI (KSN) - Keying Systems and Nomenclature; 2019.

Q. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

R. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

S. ITS (DIR) - Directory of Listed Products; Current Edition.

T. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025, with Amendment (2024).

U. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2025.

V. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

W. UL (DIR) - Online Certifications Directory; Current Edition.

X. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

Y. UL 437 - Standard for Key Locks; Current Edition, Including All Revisions.

Z. UL 1037 - Antitheft Alarms and Devices; Current Edition, Including All Revisions.

AA. UL 1610 - Central-Station Burglar-Alarm Units; Current Edition, Including All Revisions.

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1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Sequence installation to ensure facility services connections are achieved in an orderly and expeditious manner.

C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; require attendance by affected installers and the following:
   1. Architect.
   2. Installer's Architectural Hardware Consultant (AHC).
   3. Hardware Installer.
   4. Owner's Security Consultant.

D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

E. Keying Requirements Meeting:
   1. Schedule meeting at project site prior to Contractor occupancy.
   2. Attendance Required:
      a. Contractor.
      b. Owner.
      c. Door Hardware Installer.
      d. Owner's Security Consultant.
   3. Agenda:
      a. Establish keying requirements.
      b. Verify locksets and locking hardware are functionally correct for project requirements.
      c. Verify that keying and programming complies with project requirements.
      d. Establish keying submittal schedule and update requirements.
   4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
   5. 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.
   6. Deliver established keying requirements to manufacturers.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Manufacturer's Instructions: Indicate special procedures and perimeter conditions requiring special attention.

C. Operation and Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

D. Executed Warranty.

1.06 QUALITY ASSURANCE

A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.08 WARRANTY

A. See Section 01 77 19 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide manufacturer warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.

1. Closers: Five years.
2. Exit Devices:
   a. Mechanical: Five years.
   b. Electrical: Two years.
3. Locksets:
   a. Mechanical: Ten years.
4. Cylinders: Three years.
5. Other Hardware: Two years.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Closers:
   1. Provide door closer on each exterior door, unless otherwise indicated.
   2. Provide door closer on each fire-rated and smoke-rated door.
   3. Spring hinges are not an acceptable self-closing device, unless otherwise indicated.

D. Drip Guards: Provide at head of outswinging exterior doors unless protected by roof or canopy directly overhead.

E. Weatherstripping and Gasketing:

F. Fasteners:
   1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
      a. Aluminum fasteners are not permitted.
      b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
   2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
      a. Self-drilling (Tek) type screws are not permitted.
   3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
   4. Provide wall grip inserts for hollow wall construction.
   5. Fire-Resistance-Rated Applications: Comply with NFPA 80.
      a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
      b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.02 PERFORMANCE REQUIREMENTS

A. Provide door hardware products that comply with the following requirements:
   1. Applicable provisions of federal, state, and local codes.
   2. Accessibility: ADA Standards and ICC A117.1.
   3. Fire-Resistance-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
   4. Hardware on Fire-Resistance-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.
   5. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
   6. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
   7. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

2.03 HINGES

A. Manufacturers: Conventional butt hinges.
   1. BEST, dormakaba Group: www.bestaccess.com/#sle.

2. Substitutions: Upon Architect approval.

B. Manufacturers: Continuous hinges.
   1. BEST, dormakaba Group: www.bestaccess.com/#sle.
   2. Substitutions: Upon Architect approval.

C. Properties:
   1. Butt Hinges: As applicable to each item specified.
      a. Template screw hole locations.
      b. Bearing assembly installed after plating.
      c. Bearings: Exposed fully hardened bearings.
      d. Bearing Shells: Shapes consistent with barrels.
      e. Pins: Easily seated, non-rising pins.
         1) Fully plate hinge pins.
         2) Non-Removable Pins: Slotted stainless steel screws.
      f. UL 10C listed for fire-resistance-rated doors.
   2. Continuous Hinges: As applicable to each item specified.
      a. Geared Continuous Hinges: As applicable to each item specified.
         1) Non-handed.
         2) Anti-spinning through-fastener.
         3) UL 10C listed for fire-resistance-rated doors.
            (a) Metal Door Installation: Rated up to 90 minutes.
            (b) Wood Door Installation: Rated up to 60 minutes.
         4) Sufficient size to permit door to swing 180 degrees

D. Sizes: See Door Hardware Schedule.

E. Finishes: See Door Hardware Schedule.
   1. Fully polish hinges; front, back, and barrel.

F. Grades:
   1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.

G. Material: Base metal as indicated for each item by BHMA material and finish designation.

H. Types:
   1. Butt Hinges: Include full mortise hinges.
   2. Continuous Hinges: Include geared hinges.

I. Options: As applicable to each item specified.
   1. Provide an access panel built into the hinge to allow for access to through wires (CE-12EA).

J. Quantities:
   1. Butt Hinges: Three (3) hinges per leaves up to 90 inches (2286 mm) in height. Add one (1) for each additional 30 inches (762 mm) in height or fraction thereof.
      a. Hinge weight and size unless otherwise indicated in hardware sets:
         1) For doors up to 36 inches (914 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.134 inch (3.4 mm) and a minimum of 4-1/2 inches (114 mm) in height.
         2) For doors from 36 inches (914 mm) wide up to 42 inches (1067 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.145 inch (3.7 mm) and a minimum of 4-1/2 inches (114 mm) in height.
         3) For doors from 42 inches (1067 mm) wide up to 48 inches (1219 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.180 inch (4.6 mm) and a minimum of 5 inches (127 mm) in height.
         4) For doors greater than 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.180 inch (4.6 mm) and a minimum of 5 inches (127 mm) in height.
   2. Continuous Hinges: One per door leaf.

K. Applications: At swinging doors.

1. Provide non-removable pins at out-swinging doors with locking hardware and all exterior doors.

L. Products:
   1. Butt Hinges:
      a. Ball Bearing, Five (5) Knuckle.
   2. Continuous Hinges:
      a. Aluminum geared hinges.

2.04 EXIT DEVICES

A. Manufacturers:
   1. Von Duprin; Allegion PLC:https://www.vonduprin.com/en/index.html
   2. Substitutions: Not permitted.

B. Properties:
   1. Actuation: Full-length touchpad.
   2. Chassis:
      a. Construction: Investment cast steel, zinc dichromate plated.
      b. Compatibility: Standard Stile and Narrow Stile doors.
   3. Latch Bolts: Stainless steel deadlocking with 3/4 inch (19 mm) projection using latch bolt.
   4. Lever Trim:
   5. Cylinder: Include where cylinder dogging or locking trim is indicated.
   6. Strike as recommended by manufacturer for application indicated.
   7. Sound dampening on touch bar.
   8. Dogging:
      a. Non-Fire-Resistance-Rated Devices: hex key dogging.
      b. Fire-Resistance-Rated Devices: Manual dogging not permitted.
   9. Touch bar assembly on wide style exit devices to have a 1/4 inch (6.3 mm) clearance to allow for vision frames.
   10. All exposed exit device components to be of architectural metals and “true” architectural finishes.
   11. Handing: Field-reversible.
   12. Fasteners on Back Side of Device Channel: Concealed - exposed fasteners not allowed.
   13. Vertical Latch Assemblies' Operation: Gravity, without use of springs.

C. Grades: Complying with BHMA A156.3, Grade 1.
   1. Provide exit devices tested and certified by UL or by a recognized independent laboratory for mechanical operational testing to 10 million cycles minimum with inspection confirming Grade 1 Loaded Forces have been maintained.

D. Products:
   1. Von Duprin, 99Series

2.05 LOCK CYLINDERS

A. Manufacturers:
   1. BEST, dormakaba Group: www.bestaccess.com/#sle.
   2. Substitutions: Not permitted.

B. Properties:
   1. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
      a. Provide cylinders from same manufacturer as locking device.
      b. Provide cams and/or tailpieces as required for locking devices.
      c. Provide cylinders with appropriate format interchangeable cores where indicated.

C. Grades:
   1. Standard Security Cylinders: Comply with BHMA A156.5.

D. Material:

E. Types: As applicable to each item specified.
   1. Standard security small format interchangeable core (SFIC) type cylinders, with seven-pin, cores.

F. Applications: At locations indicated in hardware sets, and as follows
   1. As required for items with locking devices provided by other sections, including at elevator controls and cabinets.
      a. When provisions for lock cylinders are referenced elsewhere in the Project Manual to this Section, provide compatible type of lock cylinder, keyed to building keying system, unless otherwise indicated.

G. Products:
   1. Rim/mortise.

2.06 MORTISE LOCKS

A. Manufacturers:
   1. BEST, dormakaba Group: www.bestaccess.com/#sle.
   2. Substitutions: Not permitted.

B. Properties:
   1. Mechanical Locks: Manufacturer's standard.
      a. Fitting modified ANSI A115.1 door preparation.
      b. Door Thickness Coordination Fitting 1-3/4 inch (44 mm) to 2-1/4 inch (57 mm) thick doors.
      c. Latch: Solid, one-piece, anti-friction, self-lubricating stainless steel.
         1) Latchbolt Throw: 3/4 inch (19 mm), minimum.
      d. Auxiliary Deadlatch: One piece stainless steel, permanently lubricated.
      e. Backset: 2-3/4 inch (70 mm).
      f. Lever Trim:
         1) Functionality: Allow the lever handle to move up to 45 degrees from horizontal position prior to engaging the latchbolt assembly.
         2) Strength: Locksets outside locked lever designed to withstand minimum 1,400 inch-lbs (158.2 Nm) of torque. In excess of that, a replaceable part will shear. Key from outside and/or inside lever will still operate lockset.
         3) Spindle: Designed to prevent forced entry from attacking of lever.
         4) Independent spring mechanism for each lever.
            (a) Trim to be self-aligning and thru-bolted.

C. Finishes: See Door Hardware Schedule.
   1. Core Faces: Match finish of lockset.

D. Products: Mortise locks, including standard and electrified types.
   1. BEST, 45H Series.

2.07 CYLINDRICAL LOCKS

A. Manufacturers:
   1. BEST, dormakaba Group: www.bestaccess.com/#sle.
   2. Substitutions: Not permitted.

B. Properties:
   1. Mechanical Locks:
      a. Fitting modified ANSI A115.2 door preparation.
      b. Door Thickness Fit: 1-3/8 inches (35 mm) to 2-1/4 inches (57 mm) thick doors.
      c. Construction: Hub, side plate, shrouded rose, locking pin to be a one-piece casting with a shrouded locking lug.
         1) Through-bolted anti-rotational studs.
      d. Cast stainless steel latch retractor with roller bearings for exceptionally smooth operation and superior strength and durability.
      e. Bored Hole: 2-1/8 inch (54 mm) diameter.
      f. Backset: 2-3/4 inches (70 mm) unless otherwise indicated.
      g. Latch: Single piece tail-piece construction.
         1) Latchbolt Throw: 9/16 inch (14.3 mm), minimum.
      h. Cylinders:
         1) Cylinder Core Types: Locks capable of supporting manufacturers' cores, as applicable.
            (a) Small format interchangeable.
      i. Lever Trim:

1) Style: See Door Hardware Schedule.
2) Functionality: Allow the lever handle to move up to 45 degrees from horizontal position prior to engaging the latchbolt assembly.
3) Strength: Locksets outside locked lever designed to withstand minimum1,400 inch-lbs (158.2 Nm) of torque. In excess of that, a replaceable part will shear. Key from outside and/or inside lever will still operate lockset.
4) Independent spring mechanism for each lever.
(a) Contain lever springs in the main lock hub.
5) Outside Lever Sleeve: Seamless one-piece construction.
6) Keyed Levers: Removable only after core is removed by authorized control key.

C. Finishes: See Door Hardware Schedule.
1. Core Faces: Match finish of lockset.

D. Grades: Comply with BHMA A156.2, Grade 1, Series 4000, Operational Grade 1, Extra Heavy Duty.
1. Durability: Passing 100 Million cycle tests verified by third party testing agency.

E. Material: Manufacturer's standard for specified lock.
1. Critical Latch and Chassis Components: Brass or corrosion-resistance treated steel.
2. Outside Lever Sleeve: Hardened steel alloy.

F. Products: Cylindrical locks, including mechanical and electrified types.
1. BEST, 9K Series.

2.08 CLOSERS

A. Manufacturers:
1. LCN; Allegion PLC: https://www.lcnclosers.com/en/index.html
2. Substitutions: Not permitted.

B. Properties:
1. Surface Mounted Closers: Manufacturer's standard.
a. Construction: Cast iron.
b. Maximum Projection from Face of Door: 2-7/16 inches (62 mm).
c. Mechanism: Separate tamper-resistant adjusting valves for closing and latching speeds.
1) Include delayed action feature.
d. Hydraulic Fluid: All-weather type.
e. Arm Assembly: Standard for product specified.
1) Include hold-open, integral stop, or spring-loaded stop feature, as specified in Door Hardware Schedule.
2) Parallel arm to be a heavy-duty rigid arm.
3) Where “IS” or “S-IS” arms are specified in hardware sets, if manufacturer does not offer this arm provide a regular arm mount closer in conjunction with a heavy-duty overhead stop equal to a dormakaba 900 Series.
f. Covers:
1) Type: Standard for product selected.
(a) Full.
2) Material: Plastic.
3) Finish: Painted.
4) Attachment: Two-point flange mounting, dual-clamp friction fit closer cover.

C. Grades:
1. Closers: Comply with BHMA A156.4, Grade 1.
a. Underwriters Laboratories Compliance:
1) Product Listing: UL (DIR) and ULC for use on fire-resistance-rated doors.
(a) UL 228 - Door Closers-Holders, With or Without Integral Smoke Detectors.

D. Types:
1. Rack-and-pinion, surface-mounted. 1-1/2 inches (38 mm) minimum bore.

E. Options:

1. Advanced backcheck.

F. Installation:
1. Mounting: Includes surface mounted and concealed, overhead mounted installations.
2. Mount closers on non-public side of door and stair side of stair doors unless otherwise noted in hardware sets.
3. At outswinging exterior doors, mount closer on interior side of door.
4. Provide adapter plates, shim spacers, and blade stop spacers as required by frame and door conditions.
5. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.

G. Products:
1. Surface Mounted:
a. LCN, 4040XP

2.09 PROTECTION PLATES

A. Manufacturers:
1. ABH; ABH Manufacturing Inc.: https://www.abhmfg.com/.
2. Substitutions: Upon Architect approval.

B. Properties:
1. Plates:
a. Kick Plates: Provide along bottom edge of push side of every wood door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
b. Edges: Beveled, on four (4) unless otherwise indicated.

C. Grades: Comply with BHMA A156.6.

D. Material: As indicated for each item by BHMA material and finish designation.
1. Metal Properties: Stainless steel.

E. Installation:
1. Fasteners: Countersunk screw fasteners

F. Products:

2.10 STOPS AND HOLDERS

A. Manufacturers:
1. Architectural Builders Hardware Manufacturing, Inc (ABH): www.abhmfg.com/#sle.
2. Substitutions: Upon Architect approval.

B. General: Provide overhead stop/holder when wall or floor stop is not feasible.

C. Grades:
1. Door Holders, Wall Bumpers, and Floor Stops: Comply with BHMA A156.16 and Resilient Material Retention Test as described in this standard.

D. Material: Base metal as indicated for each item by BHMA material and finish designation.

E. Types:
1. Wall Bumpers: Bumper, concave, wall stop.

F. Installation:
1. Non-Masonry Walls: Confirm adequate wall reinforcement has been installed to allow lasting installation of wall bumpers.

G. Products:
1. Wall Bumpers.

2.11 THRESHOLDS

A. Manufacturers:
1. National Guard Products, Inc (NGP): www.ngpinc.com/#sle.
2. Substitutions: Upon Architect approval.

B. Properties:
1. Threshold Surface: Fluted horizontal grooves across full width.

C. Threshold Grades: Comply with BHMA A156.21.

D. Types: As applicable to project conditions. Provide barrier-free type at every location where specified.

E. Products:

2.12 WEATHERSTRIPPING AND GASKETING

A. Manufacturers:
   1. National Guard Products, Inc (NGP): www.ngpinc.com/#sle.
   2. Substitutions: Upon Architect approval.

B. Properties:
   1. Weatherstripping Air Leakage Performance: Not exceeding 0.3 cfm/sq ft of door opening at 0.3 inches of water pressure differential for single doors, and 0.5 cfm/sq ft) of door area at 0.3 inches of water pressure differential for double doors for gasketing other than smoke control, as tested according to ASTM E283/E283M; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

C. Grades: Comply with BHMA A156.22.

D. Products:
   1. Weatherstripping: See Door Hardware Schedule.
   2. Door Bottom Seals:
      a. Door Sweeps: See Door Hardware Schedule.

2.13 KEYS AND CORES

A. Manufacturers:
   1. BEST, dormakaba Group: www.bestaccess.com/#sle.
   2. Substitutions: Not permitted.

B. Properties: Complying with guidelines of BHMA A156.28.
   1. Provide small format interchangeable core.
   2. Provide Patented CORMAX keys and cores.
   3. Provide keying information in compliance with DHI (KSN) standards.
   4. 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.
   5. Keying: Master keyed.
   6. Include construction keying and control keying with removable core cylinders.
   7. Supply keys in following quantities:
      a. Master Keys: 4 each.
      b. Construction Master Keys: 6 each.
      c. Construction Keys: 15 each.
      d. Construction Control Keys: 2 each.
      e. Control Keys if New System: 2 each.
   8. Provide key collection envelopes, receipt cards, and index cards in quantity suitable to manage number of keys.
   9. Deliver keys with identifying tags to Owner by security shipment direct from manufacturer.
   10. Permanent Keys and Cores: Stamped with applicable key marking for identification. Do not include actual key cuts within visual key control marks or codes. Stamp permanent keys "Do Not Duplicate."
   11. Include installation of permanent cores and return construction cores to hardware supplier. Construction cores and keys to remain property of hardware supplier.

C. Products:
   1. Patented:
      a. CORMAX.

2.14 KEY CABINETS

A. Manufacturers:
   1. Lund Equipment Company, Inc: www.lundkey.com/#sle.
   2. Telkee: www.telkee.com/#sle.
   3. Substitutions: Upon Architect approval.

B. Properties:.
   1. Key Management System: For each keyed lock on project, provide one set of consecutively numbered duplicate key tags with hanging hole and snap catch.
   2. Security Key Tags: For each keyed lock on project, provide one set of matching key tags for permanent attachment to one key of each set.
   3. Provide key collection envelopes, receipt cards, and index cards in quantity suitable to manage number of keys.
   4. Mounting: Wall surface mounted.
   5. Capacity: Actual quantity of keys, plus 25 percent additional capacity.
   6. Key cabinet lock to facility's keying system.

C. Finishes: Baked enamel, manufacturer's standard color.

D. Material: Sheet steel.

E. Products:
   1. Lund
   2. Telkee

2.15 FIRE DEPARTMENT LOCKBOXES

A. Manufacturers:
   1. Knox Company; Knox-Box Rapid Entry System: www.knoxbox.com/#sle.

B. Properties:
   1. Heavy-duty, recessed, solid steel box with hinged door and interior gasket seal; single drill-resistant lock with dust covers and tamper alarm.
   2. Capacity: Holds 10 keys.
   3. Construction complying with UL 1037, UL 1610, and UL 437.

C. Finishes: Manufacturer's standard coating.
   1. Color: Manufacturer's standard dark bronze.

D. Options:. As applicable to each item specified.

E. Products:
   1. Knox

2.16 FINISHES

A. Finishes: Identified in Hardware Sets.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

B. Correct all defects prior to proceeding with installation.

C. Verify that electric power is available to power operated devices and of correct characteristics.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Install hardware using the manufacturer’s fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use “Riv-Nuts” or similar products.

C. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.

D. Install hardware for smoke and draft control doors in accordance with NFPA 105.

E. Use templates provided by hardware item manufacturer.

F. Do not install surface mounted items until application of finishes to substrate are fully completed.

G. Wash down masonry walls and complete painting or staining of doors and frames.

H. Complete finish flooring prior to installation of thresholds.

I. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
   1. Mounting heights in compliance with ADA Standards:
      a. Locksets: 40-5/16 inch (1024 mm).
      b. Push Plates/Pull Bars: 42 inch (1067 mm).
      c. Deadlocks (Deadbolts): 48 inch (1219 mm).
      d. Exit Devices: 40-5/16 inch (1024 mm).
      e. Door Viewer: 43 inch (1092 mm); standard height 60 inch (1524 mm).

J. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

K. Include in installation for existing doors and frames any necessary field modification and field preparation of doors and frames for new hardware. Provide necessary fillers, reinforcements, and fasteners for mounting new hardware and to cover existing door and frame preparations.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing.

B. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.04 ADJUSTING

A. Adjust hardware for smooth operation.

B. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.05 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation activities.

C. See Section 01 74 23 – Final Cleaning, for additional requirements.

3.06 PROTECTION

A. Protect finished Work under provisions of Section 01 77 19 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

3.07 DOOR HARDWARE

Manufacturer list

ABH	Architectural Builders Hardware
BES	BEST
LCN	LCN
NGP	National Guard Products
VON	VON DUPRIN

Option list

Code:	Name:
RX	Request to Exit
QEL	Quiet Electric Latch Retraction
NL	Night Latch, Key Retracts
SCUSH	Spring Cush-n-Stop Arm
EO	Exit Only
Head & Jambs (2)	Provide at the head and both jambs

LAR	Length As Required
RWPA	Regular Arm with Parallel Arm Bracket
48	Concealed Vertical Rod
996L-NL	Lever-night latch

Finish list

Code:	Name:
B	Brown
689	Aluminum
AL	Anodized Aluminum
626	Chromium plated, satin
US32D	Stainless Steel, Satin
630	Stainless steel metal, satin

Specification Report

Set #101

Doors: 146.1, 146.2

2.0	Continuous Hinge	661 HD UL CE-12EA	AL	BES
1.0	Exit Device	RX QEL 99 48 NL 996L-NL	US32D	VON
1.0	Exit Device	RX 99 48 EO	US32D	VON
1.0	Rim Cylinder	12E7 2 PATD	626	BES
2.0	Door Closer	4040XP SCUSH	689	LCN
1.0	Gasketing	BY ALUM FRAME MANUFACTURER		
2.0	Sweep	200S LAR	A	NGP
1.0	Threshold	8425 LAR	A	NGP
2.0	Wire Harness	BY DOOR HARWARE CONTRACTOR		
1.0	Card Reader	BY SECURITY CONTRACTOR		
1.0	Power Supply	BY SECURITY CONTRACTOR		
2.0	Door Position Switch	BY SECURITY CONTRACTOR		

NOTE: DOOR NORMALLY CLOSED AND LOCKED. PRESENTING VALID CREDENTIAL RETRACTS LATCH AND ALLOWS FOR INGRESS. RX SWITCH IN PUSHBAR TO SHUNT ALARM. EMERGENCY KEY OVERRIDE. FREE EGRESS AT ALL TIMES.

Set #102

Doors: 143.1, 144.1, 145.1, 152.1

3.0	Hinge	FBB179 4.5X4.5 NRP	652	BES
1.0	Cylindrical Lock	9K 3 7 D 15 D PATD	626	BES
1.0	Door Closer	4040XP RWPA	689	LCN
1.0	Kick Plate	PP0050 10" X Door Width less 2" CSK B4E	630	ABH
1.0	Gasketing	5050 Head & Jambs (2)	B	NGP
1.0	Wall Stop	AB409	626	ABH

Set #103

Doors: 149.1, 150.1, 151.1

3.0	Hinge	FBB179 4.5X4.5	652	BES
1.0	Cylindrical Lock	9K 3 7 D 15 D PATD	626	BES
1.0	Wall Stop	AB409	626	ABH
1.0	Gasketing	5050 Head & Jambs (2)	B	NGP

Set #104

Doors: 153.1

3.0	Hinge	FBB179 4.5X4.5	652	BES
1.0	Cylindrical Lock	9K 3 7 D 15 D PATD	626	BES
1.0	Door Closer	4040XP RWPA	689	LCN
1.0	Kick Plate	PP0050 10" X Door Width less 2" CSK B4E	630	ABH

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1.0	Wall Stop	AB409	626	ABH
1.0	Gasketing	5050 Head & Jambs (2)	B	NGP

Set #105

Doors: 154.1

3.0	Hinge	FBB179 4.5X4.5	652	BES
1.0	Mortise Lock	45H 0 L 15 H VIBE	626	BES
1.0	Door Closer	4040XP RWPA	689	LCN
1.0	Kick Plate	PP0050 10" X Door Width less 2" CSK B4E	630	ABH
1.0	Wall Stop	AB409	626	ABH
1.0	Gasketing	5050 Head & Jambs (2)	B	NGP

Set #106

Doors: 142.1, 142.2, 142.3, 142.4, 142.5

1.0	Hardware	BY OTHERS

END OF SECTION

Section 08 80 00

GLAZING

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide all glass and glazing, complete, in place, as shown on the drawings, specified herein, or needed for a complete and proper installation.

1.1.2 Related work described elsewhere:

1.	Metal Doors and Frames	Section 08 11 00
2.	Prefinished Wood Doors	Section 08 14 29
3.	Entrances and Storefront	Section 08 41 00

1.2 QUALITY ASSURANCE

1.2.1 Qualifications of installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

1.3.1 General: Comply with the provisions of Section 01 33 23.

1.3.2 Product data: Within 30 calendar days after award of the Contract, submit:

1. Complete materials list showing all items proposed to be furnished and installed under this Section.
2. Sufficient data to demonstrate that all such materials meet or exceed the specified requirements.

1.4 PRODUCT HANDLING

1.4.1 Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.

1.4.2 Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART TWO - PRODUCTS

2.1 GLASS

2.1.1 General: The type of glass is called for on details and schedules in the drawings. The "Types" as defined below.

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2.1.2 Glass types:

1. 1/4" tempered glass shall be Herculite Tempered Glass, clear glass with tong edges by Vitro Architectural Glass (formerly PPG Glass) or approved equal. Laminated glass is not acceptable.
2. 1" Solar Control Low-E Tinted Insulating Glass as manufactured by Vitro Architectural Glass (formerly PPG Glass) 1/4" glass, 1/2" air space and 1/4" glass. Outdoor lite: Standard tint as selected by Architect from manufacturers three (3) standard colors. Indoor lite: Clear float glass, sputter coated on third surface (3). Low-E coating: "Solarban" 70 solar control (sputtered). Use heat strengthened glass as required by the manufacturer. All glass tempered safety where required by code.
3. 3M™ Scotchshield Safety & Security Window Film where shown on drawings: Ultra Prestige, 8 mil thick, installed with the 3M™ Impact Protection Attachment (IPA) Sealant.

2.1.3 Other materials:

1. Sealant: G.E. Silglaze and Silglaze Tape by General Electric Company, or approved equal.
2. Glazing materials and accessories: As recommended by the glass and frame manufacturers as needed to provide a complete installation.

PART THREE - EXECUTION

3.1 PREPARATION

1. Examine the areas and conditions under which the Work of this Section will be installed.
2. Correct conditions detrimental to the proper and timely completion of the Work.
3. Do not proceed until unsatisfactory conditions have been corrected.
4. Verify that all glass locations and types comply with all applicable codes.
5. Surfaces shall be dry and free from dust or ice. Dirty surfaces shall be cleaned with a cloth saturated with turpentine or mineral spirits before glazing. Remove loose dirt particles and mortar from recesses prior to installation of glass and glazing materials.

3.2 INSTALLATION

1. General: Install the glass in accordance with the Drawings and the approved guidelines of the glass manufacturer for each type of installation except that glazing tape or putty must be installed on both faces of all glazing, no exceptions.
2. Glaze hollow metal frames in conformance with the details and general conditions governing glazing in Flat Glass Marketing Association's (FGMA) Glazing Manual.
3. Glaze doors in conformance with the appropriate glazing methods described in the standards under which they are produced.
4. The Contractor shall set all glass in the best possible manner and in such a way that there will be an equal bearing to entire width of each panel. The Contractor will be held responsible for broken glass due to improper setting. Setting, generally, will be with glazing stops, furnished by the door or fixed framing manufacturer, or by the millwork subcontractor.
5. All glass shall be accurately set to fit the frame, and all edges shall be smooth, no sharp or ragged edges being left.

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3.3 MANUFACTURER'S LABELS

Labels showing strength, grade, thickness, type and quality will be required on each piece of glass. Labels shall remain on glass until it has been set and inspected. When glass is not cut to size by the manufacturer and is furnished unlabeled from local stock, the contractor shall submit an affidavit stating the quality, thickness, type and manufacturer of the glass furnished.

3.4 CLEANING

1. After installation, mark glass by placing tape or ribbon across the glass between the mullions, avoiding sticking anything to the glass surface, if possible.
2. Just before final inspection, thoroughly clean all glass and remove all labels, paint spots, putty, and other defacements. Do not use acid solutions or water containing caustic soaps. Broken or cracked glass not complying with these specifications will be replaced. At completion of work, glass and other glazing materials shall be clean, whole and in perfect condition.

3.5 MEASURING AND SIZES

All sizes for glass shall be taken from the actual frames, doors and sash. This contract contemplates all glass to be set in place, and this contractor shall assume all responsibility in regard to correct sizes. Size marked on the drawings are approximate and shall be used for estimating only.

END OF SECTION

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Section 09 21 00

GYPSUM BOARD ASSEMBLIES

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide all gypsum drywall, gypsum ceiling, gypsum furr downs, metal studs, and accessories, complete, in place, as shown on the Drawings, specified herein, and needed for a complete and proper installation. For exterior studs, see Section 05 41 00.

1.2 QUALITY ASSURANCE

1.2.1 Qualifications of manufacturer: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable by the Architect.

1.2.2 Qualifications of installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

1.3.1 General: Comply with provisions of Section 01 33 23.

1.3.2 Manufacturer's data: Within 30 calendar days after award of the Contract, submit:

A. Complete materials list of all items proposed to be furnished and installed under this Section.

B. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.

C. Manufacturer's recommended installation procedures.

The manufacturer's recommended installation procedures, when approved by the Architect, will become the basis for inspecting and accepting or rejecting actual installation procedures used on the Work.

1.4 PRODUCT HANDLING

1.4.1 Protection: Use all means necessary to protect materials of this section before, during, and after installation and to protect installed work and materials of all other trades.

1.4.2 Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

1.4.3 Delivery and storage: Deliver all materials to the job site in their original unopened containers with all labels intact and legible at time of use. Store in strict accordance with the manufacturer's recommendations as approved by the Architect.

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PART TWO - PRODUCTS

2.1 GENERAL

All products, unless noted otherwise, are as manufactured by ClarkDietrich Building Systems Industries, Inc., Pittsburg, PA or approved equal.

2.1.1 Steel framed drywall system (ceilings and walls):

A. Metal studs, runners, and channels:

1. All members shall be a minimum of 20 ga. unless noted otherwise on drawings.
2. All interior metal stud framing (gauges and depth of frame) shall comply with manufacturer's recommended sizing properties.

B. 8 ga. galvanized hanger wire.

C. 18 ga. galvanized tie wire.

D. Faceboards:

1. 5/8" thick Fire Code "Type X" Gypsum Panels (Provide 5/8" thick Dens-Shield tile backer board at all ceramic tile locations, 5/8" thick MR board at all other wet locations, except use 1/2" Dens-Shield on partitions between water closets).
2. 1/2" DensGlass Gold Exterior Guard on exterior face of all outside walls.
3. 5/8" Fiberock wall board panels (fire resistant) by US Gyp. (where noted on drawings).
4. High Impact Gyp: USG sheetrock brand Mold Tough VHI Firecode X Core Panels.

E. Shaftliner: 1" DensGlass Ultra shaftliner where shown on drawings.

F. Fasteners: As recommended by ClarkDietrich Building Systems.

G. Trim No. 200-A.

H. Corner bead No. 104 Dur-A-Bead.

I. Control joint No. 093

PART THREE - EXECUTION

3.1 PARTITION INSTALLATION

3.1.1 Stud system erection: Attach steel runners at floor and ceiling to structural elements with suitable fasteners located 2" from each end and spaced 24" o.c. or to suspended ceilings with toggle bolts or hollow wall anchors spaced 16" o.c.

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Position studs vertically, with open side facing in same direction, engaging floor and ceiling runners, and spaced 1'4" o.c. when necessary, splice studs with 8" nested lap and two positive attachments per stud flange. Place studs in direct contact with all door frame jambs, abutting partitions, partition corners and existing construction elements. Where studs are installed directly against exterior walls and a possibility of water penetration through walls exists, install asphalt felt strips between studs and wall surfaces.

Anchor all studs for shelf-walls and those adjacent to door and window frames, partition intersections, corners and free-standing furring to ceiling and floor runner flanges with USG Metal Lock Fastener tool or screws. Securely anchor studs to jamb and head anchor clips of door or borrowed-light frames, place horizontally a cut-to-length section of runner, with a web-flange bend at each end, and secure to strut-studs with two screws in each bent web. Position a cut-to-length stud (extending to ceiling runner) at vertical panel joints over door frame header.

Install horizontal bridging of 54 mil. “U” channel in stud system, spaced at not more than 4’-0” o.c. vertically.

3.1.2 Gypsum panel erection: For walls 12’-0” tall or less, apply gypsum panels parallel to studs (vertically). Position edges over studs for attachment. Use maximum practical lengths to eliminate end joints. Fit edges closely, but not forced together. Stagger joints on opposite sides of partitions.

For walls over 12’-0” tall, apply gypsum panels perpendicular to studs. Position ends over studs for perpendicular application. Use maximum practical lengths to minimize end joints. Fit ends and edges closely, but not forced together. Stagger joints on opposite sides of partition.

For single-layer parallel application of gypsum panels, space screws 12" o.c. in field of panels and along vertical abutting edges. For perpendicular panel application, space screws 16" o.c. in field and 8" o.c. staggered along abutting end joints.

For double-layer screw attachment, space screws 24" o.c. in base layer and 8" o.c. at edges and 12" o.c. in field in face layer. Apply both layers of gypsum panels vertically with joints in face layer offset from base layer joints. For 1/2" and 5/8" panels, use 1" screws for base layer and 1-5/8" screws for face layer.

3.2 CEILING INSTALLATION

3.2.1 Grillage erection: Space 8-ga. hanger wires 48" o.c. along carrying channels and within 6" of ends of carrying-channel run. In concrete, anchor within 6" of ends of carrying-channel run. In concrete, anchor hangers by attachment to reinforcing steel, by loops embedded at least 2" or by approved inserts. For steel construction, wrap hanger around or through beams or joists.

Install 1-1/2" carrying channels 48" o.c. and within 6" of walls. Position channels for proper ceiling height, level, and secure with hanger wire saddle-tied along channel. Provide 1" clearance between runners and abutting walls and partitions. At channel splices, interlock flanges, overlap ends 12" and secure each end with double-strand 18-ga. wire.

Erect metal furring channels at right angles to 1-1/2" carrying channels or main supports. Space furring (16") o.c. and within 6" of walls. Provide 1" clearance between furring ends and abutting walls and partitions. Secure furring to carrying channels with clips or wire-tie to supports with double-strand 18-ga. wire. At splices, nest furring channels at least 8" and securely wire-tie each end with double-strand 18-ga. wire.

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At light troffers or any openings that interrupt the carrying or furring channels, install additional cross reinforcing to restore lateral stability of grillage.

3.2.2 Steel stud framing system erection: Attach runners at ceiling height, through gypsum panels, to each partition stud with two screws. Insert steel studs in runners and attach each end with one 3/8" pan head screw. Install 1-5/8" stud cross-bracing over stud framing, space 48" o.c. and attach to each framing stud with two 3/8" pan head screws. At hangers, install 12" long stud section for box reinforcing or lap studs 12" and secure each end with two 3/8" pan head screws.

At light troffers or any openings that interrupt the ceiling, install additional cross reinforcing to maintain structural integrity of framing.

3.2.3 Gypsum panel erection: Apply gypsum panels of maximum practical length with long dimension perpendicular to furring channels. Position end joints over channel web and stagger in adjacent rows.

Fit ends and edges closely, but not forced together. Fasten panels to channels with 1" type "S" screws spaced 12" o.c. in field of panels and along abutting ends and edges.

3.3 WALL FURRING INSTALLATION

3.3.1 Direct furring channel attachment: Attach metal furring channels (vertically), spaced 24" o.c. to interior of masonry or concrete surfaces with hammer-set or power-driven fasteners or concrete stub nails staggered 24" o.c. on opposite flanges. Nest channels 8" at splices and anchor with two fasteners in each wing. Where furring channel is installed directly to exterior wall and a possibility of water penetration through walls exists, install asphalt felt protection strip between furring channel and wall.

Apply gypsum panels perpendicular to channels. Position all edges over furring channels in parallel application; all ends over framing in perpendicular application with joints staggered in successive courses. Use maximum practical lengths to minimize end joints. Fit ends and edges closely, but not forced together. Fasten panels to channels with 1" type "S" screws spaced 12" o.c.

3.3.2 Mechanical Application — Z-Furring Channels: Erect insulation vertically and hold in place with Z-furring channels spaced 24" o.c. Except at exterior corners, attach narrow flanges of furring channels to wall with concrete stub nails or power-driven fasteners spaced 24" o.c. At exterior corners, attach wide flange furring channel to wall with short flange extending beyond corner. On adjacent wall surface, screw attach short flange of furring channel to web of attached channel. Start from this furring channel with a standard width insulation panel and continue in regular manner. At interior corners, space second channel nor more than 12" from corner and cut insulation to fit. Hold mineral-fiber insulation in place until gypsum panels are installed with 10" long staple field-fabricated from 18-ga. tie wire and inserted through slot in channel. Apply wood blocking around window and door openings and as required for attachment of fixtures and furnishings.

Apply gypsum panels parallel to channels with vertical joints occurring over channels. Use no end joints in single-layer application. Attach gypsum panels with 1" type "S" screws spaced 12" o.c. at exterior corners. For double-layer application, apply base layer parallel to channels with vertical joints offset at least one channel. Attach base layer with screws 24" o.c. and face layer with 1-5/8" screws 16" o.c.

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3.4 ACCESSORY APPLICATION

A. Joint system: Finishing of all face panel joints and internal angles by painting contractor.

B. Laminating adhesive: Spread to provide 1/2" adhesive beads 4-1/2" o.c. for full sheet lamination. For strip lamination, apply adhesive in vertical strips of four 1/2" beads 1-1/2" to 2" o.c. Space strips 24" o.c.

C. Corner bead: Reinforce all vertical and horizontal exterior corners with corner bead fastened with 1-1/8” drywall screws 9" o.c. on both flanges along entire length of bead.

D. Metal trim: Where assembly terminates against masonry or other dissimilar material, apply metal trim over panel edge and fasten with 1-1/8” drywall screws 9" o.c.

E. P-1 vinyl trim: Slip trim over panel with long flange behind panel. Install panel with trim firmly abutting surface.

F. Screws: Power-driven at least 3/8" from edges or ends of panel to provide uniform dimple 1/32" deep.

G. Control joints: Break panel behind joint and back by double framing members (and 2" wide gypsum panel strip). Attach control joint to face layer with 1-1/8” drywall screws spaced 6" o.c. on both flanges along entire length of joint. Locate control joints where shown on plans or a maximum of 30 feet in continuous unbroken expanses of walls and furrdowns. Locate control joints a minimum of 30' o.c. of continuous gypsum ceiling.

H. Reveal molding: Extruded aluminum as manufactured by Fry Reglet Corp. or approved equal. Sizes as shown on drawings.

I. Aluminum breakaway clip (AB): 2” x 2” x 2 1/2" designed to melt and break away when exposed to fire.

3.5 TEXTURE COAT

By Painting Contractor; see Section 09 91 00.

3.6 CLEANING UP

Use all necessary care during execution of this portion of the work to prevent scattering of gypsum wallboard scraps and dust and to prevent tracking of joint and finishing compound onto floor surfaces. At completion of each segment of installation in a room or space, promptly pick up and remove from the working area all scraps, debris, and surplus material of this Section.

END OF SECTION

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Section 09 30 00

TILE

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide all porcelain wall tile and trim shapes, complete in place, as indicated on the drawings, specified herein, or otherwise needed for a complete and proper installation of the work of this Section.

1.2 QUALITY ASSURANCE

1.2.1 Standards:

1. ANSI A137.1-1988 (American National Standard Institute).
2. TCA-137.1-2000 (Tile Council of America - Recommended Standard specifications for Ceramic Tile).

1.2.2 Qualifications of manufacturer: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a 10-year history of successful production acceptable to the Architect.

1.2.3 Qualifications of installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.

1.3 SUBMITTALS

1.3.1 General: Comply with the requirements of Section 01 33 23.

1.3.2 Product data: Within 30 calendar days after award of the Contract, submit:

1. Complete materials list of all items proposed to be furnished and installed under this Section.
2. Manufacturer's specifications and other data required to demonstrate compliance with specified requirements.

1.4 PRODUCT HANDLING

1.4.1 Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.

1.4.2 Replacement: In the event of damage, immediately make all repairs and replacements needed to the approval of the Architect and at no additional cost to the Owner.

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PART TWO - PRODUCTS

2.1 APPROVED TILE MANUFACTURERS

2.1.1 American Olean Tile Company.

2.1.2 United States Ceramic Tile Company.

2.1.3 Mannington Ceramic Tile by Mid-State.

2.1.4 Dal-Tile by Dal-Tile Corporation.

2.1.5 Emser Tile

2.2 PORCELAIN TILE

2.2.1 PT-1 – "Esplanade"

1. Finish: Porcelain glazed tile.
2. Size 12" x 24".
3. Color and pattern shall be selected by the Architect.

2.2.2 Trim:

1. Inside corners, outside corners, bull-nose as required.

2.3 SETTING MATERIAL

1. Dry-set mortar: ANSI A118.1-1999 or
2. Latex-Portland Cement Mortar: ANSI A118.4-1999.

2.4 GROUT

1. Prism® ultimate performance cement-based grout as manufactured by Custom Building Products or approved equal. Material shall meet ANSI A-118.6-1999. Color(s) as selected from manufacturer's stock colors by the Architect.

2.5 WATERPROOFING MEMBRANE

2.5.1 RedGard Waterproofing and Anti-Fracture Membrane as manufactured by Custom Building Products shall be installed at all wet areas.

PART THREE - EXECUTION

3.1 PREPARATION

3.1.1 Ensure that concrete slab is well cured, dimensionally stable and free of cracks, waxy or oily films and curing compounds.

3.1.2 Ensure that concrete masonry wall has struck joints, is dimensionally stable, and is free of cracks, waxy or oily films.

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3.1.3 Install elastomeric waterproofing material at all wet areas according to manufacturer's published installation instructions.

3.2 INSTALLATION

3.2.1 Ceramic mosaic floor tile: Install in accordance with ANSI 108.5-1999, for TCA Method #F113-80 as described in the TCA 2003-2004 "Handbook for Ceramic Tile Installation". Provide floor control joints maximum 20' o.c. or as shown on plans. Coordinate joints with concrete slab control joints.

3.2.2 Completed installation shall be free of broken, damaged, or faulty tile.

3.2.3 Cut wall tile, at the course above the ceramic base, are not acceptable. Determine the high floor corner of the room and set the top of all base tile level with that corner. Install floor leveling compound as required to bring the floor tile level with ceramic cove base. Taper leveling compound as required to provide level floor tile installation.

3.2.4 Install wall tile and cap trim at toilet stall divider walls as shown on drawings.

3.2.5 Install all tile using leveling clips.

3.3 CAULK JOINTS

At all vertical inside corners, at all masonry control joints, and at all vertical joints where tile butts other material (such as door frames) install caulk joint (color to match grout). Refer to Section 07 92 00 for material. Where floor tile crosses floor control joints, provide caulk joint.

3.4 CLEANING

3.4.1 Upon completion of the glazed ceramic wall tile installation, remove all unused materials rubbish, etc., in connection with this contract and give the tile work a thorough cleaning at the time of its completion. When tiles are set, sponge off grout or cement with clean water, leaving surface of tile clean. Acid will not be permitted in cleaning solutions for tile. Walls above tile shall be protected from stains or damage in the installation of tile and cleaning of tile.

END OF SECTION

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Section 09 51 00

ACOUSTICAL CEILINGS

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Acoustical treatment required for this Work includes, but is not necessarily limited to acoustical tile ceilings.

1.1.2 Related work described elsewhere:

1. Acoustical Ceiling Suspension Assemblies Section 09 53 00

1.2 QUALITY ASSURANCE

1.2.1 Qualifications of manufacturers: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.

1.2.2 Qualifications of installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.

1.3 SUBMITTALS

1.3.1 General: Comply with the provisions of Section 01 33 23.

1.3.2 Product data: Within 30 days after award of the Contract, submit:

1. Complete materials list of all items proposed to be furnished and installed under this Section.
2. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.
3. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for inspecting and accepting or rejecting actual installation procedures used on the Work.

1.4 PRODUCT HANDLING

1.4.1 Delivery and storage: Deliver the materials in their original unopened containers with all labels intact and legible at time of use. Store in strict accordance with the manufacturer's recommendations as approved by the Architect.

1.4.2 Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.

1.4.3 Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

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PART TWO - PRODUCTS

2.1 LAY-1: Armstrong School Zone #1824 (2’ x 4’) or #1717 (2’ x 2’) or HHF Series by Certainteed as shown on drawings in accordance with specified UL design assembly. Humiguard Plus Performance with BioBlock paint on face and back of board. UL Classified NRC .70, minimum CAC 35. Installed on Armstrong Prelude XL (XL Fire Guard where required) hot dipped galvanized grid providing a 30 Year systems warranty on board and grid.

2.2 OTHER MATERIALS

All other materials, not specifically described but required for a complete and proper installation of the Work of this Section, shall be as selected by the Contractor subject to the approval of the Architect.

PART THREE - EXECUTION

3.1 INSPECTION

Examine the areas and conditions under which work of this Section will be installed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

Install all materials in strict accordance with the manufacturer's recommendations as approved by the Architect, anchoring all components firmly into position for long life under hard use. Install acoustical tiles true to alignment within a tolerance of one in 1000 and true to plane within a tolerance of one in 200.

END OF SECTION

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Section 09 53 00

ACOUSTICAL CEILING
SUSPENSION ASSEMBLIES

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide exposed ceiling suspension system, complete, in place, as shown on the Drawings, specified herein, and needed for a complete and proper installation.

1.1.2 Related work described elsewhere:

1. Acoustical Ceilings Section 09 51 00

1.2 QUALITY ASSURANCE

1.2.1 Qualifications of manufacturers: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.

1.2.2 Qualifications of installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

1.3.1 General: Comply with provisions of Section 01 33 23.

1.3.2 Manufacturer's data: Within 30 calendar days after award of the contract, submit:

1. Complete materials list of all items proposed to be furnished and installed under this Section.
2. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.
3. Manufacturer's recommended installation procedures.

The manufacturer's recommended installation procedures, when approved by the Architect, will become the basis for inspecting and accepting or rejecting actual installation procedures used on the work.

1.4 PRODUCT HANDLING

1.4.1 Protection: Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed work and materials of all other trades.

1.4.2 Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

1.4.3 Delivery and Storage: Deliver all materials to the job site in their original unopened containers with all labels intact and legible at time of use. Store in strict accordance with the manufacturer's recommendations as approved by the Architect.

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PART TWO - PRODUCTS

2.1 EXPOSED GRID LAY-IN TILE SUSPENSION SYSTEM

The exposed ceiling suspension system shall be the Armstrong Prelude or Architect approved equal.

2.1.1 Main runners: Intermediate Duty ASTM C635.

2.1.2 Main runners and cross tees: Cold rolled, hot dipped galvanized steel and cap with standard white factory applied paint finish.

2.1.3 Angles: Cold rolled No. 7800, 7/8” x 7/8”, hot dipped galvanized with standard white factory applied paint finish.

2.1.4 Outside miter molding: No. 7863 white 7/8" outside corner cover.

2.1.5 Ceiling areas over 1,000 sq.ft.: Must have horizontal restraint wire or rigid bracing.

2.1.6 Ceiling areas over 2,500 sq.ft.: Must have seismic separation joints or full height partitions.

PART THREE - EXECUTION

3.1 INSPECTION

Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.1.1 Follow the manufacturer’s installation requirements for specified seismic zone.

3.2 COORDINATION

Use all means necessary to coordinate with other trades and to ensure the proper and adequate provision is made in the work of other Sections.

3.3 INSTALLATION

3.3.1 Main runners and hanger wires: Install runners at 48 inches on center, and be directly suspended by not less than 12 gauge galvanized steel wire. The hanger wires shall be installed in an exactly vertical position from the metal deck flute at 48 inches on center. Punch holes, through the sides of the flute, install hanger wire and wrap tightly at least 3 full turns. At each lay-in light fixture add two additional hanger wires to have one within 3 inches of each corner. Installing hanger wires to steel joists and dropping diagonally to runner members is not acceptable.

3.3.2 Cross tees: 48" long and interconnected with main tees to form 24" x 48 modules or 24" x 24" as shown on plan.

3.3.3 Wall angle moldings: Install at all vertical surfaces. Miter all corners.

3.3.4 Enclosures at light fixtures are not required.

END OF SECTION

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Section 09 65 00

RESILIENT FLOORING

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide all resilient flooring, complete in place, as indicated on the Drawings, specified herein, or otherwise needed for a complete and proper installation of the Work of this Section. Leave extra stock of each color of tile for Owner as specified.

1.2 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

1.3 SUBMITTALS

1.3.1 General: Comply with pertinent provisions of Section 01 33 23.

1.3.2 Manufacturer's data: Within 30 calendar days after award of contract, submit:

1. Complete materials list of all items proposed to be furnished and installed under this Section.
2. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.
3. Samples of each item, color, and pattern available in the specified products from the proposed manufacturer.
4. Manufacturer's recommended methods of installation.

The manufacturer's recommended methods of installation, when approved by the Architect, will become the basis for inspecting and accepting or rejecting actual installation methods used on the Work.

1.4 PRODUCT HANDLING

1.4.1 Delivery and storage: Deliver materials to the job site and store in their original unopened containers with all labels intact and legible at time of use. Store in strict accordance with the manufacturer's recommendations.

1.4.2 Protection: Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed work and materials of all other trades.

1.4.3 Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

1.5 EXTRA STOCK

1.5.1 Upon completion of the work of this section, deliver to the Owner an extra stock equal to 2% of each color and type of flooring.

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PART TWO - PRODUCTS

2.1 MATERIALS, GENERAL

2.1.1 Colors and patterns shall be as selected by the Architect from standard colors and patterns available from the approved manufacturer in the specified types.

2.1.2 Adhesives shall be a waterproof and stabilized type as recommended by the manufacturer of the approved resilient material. Asphalt emulsions and other non-waterproof types will not be acceptable.

2.1.3 Concrete slab primer shall be a non-staining type as recommended by the manufacturer of the resilient material to be applied over it.

2.1.4 Rubber base shall be 4" high cove base as manufactured by Tarkett-Johnsonite or Architect approved equal. Color as selected by the Architect from standard colors of the approved manufacturer. Furnish pre-formed corners. Vinyl base is not acceptable.

2.1.5 Luxury vinyl tile: Color Anchor LVT Collection “Groove”, 12” x 24”, as manufactured by Mannington Commercial, or Architect approved equal.

2.2 OTHER MATERIALS

All other materials, not specifically described but required for a complete and proper installation of the work of this Section, shall be as recommended by the manufacturer of the resilient materials, used, and as approved by the Architect.

PART THREE - EXECUTION

3.1 INSPECTION

3.1.1 General: Examine the areas and conditions under which resilient flooring is to be placed. Correct conditions detrimental to the proper and timely completion of the Work. Remove all dust and debris. Fill slab as required to achieve totally smooth and level surface. Do not proceed until unsatisfactory conditions have been corrected.

3.1.2 Surface shall be smooth, level, at the required finish elevation, without more than 1/8" in 10'0" variation from level or slopes shown.

3.1.3 By beginning the work this subcontractor assumes all responsibility for any debris or imperfections that show through the floor material.

3.2 PREPARATION

3.2.1 Subfloors: Prior to start of laying tile units, broom clean or vacuum all surfaces to be covered and inspect the subfloors. Start of laying tile will indicate acceptance of subfloor conditions.

3.2.2 Concrete primer: Apply concrete slab primer if recommended by tile manufacturer, prior to application of the adhesive. Apply in compliance with manufacturer's directions.

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3.3 INSTALLATION

3.3.1 General:

3.3.1.1 Install tile only after all finishing operations, including painting, have been completed and permanent heating system is operating. Moisture must be within limits recommended by tile manufacturer.

3.3.1.2 Place tile units with adhesive cement in strict compliance with the manufacturer's recommendation. Butt tile units tightly to vertical surfaces, thresholds, nosings and edgings. Scribe as necessary around obstructions and to produce neat joints laid tight, even and in straight, parallel lines.

3.3.1.3 Extend tile units into toe spaces, door reveals, and in closets and similar openings.

3.3.1.4 Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on the finish tile as marked in the subfloor. Use chalk or other non-permanent marking device.

3.3.1.5 Lay tile from center marks established with principal walls, discounting minor off-sets, so that tile at opposite edges of the room are of equal width. Adjust as necessary to avoid use of cut widths less than 8" at room perimeters. Lay tile square to room axis.

3.3.2 Matching:

3.3.2.1 Match tiles for color and pattern by using tile from cartons in the same sequence as manufactured and packaged. Cut tile neatly to and around all fixtures. Broken, cracked, chipped or deformed tile are not acceptable.

3.3.2.2 Tightly cement tile to sub-base without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks through tile, or other surface imperfections.

3.3.3 Edgestrips: Place the resilient edgestrips tightly butted to tile, and secure with adhesive. Provide edgestrips at all unprotected edges of tile, unless otherwise shown.

3.4 CLEANING AND PROTECTION

Remove excess adhesive or other surface blemishes from tile, using neutral type cleaners recommended by the tile manufacturer. Protect installed flooring from damage until acceptance by the Owner.

END OF SECTION

Section 09 68 00

CARPETING

PART ONE - GENERAL

1.1 DESCRIPTION

Provide all carpeting and accessories complete, in place, as shown on the Drawings, specified herein, and needed for a complete and proper installation.

1.2 QUALITY ASSURANCE

1.2.1 Qualifications of manufacturer: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.

1.2.2 Qualifications of installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

1.3.1 General: Comply with provisions of Section 01 33 23.

1.3.2 Product data: Within 30 calendar days after award of the Contract submit:

1. Complete materials list of all items proposed to be furnished and installed under this Section.
2. Manufacturer's specifications and other data required to demonstrate compliance with specified requirements.
4. Samples of the full range of colors and patterns of carpet and of exposed accessories available from the proposed manufacturers in the specified qualities.
5. Manufacturer's recommended installation procedures.

The manufacturer's recommended installation procedures, when approved by the Architect, will become the basis for inspection and accepting or rejecting actual installation procedures used on the work.

1.4 PRODUCT HANDLING

1.4.1 Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.

1.4.2 Replacement: In the event of damage, immediately make all repairs and replacements needed to the approval of the Architect and at no additional cost to the Owner.

1.5 EXTRA STOCK

1.5.1 Upon completion of the work of this section, deliver to the Owner an extra stock equal to 5% of each color and type of flooring.

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PART TWO - PRODUCTS

2.1 CARPET

2.1.1 Carpet as manufactured by Mannington Commercial or Architect approved equal.

2.1.2 CPT-1 – “Force” - Modular

a. Construction: Textured Patterned Loop 50%
b. Face Fiber: Type 6, 50% Type 6,6 Nylon
c. Dye Method: Solution
d. Gauge: 1/12
e. Stitches Per Inch: 10
f. Pile Thickness: .185 Inches
g. Weight: 36 Ounces Per Square Yard
h. Backing Type: Infinity® 2 Modular
i. Standard Size: 18" X 36" Modular Tiles
j. Installation Method: Horizontal Brick Ashlar

2.2 ADHESIVES

Adhesives shall be as approved by the Architect and recommended for the purpose by the manufacturer of the approved carpet.

2.3 RUBBER CARPET EDGE

Rubber carpet edge shall be "Glue Down Carpet Edge" as manufactured by Roppe Rubber Corporation of Fostoria, Ohio, or approved equal. Install at all exposed edges of carpet.

2.4 OTHER MATERIAL

Other material shall be as recommended by the carpet manufacturer subject to the approval of the Architect.

PART THREE - EXECUTION

3.1 INSPECTION

Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

3.2.1 Cleaning: Immediately prior to installation of the work of this Section, thoroughly clean all substrata and remove all oil, grease, paint, varnish, hardeners, and other items which would adversely affect the bond of adhesive.

3.2.2 Smoothing: Make all substrata level and free from irregularities. Assure one constant floor height after carpet is installed, grinding high spots and filling low spots as required.

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3.3 INSTALLATION

3.3.1 General:

3.3.1.1 Glue directly to floor, using no pad and no foam.

3.3.1.2 Scribe the carpet accurately to all vertical surfaces.

3.3.1.3 Align the lines of carpet as woven, using no fill strips less than 6" in width, laying all carpet in the same direction unless specifically otherwise directed by the Architect.

3.3.2 Cleaning up: In addition to the requirements of Section 01 74 23, thoroughly clean all carpet surfaces prior to final acceptance of the carpeted areas by the Owner.

3.4 PROTECTION

Provide a heavy non-staining paper or plastic walkway as required over carpeting in direction of foot traffic, maintaining intact until carpeted space is accepted by the Owner.

END OF SECTION

Section 09 91 00

PAINTING

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Paint, caulk all joints of dissimilar materials, and finish all exterior and interior exposed surfaces listed on the Painting Schedule in Part Three of this Section, in accordance with the type of finish shown on the Finish Schedules in the Drawings and as specified herein. Tape and float all interior gypsum board surfaces. Provide firetaping as required. Existing walls shown to be painted on Finish Schedules in the Drawings shall be repaired (patched, filled, textured, etc.), if required, prior to painting.

1.1.2 Related work described elsewhere: Priming or priming and finishing of certain surfaces are specified to be factory performed or install performed under pertinent other sections.

1. Gypsum Board Assemblies Section 09 21 00

1.1.3 Work not included:

1.1.3.1 Do not include painting which is specified under other Sections.

1.1.3.2 Unless otherwise indicated, painting is not required on surfaces in concealed areas and inaccessible areas such as furred spaces, foundation spaces, utility tunnels, pipe spaces and duct shafts.

1.1.3.3 Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze, and similar finished materials will not require painting under this Section except as may be specified herein.

1.1.3.4 Do not paint any moving parts of operating units; mechanical or electrical parts such as valve operators, linkages, sinkages, sensing devices, and motor shafts, unless otherwise indicated.

1.1.3.5 Do not paint over any required labels or equipment identification, performance rating, name, or nomenclature plates.

1.1.4 Definitions: The term "paint" as used herein, means all coating systems materials including primers, emulsions, epoxy, enamels, sealers, fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1.2 QUALITY ASSURANCE

1.2.1 Qualification of manufacturer: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.

1.2.2 Qualifications of workmen:

1.2.2.1 Provide at least one person who shall be present at all times during execution of the work of this Section who shall be thoroughly familiar with the specified requirements and the materials and methods needed for their execution, and who shall direct all work performed under this Section.

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1.2.2.2 Provide adequate numbers of workmen skilled in the necessary crafts and properly informed of the methods and materials to be used.

1.2.2.3 In acceptance or rejection of the work of this Section, the Architect will make no allowance for lack of skill on the part of workmen.

1.2.3 Paint coordination:

1.2.3.1 Provide finish coats which are compatible with the prime coats used.

1.2.3.2 Review other Section of these Specifications as required, verifying the prime coats to be used and assuring compatibility of the total coating system for the various substrata.

1.2.3.3 Upon request, furnish information on the characteristics of the specific finish materials to ensure that compatible prime coats are used.

1.2.3.4 Provide barrier coats over noncompatible primers, or remove the primer and reprime as required at no additional cost to the owner.

1.2.3.5 Notify the Architect in writing of anticipated problems in using the specified coating systems over prime coating supplied under other Sections.

1.3 SUBMITTALS

1.3.1 General: Comply with provisions of Section 01 33 23.

1.3.2 Material Safety Data Sheets (MSDS) shall not be submitted as part of the submittal package. They are not a requirement of the Contract Documents and will be returned to the Contractor.

1.3.3 Manufacturers' data: Within 30 calendar days after award of the Contract, submit:

1. Complete materials list of all items proposed to be furnished and installed under this Section.
2. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.
3. For information only, submit two copies of manufacturer's specifications, including paint analysis and application instructions for each materials. Indicate by transmittal that copy of each manufacturer's instructions has been distributed to the applicator.

Upon receipt of review comments, make all revisions and corrections, and resubmit if so required.

1.4 PRODUCT HANDLING

1.4.1 Delivery of materials: Deliver all materials to the job site in original, new, and unopened containers bearing the manufacturer's name and label showing at least the following information:

1. Name or title of the material,
2. Fed. Spec. number, if applicable,
3. Manufacturer's stock number,
4. Manufacturer's name,
5. Contents by volume for major constituents,
6. Thinning instructions,

7. Application instructions.

1.4.2 Storage of materials: Provide proper storage to prevent damage to, and deterioration of, paint materials.

1.4.3 Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work materials of all other trades.

1.4.4 Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

1.5 JOB CONDITIONS

1.5.1 Surface and Air Temperatures: Do not apply any paint materials when the temperature of surfaces to be painted and the surrounding air temperature are below 55 degrees F, unless otherwise permitted by the manufacturer's printed instructions as approved by the Architect. HVAC equipment shall be functioning minimum 48 hours before painting shall begin.

1.5.2 Weather Conditions: Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceed 85%; or to damp or wet surfaces; unless otherwise permitted by the manufacturer's printed instructions as approved by the Architect. Applications may be continued during inclement weather within the temperature limits specified by the paint manufacturer during application and drying period.

1.6 EXTRA STOCK

1.6.1 Amount: Upon completion of the work of this Section, deliver to the Owner an extra stock equaling 3% of each color, type, and gloss of paint used on the Work.

1.6.2 Packaging: Tightly seal each container and clearly label with the contents and location used.

PART TWO - PRODUCTS

2.1 PAINT MATERIALS

2.1.1 Design is based on use of paint products manufactured by Sherwin-Williams Company. Equal products by Benjamin Moore, Farrell Calhoun and Pittsburg Paints will be acceptable when approved by the Architect.

2.1.2 General: Provide the best quality grade of the various types of coatings as regularly manufactured by paint materials manufacturers approved by the Architect. Materials not displaying the manufacturer's identification as a standard best-grade product will not be acceptable.

2.1.3 Durability: Provide paints of durable and washable quality. Do not use paint materials which will not withstand normal washing as required to remove pencil marks, ink, ordinary soil, and similar material without showing discoloration, loss of gloss, staining, or other damage.

2.1.4 Colors and Glosses: The Architect will select colors to be used in the various types of paint specified and will be the sole judge of acceptability of the various glosses obtained from the materials proposed to be used in the Work.

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2.1.5 Color Selection: The Architect shall select a basic color to be used on 70% of painted surfaces, The remaining 30% of the painted surfaces shall receive any of twelve colors selected from any of the manufacturer's standard colors. Refer to the finish schedule for any additional painting requirements.

2.1.6 Undercoats and thinners: Provide undercoat paint produced by the same manufacturer as the finish coat. Use only the thinners recommended by the paint manufacturer, and use only to the recommended limits. Insofar as practicable, use undercoat, finish coat, and thinner material as parts of a unified system of paint finish.

2.1.7 Standards: Provide paint materials which meet or exceed the standard listed for each application in the Painting Schedule in PART THREE of this Section.

2.2 APPLICATION EQUIPMENT

2.2.1 General: For application of the approved paint, use only such equipment as is recommended for application of the particular paint by the manufacturer of the particular paint, and as approved by the Architect.

2.2.2 Compatibility: Prior to actual use of application equipment, use all means necessary to verify that the proposed equipment is actually compatible with the material to be applied and that the integrity of the finish will not be jeopardized by the use of the proposed application equipment.

2.3 OTHER MATERIALS

All other materials, not specifically described but required for a complete and proper installation of the work of this Section, shall be new, first-quality of their respective kinds, and as selected by the Contractor subject to the approval of the Architect.

PART THREE - EXECUTION

3.1 SURFACE CONDITIONS

3.1.1 Inspection: Prior to installation of the work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. Verify that painting may be completed in strict accordance with the original design and with the manufacturer's recommendations as approved by the Architect.

3.1.2 Discrepancies: Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 MATERIALS PREPARATION

3.2.1 General:

3.2.1.1 Mix and prepare painting materials in strict accordance with the manufacturer's recommendations as approved by the Architect.

3.2.1.2 Store materials not in actual use in tightly covered containers.

3.2.1.3 Maintain containers used in storage, mixing, and application of paint in a clean condition, free from foreign materials and residue.

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3.2.2 Stirring: Stir all materials before application to produce a mixture of uniform density, and as required during the application of materials. Do not stir into the material any film which may form on the surface. Remove the film and, if necessary, strain the material before using.

3.3 SURFACE PREPARATION

3.3.1 General:

3.3.1.1 Perform all preparation and cleaning procedures in strict accordance with the paint manufacturer's recommendations as approved by the Architect.

3.3.1.2 Remove all removable items which are in place and are not scheduled to receive paint finish, or provide surface-applied protection prior to surface preparation and painting operations.

3.3.1.3 Following completion of painting in each space or area, reinstall the removed items by using workmen skilled in the necessary trades.

3.3.1.4 Clean each surface to be painted prior to applying paint or surface treatment.

3.3.1.5 Remove oil and grease with clean cloths and cleaning solvents of low toxicity and a flash point in excess of 38 degrees C (100 degrees F), prior to start of mechanical cleaning.

3.3.1.6 Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall onto wet newly painted surfaces.

3.3.2 Preparation of metal surfaces:

3.3.2.1 Thoroughly clean all surfaces until they are completely free from dirt, oil, and grease.

3.3.2.2 On galvanized surfaces, use solvent for the initial cleaning and then treat the surface thoroughly with phosphoric acid etch. Remove all etching solution before proceeding.

3.3.2.3 Allow to dry thoroughly before application of paint.

3.3.3 Preparation of gypsum board surfaces:

3.3.3.1 Apply joint treatment as follows:

1. First and Second Coat: Sheetrock® All-Purpose Joint Compound.
2. Third Coat: Sheetrock® Plus 3 Lightweight Joint Compound.

3.3.3.2 Clean all gypsum board surfaces until they are free from dirt, oil, and all other foreign substance.

3.3.3.3 Gypsum Panel Joints: Finish all face layer joints and internal angles with a U.S. Gypsum Joint System installed according to manufacturer's directions. Spot exposed fasteners on face layers and finish corner bead, control joints and trim as required, with at least three coats of joint compound, feathered out onto panel faces and sanded smooth.

3.3.3.4 Gypsum Base Joints: Apply Imperial Tape over full length of all gypsum base joints; do not overlap at intersections. Firmly press Type P Tape along entire length with steel trowel to insure firm wrinkle-free attachment. When rapid drying conditions exist, use Durabond Joint System installed according to manufacturer's directions.

3.4 PAINT APPLICATION

3.4.1 General:

3.4.1.1 Slightly vary the color of succeeding coats. Do not apply additional coats until the complete coat has been inspected and approved. Only the inspected and approved coats of paint will be considered in determining the number of coats applied.

3.4.1.2 Sand and dust between enamel coats to remove all defects visible to the unaided eye from a distance of five feet.

3.4.l.3 On all removable panels and all hinged panels, paint the back sides to match the exposed sides.

3.4.2 Drying:

3.4.2.1 Allow sufficient drying time between coats. Modify the period as recommended by the material manufacturer to suit adverse weather conditions.

3.4.2.2 Oil-base and oleo-resinous solvent-type paints shall be considered dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

3.4.3 Brush application: Brush out and work all brush coats onto the surfaces in an even film. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, and other surface imperfections will not be acceptable.

3.4.4 Spray application:

3.4.4.1 Confine spray application to metal framework, hollow metal doors and frames, and similar surfaces where hand brush work would be inferior.

3.4.4.2 Wherever spray application is used, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double back with spray equipment for the purpose of building up film thickness of two coats in one pass.

3.5 PAINTING SCHEDULE

All products listed below are manufactured by Sherwin Williams. Other manufacturers, when equal in quality and performance, will be considered for substitution.

3.5.1 Interior Gypsum Board:
Semi-gloss Enamel (Total DFT 5.3 mils.)

1. Surface preparation: Set and spackle all nail & screw heads. Tape and cover all joints with compound, sand smooth and remove all dust prior to paint application.
2. First Coat: Textured sheetrock mud mixed with S-W PrepRite High Build Interior Latex Primer/Surfacer, B28W8601, thinned to painting consistency and applied with roller covered with lambs wool.
3. Second and Third Coat: S-W ProMar 200 HP Zero VOC Interior Latex Semi-Gloss Enamel, B31-1950 Series. (2.5 mils DFT/coat.)

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3.5.2 Interior Gypsum Board:
Epoxy paint (Total DFT = 9.3 mils).

l. Surface preparation: Set and spackle all nail and screw heads, tape and cover all joints with compound, sand smooth and remove all dust prior to paint application.
2. First Coat: Textured sheetrock mud mixed with S-W ProMar 200 Zero VOC nterior Latex Primer, B28W12600.
3. Second and Third Coat: S-W Pro Industrial Water Based Catalyzed Epoxy, B73Series.

3.5.3 Interior Gypsum Board:
Flat Finish

1. Surface preparation: Set and spackle all nail and screw heads, tape and cover all joints with compound, sand smooth and remove all dust prior to paint application.
2. First Coat: Textured sheetrock mud mixed with S-W PrepRite High Build Interior Latex Primer/Surfacer, B28W8601, thinned to painting consistency and applied with roller covered with lambs wool.
3. Second and Third Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-Series (4 mils wet, 1.4 mils dry per coat).

3.5.4 Interior Ferrous Metal:
Semi-gloss Enamel (Total DFT = 6.0 mils).

1. Surface preparation: Sand smooth and remove all dust prior to paint application
2. First Coat: S-W Pro Industrial Pro-Cryl Universal Acrylic Primer, B66-1300 Series. (DFT 3 mils).
3. Second and Third Coat: S-W Pro Industrial WB Alkyd Urethane Semi-Gloss Enamel, B53-2150 Series. (1.5 mils DFT/coat).

3.5.5 Interior Ferrous Metal:
Waterbased intumescent coating.

1. Surface preparation: Remove all oil, dust grease, dirt, loose rust and other foreign material to ensure adequate adhesion.
2. First Coat: S-W Pro Industrial Pro-Cryl Universal Acrylic Primer, B66-1300 Series.
3. Second Coat: S-W Firetex FX5120 waterbased intumescent coating, B59W5120.
4. Third Coat: S-W Pro Industrial Pre-Catalzyed Water Based Epoxy, K46-1150 Series.

3.5.6 Exterior Ferrous Metal:
Gloss (Total DFT - 9 mils).

1. Surface preparation: Sand smooth and remove all dust prior to paint application.
2. First coat: S-W Pro Industrial Pro-Cryl Universal Acrylic Primer, B66-1300 Series.
3. Second and Third Coat: S-W Pro Industrial Urethane Enamel B54-150 Series (3 mils DFT/coat).

3.6 PROTECTION AND CLEAN UP

3.6.1 Adequately protect other surfaces from paint and damage. Repair damage as a result of inadequate or unsuitable protection.

3.6.2 Furnish sufficient drop cloths, shields and protective equipment to prevent spray or droppings from fouling surfaces not being painted and, in particular, surfaces within storage and preparation area.

3.6.3 Place cotton waste, cloths and material which may constitute a fire hazard in closed metal containers and remove daily from site.

3.6.4 Remove electrical plates, surface hardware, fittings and fastenings, prior to painting operations. These items are to be carefully stored, cleaned and replaced on completion of work in each area. Do not use solvent to clean hardware that may remove permanent lacquer finish.

3.6.5 This Subcontractor shall be responsible for the condition of the building or parts of the building in his charge, as well as the protection of adjacent work. Damage done to the work of other Subcontractors to such an extent that the work and/or materials cannot be restored to their original condition shall be replaced at the expense of this Subcontractor.

END OF SECTION

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Section 09 96 56

EPOXY COATINGS

PART ONE - GENERAL

1.1 DESCRIPTION

A. Work included: Provide seamless epoxy flooring with slip resistant finish, complete, in place, as shown on the drawings, specified herein, and needed for a complete and proper installation.

1.2 RELATED SECTIONS

A. Division Three - Concrete

1.3 QUALITY ASSURANCE

A. All materials must be recommended and manufactured by a single supplier to insure compatibility and proper chemical and mechanical bond.

B. Surfacing shall be applied by a surfacing applicator approved by the Architect, with a minimum of seven (7) years experience installing the brand of surfacing in similar size and function projects. A list of ten (10) completed projects using the specified materials must be submitted proving seven (7) years experience by the lead mechanic.

C. Surfacing applicator shall provide to the architect a completed list of jobs including the names of the Architect, General Contractor, Owner, telephone numbers of all concerned, materials used, quantity installed and date completed on similar projects.

D. Surfacing applicator must provide a written guarantee for materials and workmanship between applicator and surfacing manufacturer for one (1) year.

E. Surfacing applicator or manufacturer seeking approval of products other than what is specified must supply samples, full product information, technical data with specifications, certification from an independent testing laboratory that the product being submitted for approval meets all requirements of the performance properties specified within this specification, installation instructions and comply with the above quality assurances in writing fourteen (14) days before bid letting. Omission of any item will result in an automatic rejection.

F. Bidders will be notified by addendum of substitute surfacing materials, if approved.

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1.4 SUBMITTALS

A. Surfacing applicator shall submit samples of color and textures for Architect's approval.

B. Prior to commencing work, at architect’s discretion, applicator shall install a 100 square foot sample on the job of desired color and texture and when approved, this will serve as the standard for the entire project.

1.5 PRODUCT STORAGE AND ENVIRONMENTAL CONDITIONS

A. Material temperatures shall be a minimum of 55°F before use.

B. Work on seamless flooring shall not commence until the building can be maintained at a minimum temperature of 55°F for 48 hours before, during and 48 hours after application. Areas shall also be broom clean and reasonably dust free and shall have adequately controlled ventilation with bright, uniform lighting.

1.6 PROJECT CONDITIONS

A. Before commencing work, ensure environmental and site conditions are suitable for application and curing.

B. Surfaces shall be acceptable in accordance with flooring manufacturer's recommendations.

C. Notify Architect and Contractor in writing of unsuitable surfaces and conditions. Commencement of work shall imply acceptance of surfaces and working conditions.

D. Recommended Moisture Vapor Transmission Considerations:

1. Placement of on-grade slabs over a Class A vapor retarder as defined by ASTM E-145.
2. A water cement ratio of 0.45 and 0.5.
3. Curing by ASTM C-171 sheet materials for curing concrete.
4. A slump in the range of 3 to 4 inches which can be increased by the use of super plasticizers.

1.7 PROTECTION

A. Protect adjacent surfaces from damage resulting from work of this trade. If necessary, mask and/or cover adjacent surfaces, fixtures, cabinet work, equipment, etc. by suitable means.

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1.8 WARRANTY

A. Applicator shall notify manufacturer of project requirements before bidding. An officer of the manufacturing company shall provide written statement before bidding; to the Architect, that they accept single source warranty for entire installation including labor for one year. By agreeing to sign warranty and supply product, manufacturer waives all rights of sellers' liability of warranty and limitation. Warranty shall include removal and replacement if proven defective. Defective items are, but not limited to debonding, regionalized discoloration, excessive wear and staining by bodily fluids. Non-acceptance of above by manufacturer is grounds for rejection of product.

PART TWO - PRODUCTS

2.1 MATERIALS

A. Seamless floor covering, Desco Quartz Cremona TG Floor, as manufactured by Desco Coatings, Inc. 1-800-426-4164, provided with a 4" high turned up coved base with 1" radius cove as indicated on drawings.

B. Approved Equal Manufacturer and System:
Tnemec Co., Inc.
Series 223 Deco-Trowel

C. Binder and all successive grout and top coats shall be 100% solids clear/epoxy resin. Ceramic coated quartz aggregates as supplied by Desco Coatings are to be used to achieve all color. No pigmented epoxy base or top coats allowed.

D. Minimum Performance Characteristics:

1.	Compressive Strength (ASTM C-579)	10,000 psi
2.	Tensile Strength (ASTM C-307)	2,250 psi
3.	Flexural Strength	4,000 psi
4.	Shore D Hardness (ASTM D-2240)	85-90
5.	Bond Strength (ASTM D-4541)	425 psi
6.	Abrasion Resistance (ASTM D-4060)	0.08 gm
7.	Pot Life	35 min
8.	Cure Time @ 77˚ F	10-12 hours

Epoxy top coats shall produce no color shift after exposure to fluorescent lighting on the "b" axis yellow index after 3 weeks exposure.

20% Hydrochloric Acid	10% Lactic Acid
Urine	Tea
Coffee	Mustard
Ethyl Alcohol	Mercurochrome
	Betadyne

2.2 COLORS

A. Colors shall be as selected by the Architect from manufacturers standard range of colors.

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PART THREE – EXECUTION

3.1 TESTING OF CONCRETE SUBSTRATE

One of the following three methods shall be used to determine moisture content of slab at time of application. These tests only measure the specific area tested at the time of the test and are not predictors of future substrate conditions.

A. Using a Tramax concrete moisture detection device, firmly apply the test apparatus to concrete that has had sealers or other subsequent coatings removed. The readings shall be 4.2% or less. If readings are higher, use ASTM F-2170 for non conditional spaces and/or ASTM F1869 for conditioned spaces.

B. ASTM F-2170 in site Relative Humidity Test. Follow test procedures of manufacturer of testing equipment. Reading should be below 80%. If above 80%, use the next test method below. (Only if space is conditioned.)

C. ASTM F-1869 Calcium Chloride Moisture Vapor Transmission Test. Follow test procedures of manufacturers of MVT kits. Results should be below 3 to 4 lbs/1,000 square feet/24 hours.

3.2 FLOORING PREPARATION

A. Surface must be clean, sound and dry.

B. Effectively remove concrete laitance on accessible floor surfaces by mechanical shot blast. Acid etching is not acceptable.

C. Areas where flooring is existing must be cleaned to remove all floor material, grease or any residue that might retard interfacial adhesion between substrate and surfacing.

3.3 FLOORING APPLICATION

A. Apply flooring in accordance with manufacturer's printed instructions, employing lead mechanic qualified under the quality assurance portion of this specification, using equipment specifically designed for this purpose.

B. Thickness of 3/16 inch.

1. Desco Quartz Cremona TG is a hand troweled grade 11 Desco quartz aggregate with 20% of grade 28 as a filler. The system should be hand troweled to 3/16” thickness over epoxy primer.

C. Install integral cove base to height of 4" with 1" radius cove.

1. Trowel apply vertical cove base.
2. Hand sand cove base.
3. Apply three coats of resin to assure a smooth surface and cove.
4. Do not allow resin to puddle in cove.

E. Finished work shall match approved samples; be uniform in thickness, sheen, color, pattern, and texture; and be free from defects detrimental to performance.

3.2 PROTECTION

A. After completion of flooring the General Contractor/Owner shall protect flooring from damage by other trades.

END OF SECTION

Section 10 14 00

SIGNAGE

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide all exterior aluminum letters, exterior logos, building plaque and door signs, complete, in place, as shown on the Drawings, specified herein, and needed for a complete and proper installation.

1.2 QUALITY ASSURANCE

1.2.1 Qualifications of manufacturer: Products used in the work of this Section shall be produced by Manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.

1.3 SUBMITTALS

1.3.1 General: Comply with the provisions of Section 01 33 23.

1.3.2 Product data: Within 30 calendar days after award of Contract, submit:

1. Complete materials list showing all items proposed to be furnished and installed under this Section.
2. Manufacturer's specifications and other data required to demonstrate compliance with specified requirements.
3. Manufacturer's recommended methods of installation.
4. Complete descriptive data on fasteners proposed for each type of wall construction, recommended mounting locations, and mounting instruction.

The manufacturer's recommended methods of installation, when approved by the Architect, will become the basis for inspecting and accepting or rejecting actual installation methods used on the Work.

1.4 PRODUCT HANDLING

1.4.1 Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.

1.4.2 Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

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PART TWO - PRODUCTS

2.1 EXTERIOR ALUMINUM LETTERS

2.1.1 Letter size, depth, and height as shown on drawings. If lighting is required, refer to electrical drawings.

2.2 EXTERIOR LOGOS

2.2.1 Logo size, depth, and height as shown on drawings. If lighting is required, refer to electrical drawings.

2.3 BUILDING PLAQUE

2.3.1 General: Aluminum tablet shall be as manufactured by the Southwell Co., San Antonio, Texas or approved equal.

2.3.2 Material: Tablet is to be cast from F-214 aluminum alloy. Casting shall be free of pits and gas holes and all letters shall be sharp and hand tooled. Borders and faces of raised letters are to be satin finish and background is to be stipple texture.

2.3.3 Finish: Background shall be sprayed with black acrylic lacquer. Plaque shall be chemically cleaned and etched and treated with alodine. Two coats of clear acrylic lacquer shall be sprayed on completed plaque.

2.3.4 Design: Tablet is to be 24 inches wide and 30 inches high with "double line" border design. Letter style shall be "Seneca". Furnish Architect with rubbing of actual pattern for approval prior to casting.

2.4 INTERIOR DOOR SIGNS

2.4.1 Acceptable Manufacturers: Archway Graphic Designs, Little Rock, Arkansas; Best Sign Systems, Montrose, Colorado or Architect approved equal.

2.4.2 Schedule: Provide for door signs at each new interior door, stairwell openings and at the openings of gang toilet rooms. Toilet partition doors and furnace doors shall be excluded. Exact wording and numbers will be provided by Owner.

2.4.3 Design: Manufacturer’s standard monolithic tactile plaque constructed of one material utilizing a thermoforming process, which provides a monolithic plaque sign. The sign body, face, raised text and Braille are compression molded to form a single dimensional component.

1. Thickness: 1/8”
2. Tactile Characters/Symbols: Raised 1/32 inch from sign plate face.
3. Lettering Style: Helvetica regular, upper case letters, minimum height 5/8”, maximum height 2”.
4. Braille: Grade 2 braille, placed directly below last line of characters.
5. Contrast: Letters, numbers and symbols shall contrast with background as selected by the Architect.
6. Panel Shape and Sizes: Rectangular. Size shall be 5" x 7"; restrooms shall be 8" x 6".
7. Background Standard: Painted custom colors, Matthews acrylic polyurethane paint, subsurface.
8. Surface Texture: Standard – Suede – Low Gloss 12 gloss units +/- 3 units.
9. Surface Protection: Matthews acrylic polyurethane, satin finish clear coat.

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10. Painted Backer: All signs mounted to glass shall have painted backer.

2.4 TORNADO SHELTER SIGNAGE

2.4.1 General: Provide identification sign at every entrance to Safe Room as manufactured by Compliance Signs, Chadwick, Illinois or equal.

2.4.2 Design: Sign shall be black acrylic with "Tornado Shelter" in white letters and a white tornado graphic with pre-drilled holes for exterior mounting. Sign shall comply with FEMA Safe Room Guideline (FEMA 361) and ICC-500 2020.

PART THREE - EXECUTION

3.1 EXTERIOR ALUMINUM LETTERS

Provide all necessary blocking as required by the manufacturer.

3.2 EXTERIOR LOGOS

Provide all necessary blocking for complete installation of logos.

3.3 BUILDING PLAQUE

Locate as directed by the Architect and mount using concealed masonry anchors.

3.4 DOOR SIGNS

Where permanent identification is provided for, signs shall be installed on the wall adjacent to the latch side of the door. Where there is no wall space to the latch side of the door, including at double leaf doors, signs shall be placed on the nearest adjacent wall. Mounting height shall be 60 inches above the finish floor to the centerline of the sign. Mounting location for such signage shall be so that a person may approach within 3 inches of signage without encountering protruding objects or standing within the swing of a door. Interior signs to be mounted to wall with double-sided vinyl tape and silicone adhesive. Exterior signs to be predrilled in (4) corners and attached with appropriate screws (and anchors) and decorative washers (nickel finish) to exterior wall surface.

END OF SECTION

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Section 10 21 13

TOILET COMPARTMENTS

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Provide all toilet partitions and urinal screens, complete, in place, as shown on the Drawings, specified herein, and needed for a complete and proper installation.

1.2 QUALITY ASSURANCE

1.2.1 Qualifications of Manufacturers: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar products and with a history of successful production acceptable to the Architect.

1.2.2 Qualifications of Installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specific requirements and the methods needed for proper performance of the Work of this Section.

1.3 SUBMITTALS

1.3.1 General: Comply with provisions of Section 01 33 23.

1.3.2 Product data: Within 30 calendar days after award of the Contract, submit:

1. Manufacturer's specifications and other data required to demonstrate compliance with specified requirements.
2. Manufacturer's recommended installation procedures which, when approved by the Architect, shall become the basis for inspecting and accepting or rejecting actual installation procedures used on the Work.
3. Complete materials list of all items proposed to be furnished and installed under this Section.
4. Shop drawings and sufficient dimensional data to enable proper co-ordination of installation of concealed items of support.

1.4 PRODUCT HANDLING

1.4.1 Protection: Use all means necessary to protect materials of this Section before, during, and after installation and to protect work and materials of all other trades.

1.4.2 Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

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PART TWO - PRODUCTS

2.1 TOILET PARTITIONS

Provide floor anchored overhead braced solid plastic, homogenous colored partitions by Scranton Products, Inc. or approved equal.

2.1.1 All hardware, including coat hook/bumper shall be solid brass, chrome plated or stainless steel and guaranteed for twenty years. "Zamack" chrome plated non-ferrous castings are not acceptable.

2.1.2 All screws shall be stainless steel one-way machine screws.

2.1.3 All hinge brackets, strike and keeper will be thru-bolted with hex bolts having one-way theft proof heads.

2.1.4 Solid Plastic - high density polyethylene with homogenous color throughout, not less than 1" thick, seamless construction with edges eased.

2.1.5 Urinal screens shall have post from floor to headrail brace. Headrail brace shall be continuous across entire length of urinals.

2.1.6 Colors shall be selected from the manufacturer's full range of colors.

PART THREE - EXECUTION

3.1 FABRICATION

Fabricate in strict accordance with the manufacturer's product data as approved by the Architect.

3.2 PREPARATION FOR INSTALLATION

3.2.1 Coordination: Properly coordinate with all other trades as required to ensure adequate provision for anchorage of the work of this Section and for proper interface with the work of all other trades.

3.2.2 Inspection: Examine the areas and conditions under which work of this Section will be installed. Correct conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

Install the Work of this Section straight and plumb within a tolerance of one in 200 horizontally and one in 500 vertically, rigidly anchoring into position for long life under hard use. Perform all drilling and cutting for installation of anchors only at locations which will be concealed in the finished work. Provide a uniform vertical edge clearance for doors of approximately 3.16" resting open at approximately 30 degrees when the latch is not engaged.

END OF SECTION

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Section 10 28 13

TOILET ACCESSORIES

PART ONE - GENERAL

1.1 DESCRIPTION

A. Work included: Provide all toilet room accessories, complete, in place, as shown on the Drawings, specified herein, and needed for a complete and proper installation.

1.2 QUALITY ASSURANCE

A. Qualification of manufacturer: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.

1.3 SUBMITTALS

A. General: Comply with the provisions of Section 01 33 23.

B. Product data: Within 30 calendar days after award of Contract, submit:

1. Complete materials list showing all items proposed to be furnished and installed under this Section.
2. Manufacturer's specifications and other data required to demonstrate compliance with specified requirements.
3. Manufacturer's recommended methods of installation.
4. Complete descriptive data on fasteners proposed for each type of wall construction, recommended mounting locations, and mounting instructions.

The manufacturer's recommended methods of installation, when approved by the Architect, will become the basis for inspecting and accepting or rejecting actual installation methods used on the Work.

1.4 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

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PART TWO - PRODUCTS

2.1 GENERAL

A. Anchors and fasteners: Provide anchors and fasteners capable of developing a retaining force commensurate with the strength of the accessory to be mounted, and well suited for use with the supporting construction. Where exposed fasteners are permitted, provide oval head fasteners with finish matching the accessory. Provide masonry anchors for wall installation and stainless steel hex bolts for partition installation.

B. Finish: All accessory items shall be stainless steel with satin finish.

C. Design is based on use of products manufactured by Bradley, and catalog numbers of that manufacturer are given as an indication of the quality and style required. Equal products by Bobrick or other manufacturers, approved by the Architect, will be acceptable in accordance with the General Conditions.

2.2 ACCESSORY ITEMS

A. Grab bars: (Locate as shown on drawings.) Bradley 812 Series in lengths as shown on drawings. Mount at 34" above floor using mounting kit as recommended by manufacturer at block walls.

B. Mirror: (Locate as shown on drawings.) Bradley Model 780, mounted with bottom of reflective surface at 40" above the floor. Use stainless steel, tamper proof screws and metal expansion shield masonry anchors (plastic anchors are not acceptable).

C. Coat hooks: (One per toilet stall.) Bradley Model 9115 with concealed fasteners.

PART THREE - EXECUTION

3.1 INSPECTION

Examine the areas and conditions under which work of this Section will be installed. Correct conditions detrimental to proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 COORDINATION

Throughout construction of substrate surfaces, use all means necessary to ensure proper and adequate provision for concealed support devices, and for finished openings, to receive the Work of this Section.

3.3 INSTALLATION

Install the Work of this Section in strict accordance with the manufacturer's recommendations as approved by the Architect, anchoring all components plumb, level, square, and firmly into position for long life under hard use.

END OF SECTION

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Section 10 41 00

EXTERIOR SECURITY VAULT

PART ONE - GENERAL

1.1 DESCRIPTION

A. Work included: Provide vault for emergency access to building, complete, in place, as shown on the Drawings, specified herein, and needed for a complete and proper installation.

1.2 QUALITY ASSURANCE

A. Qualifications of manufacturer: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.

1.3 SUBMITTALS

A. General: Comply with the provisions of Section 01 33 23.

B. Product data: Within 30 calendar days after award of Contract, submit:

1. Complete materials list showing all items proposed to be furnished and installed under this Section.
2. Manufacturer's specifications and other data required to demonstrate compliance with specified requirements.
3. Manufacturer's recommended methods of installation.
4. Complete descriptive data on fasteners proposed for each type of wall construction, recommended mounting locations, and mounting instructions.

The manufacturer's recommended methods of installation, when approved by the Architect, will become the basis for inspecting and accepting or rejecting actual installation methods used on the work.

1.4 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

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PART TWO - PRODUCTS

2.1 SECURITY VAULT

Provide a rapid entry system for emergency access to the building with a Series 3200 recessed Knox-Vault including a recessed mounting kit as manufactured by Knox Co., Phoenix, Arizona or Architect approved equal.

PART THREE - EXECUTION

3.1 INSTALLATION

Strictly follow manufacturer's installation recommendations and coordinate as required with all trades.

END OF SECTION

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Section 10 44 16

FIRE EXTINGUISHERS

PART ONE - GENERAL

1.1 DESCRIPTION

Provide all fire extinguishers, brackets and cabinets, complete, in place, as shown on the Drawings, specified herein, and needed for a complete and proper installation.

1.2 QUALITY ASSURANCE

1.2.1 Qualification of manufacturer: Use products in the work of this Section produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect. Conform to NFPA 10 requirements for portable fire extinguishers. Provide fire extinguishers, cabinets and accessories by single manufacturer.

1.2.2 Qualifications of installers: Use skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 REFERENCES

A. NFPA 10 – Portable Fire Extinguishers

B. ADA Accessibility Guidelines

C. UBC Standard 7-5 (ASTM E-814-83)

1.4 SUBMITTALS

1.4.1 General: Comply with provisions of Section 01 33 23.

1.4.2 Manufacturers data: Within 30 calendar days after award of Contract, submit:

1. Complete materials list of all items proposed to be furnished and installed under this Section.
2. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.

1.5 PRODUCT HANDLING

1.5.1 Protection: Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed work and materials of all other trades.

1.5.2 Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

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PART TWO - PRODUCTS

2.1 GENERAL

2.1.1 This specification is written around J.L. Industries, Bloomington, MN. The following manufacturer is accepted as equal, subject to the requirements of the specifications and drawings.

Larsen's Manufacturing, Minneapolis, MN

2.2 FIRE EXTINGUISHERS

2.2.1 General: Provide Cosmic 10E Multi-purpose Dry Chemical extinguisher as manufactured by J.L. Industries of Bloomington, MN.

2.3 CABINETS

Provide Ambassador 1017, V13, color epoxy coated trim, door and tub, as manufactured by J.L. Industries of Bloomington, MN. Tub shall be semi-recessed or surface mounted as shown on drawings. Color to be selected from manufacturer's stock colors by the Architect.

2.4 FIRE RATING

Furnish fire-rated cabinet with Fire-FX option as manufactured by J.L. Industries of Bloomington, MN, at all rated wall locations as indicated on plans. Cabinet to be fabricated in accordance with the Warnock Hersey certified design and shall carry the Warnock Hersey label for 1 and 2 hour combustible and non-combustible walls.

Cabinet to be fabricated in accordance with UBC 43-6 (ASTM E814-88) to measure fire resistive performance.

PART THREE - EXECUTION

3.1 INSPECTION

Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the Work to approval of the Architect. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

Install cabinets in locations and at mounting heights as shown on the Drawings, and in accordance with the manufacturer's instructions. Provide all grounds, brackets, anchors, trim, and accessories for a complete installation.

3.3 Install using F.E. brackets where cabinets are not called for in mechanical or electrical rooms.

END OF SECTION

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Section 10 73 26

WALKWAY CANOPIES

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Provide aluminum, self guttering, walkway canopy system including all accessories, complete, in place, as shown on the Drawings, specified herein, and needed for a complete and proper installation.

1.2 RELATED WORK

1. Joint Sealants Section 07 92 00

1.3 QUALITY ASSURANCE

1.3.1 Qualifications of Manufacturers: Products used in the work of this Section shall be produced by Manufacturers regularly engaged in manufacture of similar products and with a history of successful production acceptable to the Architect.

1.3.2 Qualifications of Installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.

1.4 SUBMITTALS

1.4.1 General: Comply with provisions of Section 01 33 23.

1.4.2 Product data: Within 60 calendar days after award of the contract, submit:

1. Manufacturer's specifications and other data required to demonstrate compliance with specified requirements.
2. Design Data: Design calculations bearing the seal of a Registered Professional Engineer, licensed in the state where the project is located. Design calculations shall state that the walkway cover system design complies with the wind requirements of ASCE 7, the stability criteria of applicable building code, and all other governing criteria.
3. Manufacturer's recommended installation procedures which, when approved by the Architect, shall become the basis for inspecting and accepting or rejecting actual installation procedures used on the Work.
4. Complete materials list of all items proposed to be furnished and installed under this Section.
5. Shop drawings and sufficient dimensional data to enable proper co-ordination of installation of concealed items of support.

1.5 PRODUCT HANDLING

1.5.1 Protection: Use all means necessary to protect materials of this Section before, during and after installation and to protect work and materials of all other trades.

1.5.2 Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

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PART TWO - PRODUCTS

2.1 GENERAL

Aluminum, self guttering, canopy system shall be as manufactured by Peachtree Protective Covers, Inc., Hiram, Georgia or Architect approved equal. Color shall be selected by the Architect from manufacturers standard colors – white, bronze, and ivory.

2.1.1 Columns: Provide extruded aluminum column (sized as required), set in concrete. Provide clear acrylic coating on all surfaces below grade.

2.1.2 Beams: Provide tubular extruded sections (sized as required) with top edges designed to receive deck members in a self-flashing manner. Provide structural ties in top of all beams.

2.1.3 Roof Deck: Extruded self-flashing 3" sections interlocking into a composite unit.

2.1.4 Fascia: Provide P240 .050" aluminum roll formed self guttering fascia, with accessories.

2.1.5 Sealants and Caulking: Joints, as required, shall be caulked and sealed to provide a positive barrier against passage of air and moisture.

2.1.6 Finish: Entire canopy system shall have Kynar finish. Color shall be selected by the Architect from manufacturer's standard colors.

PART THREE - EXECUTION

3.1 Installation of canopy system shall follow printed manufacturer's recommendations as approved by the Architect.

3.2 Erect the entire installation straight and true in accordance with standard construction procedures as approved by the Architect.

3.3 All surfaces shall be cleaned thoroughly prior to acceptance of canopies.

END OF SECTION

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Section 12 24 13

ROLLER SHADES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roller shades.

1.2 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry: Wood blocking and grounds for mounting roller shades and accessories.

B. Section 09 21 00 - Gypsum Board Assemblies: Coordination with gypsum board assemblies for installation of shade pockets, closures and related accessories.

C. Section 09 51 00 - Acoustical Ceilings: Coordination with acoustical ceiling systems for installation of shade pockets, closures and related accessories.

1.3 REFERENCES

A. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. NFPA 701 - Fire Tests for Flame-Resistant Textiles and Films.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 23.

B. Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
3. Storage and handling requirements and recommendations.
4. Mounting details and installation methods.

C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.

1. Prepare shop drawings on Autocad or Microstation format using base sheets provided electronically by the Architect.

D. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.

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E. Selection Samples: For each finish product specified, one set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.

F. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shadecloth sample and aluminum finish sample as selected. Mark face of material to indicate interior faces.

G. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years experience in manufacturing products comparable to those specified in this section.

B. Installer Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.

C. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.

D. Electrical Components: NFPA Article 100 listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system. Individual testing of components will not be acceptable in lieu of system testing.

E. Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, ATCC9645.

F. Mock-Up: Provide a mock-up (manual shades only) of one roller shade assembly for evaluation of mounting, appearance and accessories.

1. Locate mock-up in window designated by Architect.
2. Do not proceed with remaining work until, mock-up is accepted by Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

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1.8 WARRANTY

A. Roller Shade Hardware and Chain Warranty: Manufacturer's standard non-depreciating twenty-five year limited warranty.

B. Standard Shadecloth: Manufacturer's standard twenty-five year warranty.

C. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: MechoShade Systems, Inc., which is located at: 42-03 35th St., Long Island City, NY 11101; Tel: 718-729-2020; Fax: 718-729-2941.

B. Acceptable manufacturer: Draper, Inc., Spiceland, Indiana

2.2 ROLLER SHADE

A. Shades:

1. Mounting: Surface mounted with fascia.
2. Clutch Mechanism: All metal single component clutch. (Mecho 5 or Draper NEXD acceptable or approved equal.)
3. Configuration: Single solar shadecloth.
4. Solar Shadecloths:
   a. Fabric: ThermoVeil 1000, 3 percent open, 2 by 2 open basket-weave pattern.
   b. Color: Selected from manufacturer's standard colors.
5. Solar Blackout Shadecloth: Where shown on drawings. Color shall be selected from manufacturer's standard colors.
6. Operation: Manual

B. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.

1. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for all shades within one room.
2. Shade Band and Shade Roller Attachment:
   a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection. Roller tubes less than 1.55 inch in diameter for manual shades are not acceptable.
   b. Provide for positive mechanical engagement with drive / brake mechanism.
   c. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" spline mounting, without having to remove shade roller from shade brackets.

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d. Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
e. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

2.3 SHADE FABRICATION

A. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.

B. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch (3.18 mm) in either direction per 8 feet (2438 mm) of shade height due to warp distortion or weave design. Fabricate hem as follows:

1. Exposed blackout hembar with light seal.

C. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shadebands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.

D. For railroaded shadebands, provide seams in railroaded multi-width shadebands as required to meet size requirements and in accordance with seam alignment as acceptable to Architect. Seams shall be properly located. Furnish battens in place of plain seams when the width, height, or weight of the shade exceeds manufacturer's standards. In absence of such standards, assure proper use of seams or battens as required to, and assure the proper tracking of the railroaded multi-width shadebands.

E. Provide battens for railroaded shades when width-to-height (W:H) ratios meet or exceed manufacturer's standards. In absence of manufacturer's standards, be responsible for proper use and placement of battens to assure proper tracking and roll of shadebands.

F. Blackout shadebands, when used in side channels, shall have horizontally mounted, roll-formed stainless steel or tempered-steel battens not more than 3 feet (115 mm) on center extending fully into the side channels. Battens shall be concealed in a integrally-colored fabric to match the inside and outside colors of the shadeband, in accordance with manufacturer's published standards for spacing and requirements.

1. Battens shall be roll formed of stainless steel or tempered steel and concave to match the contour of the roller tube.
2. Batten pockets shall be self-colored fabric front and back RF welded into the shadecloth. A self-color opaque liner shall be provided front and back to eliminate any see through of the batten pocket that shall not exceed 1-1/2 inches (38.1 mm) high and be totally opaque. A see-through moire effect, which occurs with multiple layers of transparent fabrics, shall not be acceptable.

2.4 COMPONENTS

A. Access and Material Requirements:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
3. Use only Delrin engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester will not be acceptable.

2.5 ACCESSORIES

A. Fascia:

1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
2. Fascia shall be able to be installed across two or more shade bands in one piece.
3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.
5. Notching of Fascia for manual chain shall not be acceptable.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches (50 mm) to interior face of glass. Allow proper clearances for window operation hardware.

B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

C. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

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D. Engage Installer to train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

Section 12 32 00

MANUFACTURED WOOD CASEWORK

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Provide all manufactured wood casework complete, in place, as shown on the Drawings, specified herein, and needed for a complete and proper installation.

1.2 QUALITY ASSURANCE

1.2.1 Qualifications of manufacturers: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar products and with a history of successful production acceptable to the Architect.

1.2.2 Qualifications of installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods for proper performance of the Work of this Section.

1.2.3 Approved bidders: The following manufacturers are approved for bidding, subject to meeting all construction requirements of this specification. No others shall be accepted for bidding without prior written approval issued by addenda to the Trade Contractors:

TMI Systems Design Corp.
Stevens Industries, Inc.

1.3 SUBMITTALS

1.3.1 General: Comply with provisions of Section 01 33 23.

1.3.2 Product data: Within 30 calendar days after award of the Contract, submit:

a. Manufacturer's specifications and other data required to demonstrate compliance with specified requirements.
b. Manufacturer's recommended installation procedure which, when approved by the Architect, shall become the basis for inspecting and accepting or rejecting actual installation procedures used on the work.
c. Complete materials list of all items proposed to be furnished and installed under this Section.
d. Shop drawings and sufficient dimensional data to enable proper co-ordination of installation of concealed items of support.
e. (When required by Architect), a complete sample unit showing full scale joinery, general construction, hardware type, material and finish.

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1.4 PRODUCT HANDLING

1.4.1 Protection: Use all means necessary to protect materials of this Section before, during and after installation and to protect work and materials of all other trades.

1.4.2 Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

1.5 WARRANTY

All products will be guaranteed against defects in materials or workmanship for a period of five (5) years from acceptance of building by the Owner.

PART TWO - PRODUCTS

2.1 GENERAL

2.1.1 All doors, drawers and exposed shelving edges to be covered with 3mm P.V.C. banding, machine applied. All unexposed edges to be covered with 1mm P.V.C. banding.

2.2 CONSTRUCTION

2.2.1 Ends: 3/4" thick 45 lb. test particle board with Almond cabinet liner on inside and selected Wilsonart .028 high pressure laminate on the outside. Exposed edge is protected with 3mm P.V.C. banding, machined applied. (Banding hand applied will not be acceptable.) Ends attached to top and bottom with special 1/4" x 3-1/2" knife threaded hex headed confirmat screw connectors by Hafele or equal.

2.2.2 Partitions: 3/4" thick 45 lb. text particle board. When unexposed, Almond cabinet liner on each side, when exposed, selected Wilsonart .028 high pressure laminate on each side. Exposed edge is protected with 3mm P.V.C. banding, machine applied. (Banding hand applied will not be acceptable.)

2.2.3 Tops and bottoms: 1" thick 45 lb. text particle board. When unexposed, Almond cabinet liner on each side, when exposed selected Wilsonart .028 high pressure laminate on each side. Exposed edge is protected with 3mm P.V.C. banding, machined applied. (Banding hand applied will not be acceptable.)

2.2.4 Sub-tops: At all base cabinets top frame shall be 1" thick x 4" wide plywood. Exposed edge is protected with 3mm P.V.C. banding, machined applied. (Banding applied by hand will not be acceptable.)

2.2.5 Bases: 3/4" thick x 4" wide exterior Pine or Fir Plywood applied separately to the bottom of base and tall storage cabinets.

2.2.6 Counter tops:

a. Plastic Laminate Surfacing:

i. High-pressure decorative laminate Vertical Grade Standard (VGS) (.028), NEMA Test LD 3-2005.

ii. High-pressure decorative laminate Horizontal Grade Standard (HGS) (.048), NEMA Test LD 3-2005.

iii. High-pressure decorative laminate Horizontal Grade Postformed (HGP) (.039), NEMA Test LD 3-2005. (Postformed counter – bullnose.)

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iv. Thermally fused melamine TFM laminate, NEMA Test LD 3-2005. (TFM allowed on casework interiors only, as specified below. Utilization of TFM on any exterior casework surfaces, including door and drawer faces and finished ends, will not be permitted.)

b. Solid Surface Counters:
   i. Composition Solid-Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
   ii. Thickness: 1/2"
   iii. Colors and Patterns: Wilsonart Solid Surface, Price Groups 1-3.

c. Edging Materials for Plastic Laminate Counters:
   i. 3mm PVC banding, machine applied and machine profiled to 1/8 inch radius. (Banding hand applied will not be acceptable.)

2.2.7 Tops: (Low Mobile Units and Low Shelving) 3/4" thick particle board core with selected Wilsonart .028 high pressure laminate surface on two sides. All exposed edges to be protected with 3mm P.V.C. banding, machine applied. (Banding hand applied will not be acceptable.)

2.2.8 Shelves: Shelves under 24" in width shall be 3/4" thick, shelves over 24" in width shall be 1" thick. All shelves shall be 45 lb. test particle board with selected Wilsonart .028 high pressure laminate on each side, unexposed shelves shall have Almond cabinet liner. Exposed edges shall be protected with 3mm P.V.C. banding, machine applied. (Banding hand applied will not be acceptable.)

2.2.9 Shelf Hardware:

a. Adjustable shelves: K. V. No. 255 recessed standard and No. 256 shelf support clips – adjustable on 1/2" centers.
b. Fixed shelves: Fastened by steel angle brackets and screws to ends.

2.2.10 Backs:

a. Finished backs: 3/4" 45 lb. test particle board core with selected Wilsonart .028 high pressure laminate applied to each side. Exposed edges protected with 3mm P.V.C. banding, machined applied. (Banding hand applied will not be acceptable.)
b. Unexposed backs: 1/2" thick 45 lb. test particle board core with Almond cabinet liner on one side. Back to be lipped in on all four sides and attached with glue and 1-1/2" screws.

2.2.11 Drawers:

a. Fronts: 3/4" 45 lb. test particle board with backer sheet on inside and selected Wilsonart .028 high pressure laminate on outside. Exposed edges are protected by 3mm P.V.C. banding, machined applied. (Banding hand applied will not be acceptable.) Front attached to drawer body with screws.
b. Drawer body: Sides, fronts and backs shall be 1/2" hardwood solid core plywood finger jointed on all four corners, glued and cross pinned. Dovetail joint will be considered equal construction.(Melamine covered particle board drawer body will not be acceptable.)
c. Drawer bottom: 1/4" plywood or hardboard, grooved in on all four sides.
d. Drawer slides: K. V. No. 1300 w/lever release positive stop or equal. (Slides without lever release positive stop will not be acceptable.) File drawer slides - K.V. No. 476F, full extension.

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2.2.12 Doors:

a. Standard: 3/4" test particle board core with selected Wilsonart .028 high pressure laminate on each side. All four edges shall be protected with 3mm P.V.C. banding, machine applied. (Banding hand applied will not be acceptable.)
b. Glass sliding doors: 1/4" thick safety plate glass or 1/4"thick tempered safety glass as shown on furniture schedule.
c. Glass:
    1. Glass insert doors, hinged: 1/4 inch thick laminated safety glass.
    2. Glass insert doors, hinged or sliding tall or base cabinets. 1/4 inch thick laminate safety glass.

2.2.13 Filler panels: 3/4" particle board core with selected Wilsonart .028 High pressure laminate surface. Fillers to be used as required, in colors to match other vertical surfaces.

2.2.14 Hardware:

a. Pulls: Weber-Knapp #7005 institutional design, satin chrome finish, holes on 4” centers.
b. Hinges: A & M Hardware #25270-005-05 dull chrome, five knuckle closed pin type, full overlay with 270 degree swing.
c. Catches: Magnetic type heavy duty. Doors over 36” in height shall have catches at top and bottom.
d. Locks: (When required) National Lock #C8703. When required, lock can be keyed different and master keyed.
e. ADA Vanity Bracket, Aluminum: Hafele America Co., 22” x 18”.

2.2.15 Shelving units: 1” thick 45 lb. test particle board with selected Wilsonart .028 high pressure laminate surface on two sides. All exposed edges shall be protected with 3mm P.V.C. banding, machine applied. (Banding hand applied will not be acceptable.) All shelves to be adjustable on K. V. steel shelf standard on 1/2" centers.

2.2.16 Finishes:

a. Unexposed surfaces: Almond cabinet liner.
b. Exposed vertical surfaces: Selected Wilsonart .028 high pressure laminate, color as selected by Architect.
c. Countertops: Selected Wilsonart .048 high pressure laminate, color as selected by Architect.
d. Special tops as noted on drawings by Architect.

2.2.17 Additional material: Furnish all fillers, scribes, etc., as shown on the drawings and/or part of the cabinets but which may not be shown.

PART THREE - EXECUTION

3.1 WORK NOT INCLUDED

a. Electrical work: Other than providing electric outlets at science furniture that are directly attached to cabinets for connection by the electrical contractor.
b. Mechanical service stub-ins.
c. HVAC ductwork and grilles.

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d. Framing for reinforcement of walls, floors or ceilings necessary to provide support for casework.

3.2 PREPARATION FOR INSTALLATION

3.2.1 Coordination: Properly coordinate with all other trades as required to ensure provision for anchorage of the work of this Section and for proper interface with the work of all other trades.

3.2.2 Inspection: Examine the areas and conditions under which work of this Section will be installed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

Installation shall be according to manufacturer's recommended procedures as approved by the Architect.

END OF SECTION

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Section 13 34 19

METAL BUILDING SYSTEMS

PART ONE - GENERAL

1.1 GENERAL CONDITIONS

All work under this section is subject to General Conditions and Supplementary General Conditions and shall be governed by the requirements therein.

1.2 BUILDING DESCRIPTION

1.2.1 The building size will be defined as building line to building line. Clear height under primary frames and roof purlins will be as noted on the architectural building sections. Interior and exterior column locations will be as noted on the structural plans.

1.2.2 Primary Structural: Frames will consist of welded up plate section columns and roof beams complete with necessary splice plates for bolted field assembly. All bolts for field assembly of primary frames will be high strength bolts. End wall structure shall consist of rigid frame with interior bearing columns. Exterior columns and interior columns will be welded "H" sections. Connection of all major structural members will be made with A 325 high-tensile bolts through prepunched or predrilled holes for exact alignment. All structurals will be painted with manufacturer's standard primer with manufacturer's standard surface preparation per structural painting in framing system specifications.

1.2.3 Secondary structurals shall be purlins or girts with a red primer finish applied by coil coater.

1.2.4 The roof system shall be equal to VSR panels by Butler Manufacturing Co. Color shall be Butler-Cote 500 FP and shall be selected from manufacturers standard colors - "6 minimum choices". The roof system shall also be in compliance with ENERGY STAR rating.

All roof penetrations (plumbing, mechanical, electrical, etc.) shall be performed by, and therefore the responsibility of, the roofing contractor.

1.2.5 Wall System: The metal faces shall be of 24 gage zinc coated steel and shall be supplied with a factory applied color coating selected from manufacturers standard colors. Panel profile shall be equal to Butlerib II as manufactured by Butler Manufacturing Co.

1.3 QUALITY ASSURANCE

1.3.1 Contractor shall submit contract drawings and specifications to manufacturer. Contractor is ultimately responsible that manufacturer complies with drawings and specifications.

1.3.2 Submit written Letter of Certification prepared and signed by a Professional Engineer, registered to practice in the State of Arkansas verifying that the building system design and metal roof system design (including panels, clips, and support system components) meet indicated loading requirements and codes of authorities having jurisdiction. The certification must reference specific dead loads, live loads, snow loads, wind loads/speeds, tributary area load reductions (if applicable), concentrated loads, collateral loads, seismic loads, end use categories, governing code bodies including year, load applications and deflections. The Letter of Certification must be approved before shop drawings are submitted. Letter of Certification referring to the building order will not be accepted.

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1.3.3 In addition to mill certifications of structural steel, the manufacturer shall provide, upon request, evidence of compliance with specifications through testing independent of the manufacturer's suppliers. This quality assurance testing to include structural bolts, nuts, screw fasteners, mastics, and metal coatings (primers, metallic coated products, and painted coil products).

1.3.4 Design Loads:

a. Structural design criteria for the building structural system will be the - 2021 International Building Code.

b. Risk Category per ASCE 7-16 = III

c. Roof live loads are loads produced during the life of the structure by moveable objects. Wind, snow, seismic or dead loads are not live loads. Roof live loads are applied based on the Tributary Area as follows:

1) 20 PSF Max. Reduction (frames only) 4#/Ft.^{2}

d. The roof snow load used for designing the structure may not be reduced and shall be the product of the following items as per ASCE- 7, 2016:

Snow Load Coefficient (Ce)	1.0
Importance Factor (I)	1.1
Ground Snow Load (Pg)	10 PSF
Thermal Factor (Ct)	1.0

Roof Snow Load (Pf) = Calculate per (EQ. 7.3-1, ASCE 7) Minimum Pm = Is x Pg
The Snow Load (Pf) shall be used for design if it exceeds minimum live load. Rain or Snow additional load-governing codes may require an additional 5 psf be added to the roof snow loads if the roof slope is < 1/2:12. See plans for snow loads at flat roof.

e. Ultimate wind speed is 113 mph as per ASCE-7, 2016.
Importance factor = 1.0
Exposure = C
Internal Pressure Wind Pressure Coefficient = $\pm$ .18. Coefficients and the design pressures shall be applied per governing code.

f. Seismic design shall be per ASCE 7, 2016 and based on:
Seismic Risk Category = III
S_s = 0.405
S_1 = 0.17
S_{ds} = 0.35
S_{d1} = 0.17
Site Class = C
Seismic Design Category = C
Seismic Importance Factor; Ie = 1.25

g. Dead Load is the weight of building system construction, such as roof, framing and covering members.

h. Collateral Load - Additional imposed loads required by the contract documents other than the weight of the metal building system. These added loads could include such items mechanical, electrical and ceiling systems.

1. <u>UNIFORM ROOF LOADS</u>
Sloped Roofs – 8.5 PSF
Flat Roof – 12 PSF
Above Storm Shelter – 3 PSF

2. <u>CONCENTRATED ROOF LOADS</u>
Loads and locations as shown on framing plans. (Floor loads, mechanical, etc.).

i. Load Combinations: Load combinations used to design primary and secondary structural members shall be according to the governing code.

1.3.5 Calculations for deflections shall be done using only the bare frame method. Reductions based on engineering judgment using the assumed composite stiffness of the building envelope shall not be allowed. When maximum deflections are specified, calculations shall be included in the design data. Deformation calculations for wind shall use 50-year mean recurrence allowable wind loading. Frame deformations used for seismic drift criteria is based upon the amplified deflection as determined by EQ. 12.8-15 of ASCE 7-16. All other seismic deflection criteria is based upon elastic deflections. Refer to the table in the specifications for deflection limits.

MEMBER	SPECIFIED DEFORMATION	MAXIMUM	LOADING
Metal Wall Panels	Perpendicular to girts	L/120	Wind Load
Roof Purlins	Vertical deflection	L/180	DL+LL+Collateral Load
Roof Purlins	Vertical deflection	L/240	LL
Roof Beams & Frames	Vertical deflection	L/240	DL+LL+Collateral Load
Frame Drift at eave	Horizontal deflection	H/240	Wind Load
Frame Drift at eave	Horizontal deflection	H/66	Seismic
Building Drift at Expansion Joint	Horizontal deflection	H/240	Wind or Seismic Load
Wall Girts Supporting Masonry	Horizontal deflection	L/240 (1½" Maximum)	Wind or Seismic Load
Wall Girts for Metal Panel	Horizontal deflection	L/180	Wind or Seismic Load

1.4 WARRANTIES

1.4.1 Weathertightness: Weathertightness of roof against leaks and perforations due to workmanship and/or materials shall be guaranteed for 20 years by metal building manufacturer. The Contractor shall furnish a two (2) year guarantee on material and workmanship.

1.4.2 Color: The exterior color finish for the wall and roof panels shall be guaranteed by the building manufacturer for twenty (20) years against blistering, peeling, cracking, flaking, checking and chipping. Excessive color change and chalking shall be guaranteed for twenty (20) years. Chalking shall not exceed #8 – ASTM D4214 and color change shall not exceed 5 N.B.S. units (ASTM D-2244).

1.4.3 Provide signed warranty of above guarantees at completion of work.

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1.5 SHOP DRAWINGS

1.5.1 Shop Drawings: Steel fabricator shall submit one hard copy (not to be returned) and one electronic copy in PDF format as per Section 01 33 23 of detailed and checked shop drawings for approval by the Architect. All drawings shall clearly show location and sizes of all material, all building dimensions and elevations pertinent to the structure, and any other miscellaneous technical and erection data required for approval and construction. These shop drawings must be approved by the Architect before fabrication and shipment. PARTIAL SUBMITTALS WILL NOT BE ACCEPTED UNLESS APPROVED IN ADVANCE WITH THE ARCHITECT.

1.5.2 Calculations: Three (3) copies of calculations shall be submitted with the shop drawings. Calculations shall be stamped and signed by a professional engineer registered to practice in the state of Arkansas.

1.5.3 Column Reactions: Column reactions for each column shall be submitted for approval. This submittal shall include reactions for each load case and maximum and minimum reactions for each load combination. Reactions shall not include amplified seismic loads or seismic overstrength factors.

1.6 SYSTEM DESCRIPTION

1.6.1 The pre-engineered metal building covered by this specification is to be a beam-and-column structure or steel frames and columns, complete with purlins, girts, wall panels, roof panels, braces and miscellaneous framing required.

1.6.2 The roof slope shall be as noted on plans.

1.6.3 Column spacing shall be as shown on the foundation plan.

1.6.4 Provide frames with eaves heights and clearances shown on plans.

1.6.5 Vertical diagonal bracing shall be permitted only in the sidewall or roof planes where they will not obstruct openings. Horizontal plane bracing shall be permitted providing it is above the building's required interior clear height. Cables for bracing are not allowed. Portal frames shall be located as shown on the drawings.

1.6.6 All roof accessories (roof curbs, snowguards, roof walkways, roof hatches, etc.) shall be provided by a manufacturer approved by the metal building manufacturer and shall be included in the weathertightness warranty.

1.6.7 All column base plates will be pinned connections to foundation.

PART TWO - MATERIALS

2.1 MANUFACTURERS

2.1.1 Manufacturers shall meet the requirements of the International Accreditation Service, Inc. document AC472, “Accredation Criteria for Inpsection Programs for Manufacturers of Metal Building Systems.” Manufactures are not required to be certified by the International Accreditation Service (IAS), but must meet the technical criteria. Upon successful bidding, the manufacture shall submit documentation depicting how it meets the requirements of the IAS. This documentation shall be submitted to the Architect/Engineer and approved prior to contracts being signed.

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2.2 STRUCTURAL STEEL

2.2.1 The design of the structure system shall be a clear or multi span frame system with tapered or straight legged columns and roof beams with a gable roof as noted on the drawings.

2.2.2 Field modifications of parts shall be in accordance with the best standard procedures, require the approval of the manufacturer, and shall be the responsibility of the building erector.

2.2.3 Anchor bolt diameter and length shall be as specified by the building manufacturing company's standard anchor bolt layout drawings. Anchor bolts shall be supplied by the contractor, not the building manufacturer. Design of anchor bolts shall be by the building manufacturer.

2.2.4 All structural mill sections or welded-up plate sections shall be designed in accordance with the ANSI/AISC 360-16 “Specification for Structural Steel Buildings," and all cold-formed steel structural members shall be designed in accordance with the AISI S100-16 “North American Specification for the Design of Cold-Formed Steel Structural Members”.

2.2.5 The structural system will be designed in accordance with a specified building code. (Refer to Design Loads and Building Codes).

2.2.6 Frames shall consist of welded-up plate section columns and roof beams complete with necessary splice plates for bolted field assembly.

a. All base plates, cap plates, compression splice plates and stiffener plates shall be factory welded into place and have the connection holes shop fabricated.
b. Columns and roof beams shall be fabricated complete with holes in webs and flanges for the attachment of secondary structural members and bracing except for field work as noted on manufacturer's erection drawings.

2.2.7 All bolts for field assembly of frame members shall be high strength bolts as indicated on erection drawings.

2.2.8 The endwall structurals shall be cold-formed channel members designed in accordance with the latest AISI Specification or welded-up plate sections designed in accordance with the latest AISC Specification.

2.2.9 The endwall frames shall consist of endwall multi-span frames with endwall bearing posts as required by design criteria.

a. All splice plates and base clips shall be shop fabricated, complete with bolt connection holes. All base plates, cap plates, compression splice plates and stiffener plates shall be factory welded into place and have the connection holes shop fabricated.
b. Beams and posts shall be shop fabricated, complete with holes for the attachment of secondary structural members except of field work as noted on manufacturer's erection drawings.

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2.3 SECONDARY STRUCTURAL MEMBERS

2.3.1 Purlin and girts:

a. Purlin and girts precision roll formed.
b. Girts backing metal wall panel shall be “Z” shaped sections.
c. Girts above stud or block walls shall be “C” shaped sections.
d. Purlins shall be "Z" shaped sections.

2.3.2 Eave struts shall be factory pre-punched "C" sections.

2.3.3 Bracing shall be located as required. Diagonal bracing shall be hot-rolled rods and attached to columns and roof beams. Flange braces, purlin braces, etc., when required, shall be cold formed and installed as required.

2.4 WELDING

2.4.1 Welding procedure and operator qualifications and welding quality standards shall be in accordance with the American Welding Society Structural Welding Code. Inspection other than visual inspection as defined by AWS paragraph 8.15.1, shall be identified and negotiated prior to bidding. Certification of welder qualification shall be supplied when requested.

2.5 STRUCTURAL PAINTING

2.5.1 General:

a. All structural steel shall be prime painted as temporary protection against ordinary atmospheric conditions. Subsequent finish, painting, if required, shall be performed in the field by others.
b. Prior to painting all steel shall be cleaned of loose rust, loose mill scale, dirt and other foreign material. Unless otherwise specified, the fabricator shall not sand blast, flame clean or pickle prior to painting.
c. Factory cover all steel with one coat of red oxide primer paint formulated to equal or exceed the performance requirements of Federal Specifications TT-P-636D, TT-P-664C and SSPC Paint-25.

2.5.2 Primary frames:

a. Clean all steel per SSPC-SP2.
b. Apply one coat of water reducible alkyd primer by spray or dip method to a minimum coating thickness of 1.0 mil.

2.5.3 Secondary structurals:

a. Clean all steel per SSPC-SP8.
b. Apply one coat of coil applied polyester primer to a minimum coating thickness of 0.5 mil. (purlin and girts).

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2.6 ROOF PANEL

2.6.1 The exposed metal roof covering shall be 24-gage minimum commercially pure G-90 galvanized steel or galvalume coated steel, with factory applied color coating. The color finish applied to the exterior (exposed) surface of the panel shall be of such composition as to provide twenty (20) years of film and color life. Panel configuration to provide the specified load carrying capabilities and deflection requirements of this specification. Roof panels shall be of "standing-seam interlocking" design, Butler MR24 or equal, and secured to the purlins with a concealed structural fastening system. The concealed system shall provide minimal through penetration of the exposed roofing surface and allow the roof covering to move independently of any differential thermal movement by the structural framing system. Except at the concealed fastener, there shall be no thermal contact of the roof panels with the supporting purlin. The standing seams shall have a factory-applied non-hardening sealant, and the seams shall have a continuously locked or crimped together by mechanical means during erection. Roof panels shall be "seamed" same day as installation. Roof panels with lap-type side longitudinal joints and exposed structural fasteners shall not be considered acceptable. Clips shall be compatible with roof covering and have a protective metallic coating. Panel assembly shall have UL90 wind uplift rating. Manufacturer's logo will not be allowed on gable ends.

2.6.2 Roof panel finish: Provide manufacturer's standard shop applied fluoropolymer finish to roof panels.

a. Clean galvanized steel with an alkaline compound, then treat with a zinc phosphate conversion coating and seal with a chromic acid rinse.
b. Apply to exterior surfaces of pretreated galvanized steel a fluoropolymer coating system supplied to provide a total dry film thickness of 0.90 mils minimum. Color shall be Butler-Cote 500FP or approved equal.
c. Interior finish of roof panels shall be same as exterior finish or may be polyester color coat at manufacturer's option.

2.6.4 Physical characteristics of exterior coating:

a. The physical characteristics of the exterior coating shall provide resistance to failure through cracking, checking, crazing, spotting or loss of adhesion.
b. The physical characteristics of the exterior coating shall be measured by laboratory weather simulating tests to obtain test results justifying the manufacturer's 10 year warranty.

2.7 ROOF CURBS

2.7.1 For equipment less than a 1000 pounds, metal roof curbs shall be single piece 14 gage metal (galvalume or aluminum) with all joints welded. Curbs shall be built as per manufacturers suggested size and height. Insulated walls shall be manufactured by a factory authorized fabricator and shall have damper tray, and a cricket/water diverter which shall match roof panel configuration with ribbed edges. Curb shall be supplied and installed by metal building supplier. (Coordinate number and exact location with Mechanical). Curb finish shall match roof.

2.7.2 Metal roof curbs for mechanical equipment in excess of 1000 pounds shall be structural double curb with acoustic style inner curb (20 gauge insulated floor), 14 gauge galvalume as manufactured by Thybar Corporation. All other metal of curbs shall be single piece 14 gauge metal (galvalume or aluminum). All joints shall be welded.

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2.7.3 Curbs shall be built as per manufacturers suggested size and height. Insulated walls shall be manufactured by a factory authorized fabricator and shall have damper tray. Shall have cricket/water diverter which shall match roof panel configuration. Curb shall be supplied and installed by metal building supplier. (Coordinate size, quantity, and exact location with Mechanical).

2.8 MISCELLANEOUS

2.8.1 Snow retention system shall be ColorGard, pre-punched, as manufactured by S-5!, matching roof panel color. When installing on MR-24 panels, a S-5-E clamp and SnoClip III shall be used. The S-5-U clamp and SnoClip II shall be used with VSR panels.

2.8.2 Roof walkway shall be by a manufacturer recommended by the metal building supplier. Walkways to be located as shown on drawings.

2.9 WALL SYSTEM

2.9.1 The metal faces shall be of 24 gage zinc coated steel and shall be supplied with a factory applied color coating selected from manufacturers standard colors. Panel profile shall be equal to Butlerib II as manufactured by Butler Manufacturing Co.

2.9.2 The top, bottom and intermediate panel closures, flashings, fascias, gutters, downspouts and trim shall be the building manufacturer's standard, compatible with materials furnished as wall panels. Gutters shall be manufacturer's standard except, in no case, shall the back of the gutter extend less than 2" above front of the gutter.

2.9.3 Liner Panels shall be 24 gauge flat panels (without face beads) with concealed fasteners. Siliconized polyester color shall be selected by Architect from manufacturer’s standard colors.

2.9.4 Solid Soffit Panels, 24 guage steel, with concealed fasteners. Shall be supplied with a factory applied fluoropolymer color coating. The color finish applied to the exterior (exposed) surface of the panel shall be of such composition as to provide twenty (20) years of film and color life. Color shall be selected by Architect from manufacturer’s standard colors.

2.10 INSULATION

2.10.1 In all areas where insulation is exposed, provide 6" R-19 fiberglass blanket insulation with facing composed of 0.0015" white metalized polypropylene film laminated to a fiberglass/polyester blend fabric with a fire resistant adhesive. The resulting facing shall have a water vapor transmission rate of 0.02 US perm (ASTM E96, Procedure A), a beach puncture of 650 scale units and a mullen burst of 250 psi. Tensile strength shall be 195# in the machine direction and 150# in the cross-machine direction, Lamtec Gymguard as manufactured by Lamtec Corp., Mount Bethel, PA. In areas where insulation is not exposed, provide 6” R-19 fiberglass blanket insulation with reinforced vinyl facing.

2.10.2 Double layer roof insulation – “Sag n Bag”: Provide two layers of 4” R-13 fiberglass blanket insulation, one layer with reinforced vinyl facing. Faced material is “sagged” to allow for the second layer. Refer to drawings for placement of each layer of insulation.

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2.11 MISCELLANEOUS FRAMING

2.11.1 Provide frames for all mechanical openings as required.

2.11.2 Provide support members between purlins and girts to carry mechanical equipment shown on mechanical plans. This contractor is responsible for coordinating the equipment requirements with members supplied.

2.11.3 Provide lintels and jambs for all openings in wall panels.

PART THREE - EXECUTION

3.1 ERECTION

3.1.1 Erection shall include the setting of all columns and bases and erection of all steel as called for under the contract for furnishing and delivery of pre-fabricated steel building.

3.1.2 Field errors shall not be corrected by burning except with the permission of the Architect.

3.1.3 Brace and guy all structural members until all connections are made.

3.1.4 After erection, touch up all injuries to priming coat and all others where field welding is done. Bolt heads and nuts shall be touched up in field. Use same material as specified for shop coat.

3.1.5 Assembled parts shall be brought into close contact and drift pins shall be used only for bringing members into position, not to enlarge or distort holes.

3.2 WELDING

3.2.1 Welding in shop and field shall be done by operators who have been previously qualified by tests as prescribed in the American Welding Society, "Standard Qualification Procedure". All operators must have successfully passed the welding qualification tests within a 24-month period preceding erection. The Architect shall be provided a copy of the welding qualification test for each operator at no additional cost to Owner.

3.2.2 Equipment to be of a type which will produce proper current so that operator may produce satisfactory welds. Welding machine shall be of 200-400 ampere, 25-40 volt capacity.

3.2.3 Electrodes shall be suitable for positions and other conditions of intended use in accordance with the instruction with each container.

3.2.4 Field welding shall be done by direct current.

3.2.5 Technique of welding employed, the appearance and quality of welds made and methods of correcting defective work shall conform to American Welding Society "Code of Arc Welding in Building Construction", Section 4, "Workmanship".

3.2.6 Surfaces to be welded shall be free from loose scale, rust grease, paint and other foreign material except that mill scale withstanding vigorous wire brushing may remain. A light film of linseed oil may likewise be disregarded. Joint surfaces shall be free from fins and tears.

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3.2.7 No welding shall be performed when temperature of the base metal is lower than 0 degrees F. At temperatures between 32 degrees F and 0 degrees F., the surfaces of all areas within 3" of a point where a weld is started shall be heated until they are too hot to touch before welding is started.

3.2.8 Finished members shall be true to line and free from twists, bends and open joints.

3.3 TESTS

3.3.1 Field tests: All field and shop welders shall be tested and certified by an approved testing laboratory. The American Welding Society Operator Qualification Test shall be used as a basis of qualification.

All field and shop operators shall qualify for the following:

Type of Weld	Position of Welding
Groove	Horizontal
Groove	Vertical
Groove	Overhead
Fillet	Vertical
Fillet	Overhead

3.3.2 The Architect's Representative may require strap cuts from welds in any supporting member to stand nick-break test. If strap fails to meet requirements, Contractor shall replace strap cut from member at no charge to Owner. If strap does meet requirements, the Architect shall pay expenses of having metal replaced. In event strap fails, the welder shall be discharged.

3.4 ROOF PANELS

3.4.1 Panels shall be positioned and properly aligned by matching the prepunched holes in the panel end with the prepunched holes in the eaves structural member and by aligning the panel with the panel clip.

3.4.2 Panel sidelaps shall be field seamed by a self-propelled and portable electrical lock seaming machine. The machine field forms the final 180 degrees of a 360 degree Pittsburgh double lock standing seam; all sidelaps sealant shall be factory applied.

3.4.3 Panel endlaps, when required, shall be at least 6", sealed with Butler sealants and fastened together by clamping plates. Sealants shall contain hard nylon beads which prevent mastic from flowing out due to clamping action. The panel laps shall be jointed by means of a two piece clamped connection consisting of a bottom reinforcing plate and a top panel strap. The panel endlaps shall be located directly over, but not fastened to, a supporting secondary roof structural member and be staggered, so as to avoid a four panel lap splice condition.

3.5 WALL PANELS

3.5.1 Structural system shall be plumb before wall panels are attached.

3.5.2 Wall panels shall be sealed with a molded foam closure block that fits the panel configuration at the bottom of the wall panel.

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3.6 INSPECTION

The work shall be inspected in the shop and the field. The Contractor shall give proper notice and allow full facilities for this inspection. Notify Architect 48 hours prior to shipping structural steel.

END OF SECTION

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The Engineer of Record for Classroom Addition, Junior High School, Stuttgart School District, Stuttgart, Arkansas Divisions 21 and 22 of the specifications.

September 14, 2026

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Section 21 13 00

FIRE-SUPPRESSION
SPRINKLER SYSTEMS

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 This work shall include necessary labor, material, appliances, and equipment to install complete fire protection system throughout the new Stuttgart Junior High School connecting to existing school's fire sprinkler system in accordance with the specifications and plans, with no additional cost to the Owner unless the scope of the building changes. Existing Junior High School area = 29,261 square feet.

1. Fabrication and installation shall be by experienced, competent workmen, regularly engaged in the work of automatic sprinkler installation.
2. Plans shall be designed and signed by an RME (Responsible Management Employee) which has a level 3 certification as provided by NICET. Coordinate with existing sprinkler system and new gas and water as shown on plumbing documents. (Refer to P1.1.)
3. Designer shall perform current flow test to determine volume and pressure of supply water. Flow test shall be coordinated with Stuttgart Fire Dept. and Water Dept. Preliminary design may be based on 54 PSIG static and 50 PSIG residual at 1125 GPM. Provide a 10 PSIG buffer on calculations to account for fluctuation in pressure.
4. Design criteria shall be based on Light Hazard occupancy using standard coverage heads.
5. This facility is classified as Seismic Design Category C except Safe Room 142 and adjacent rooms (Area D) are Category D, Seismic Use Group 2 and Risk Category 3 with a Component Importance Factor (Ip) = 1.5.
    a. The Fire Protection Designer shall be familiar with Section 1613 earthquake loads of the 2021 Arkansas Fire Prevention Code (2021 International Building Code) and American Society of Civil Engineers Standard ASCE 7 Guidelines such that the system and components are installed to comply.
    b. Seismic design and construction of the sprinkler system may be in accordance with NFPA 13; provided that the design force and displacement calculated must not be less than prescribed by the code when multiplied by a factor of 1.4.
    c. Suspended ceilings for this building are exempt from meeting the requirements of seismic construction due to the Category C and less than three (3) stories exception in the code; therefore, a swivel joint or flexible connection is not required.
    d. In a Category C classification when the pipe is of "high deformability" piping (steel) and 2" or smaller, sway bracing is not required. Also, any pipe size where the threaded rod hanger is 12" or less from the top of the pipe to the structure, the sway bracing may be omitted.
    e. Safe Room 142 and adjacent rooms: Seismic Design Category D shall have ceilings where the tile has at least 1 inch of free movement around the sprinkler head. In order to comply with this requirement, where the heads are located in a lay-in ceiling, a UL listed flexible fire sprinkler connection system equal to Flexhead Industries or Viking FPSJ with mounting brackets shall be used. The heads shall be located in the center of the tiles.
6. Sprinkler heads mounted in a lay-in ceiling shall be centered in the tile.

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7. Installers:
    a. VSC Fire & Security
    b. State Systems, Inc.
    c. A&A Fire and Safety Co.
    d. Johnson Controls Fire Protection
    e. Northwest Fire Protection
    f. Summit Fire & Security
    g. Reliable Fire Protection
    h. American Fire Protection
    i. Engineer approved

1.1.2 Work shall include, but shall not necessarily be limited to the following:

1. Connection to existing Junior High sprinkler system.
2. Wet pipe sprinkler system.
3. Inspection and testing of installed system.

1.2 GOVERNING AGENCIES, CODES AND PERMITS AND INSPECTION

1.2.1 This contractor shall obtain necessary permits, local or otherwise, required paying fee therefore, shall give required notice to proper authorities related to work under his discharge, shall afford the architect, engineer, and authorized inspectors every facility for inspection, and shall be responsible for violations of the law. Upon completion of the work, Contractor shall obtain certificates of inspection and approval and deliver one to Owner and one to Architect/Engineer.

1.2.2 The fire protection system shall be designed and installed to comply with the following standards and/or codes of the latest issue:

1. NFPA pamphlet #13-Sprinkler Systems.
2. Other NFPA pamphlets as may apply.
3. 2021 Arkansas Fire Prevention Code Section 1613 Earthquake Loads. (ASCE 7.)
4. UL and FM requirements.
5. Arkansas State Health Dept. requirements.

1.2.3 Shop drawings shall be submitted to the local Fire Chief and Health Department Engineering Branch for their approval. Drawings shall be stamped approved and signed by those organizations prior to Architect's review.

1.3 DRAWINGS

1.3.1 Shop drawings consisting of the following shall be furnished. In accordance with Division One of the General Conditions, the Fire Protection Contractor shall furnish the Architect shop drawings as detailed in Section 01 33 23. Submittal must be complete and in one installment with title page and table of contents at the front of the submittal.

1. Layout drawing of complete overhead sprinkler system indicating relationship of all other overhead items including ceiling air diffusers. Location of risers, piping, etc., shall be inconspicuous as possible, provide a pleasing overhead appearance and still fulfill all functional requirements.

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2. Plot plan indicating location of existing system connections, control valve, piping, and all related items.
3. Complete details and sections as required to clearly define and clarify the design indicated by the aforementioned layout and plot plan.
4. Provide data on piping, sprinkler heads, valves, and specialties, including manufacturers catalogue information. Submit performance ratings rough-in details, weights, support requirements, and piping connections.
5. Furnish hydraulic calculations complete with current flow test data.
6. Provide pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

1.3.2 If submittals are “Not Approved” or marked “Revise and Resubmit”, the complete package shall be corrected and returned for review. The contractor may provide a separate submittal which includes only the sections marked “Not Approved”, or “Revise and Resubmit”. Any additional submittal data requested shall also be provided in resubmittal.

1.4 AS-BUILT DRAWINGS

1.4.1 As-built drawings: During the progress of the work of this section, maintain an accurate record of all changes made in the design of the fire sprinkler system. Upon completion of the installation, and as a condition of its acceptance, accurately transfer all as-built information to three (3) identical blue line prints of the approved shop drawings. Insert one print into each copy of the manual described below:

1.5 MANUAL

1.5.1 Upon completion of the installation, and as a condition of its acceptance, compile the following manual and deliver as part of Section 01 77 19 – Contract Closeout.

1. Contents:
    a. Identification visible on or through the cover: "Manual for Fire Protection system for Junior High Classroom Addition, Stuttgart, Arkansas”.
    b. Neatly type index, at or near the front, with all emergency information located and clearly identified.
    c. A complete list of all components of the system with manufacturer's names, catalog numbers, and all data required for ordering replacement parts.
    d. One copy of the as-built drawings described above.
    e. Instructions on fire sprinkler equipment and operation.
    f. Copy of NFPA25 (Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems).
    g. Copy of system inspection report.
    h. Above ground piping test certificate.
    i. All information required to effect or secure emergency repairs or service.

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PART TWO - PRODUCTS

2.1 INSIDE MATERIAL

2.1.1 Black steel pipe: Pipe shall conform to ASTM A135, UL listed and approved by Factory Mutual, as manufactured by Allied Tube and Conduit or Bull Moose Tube Company, MIC coated. 1 inch and 2 inch shall be Schedule 40 steel and Schedule 10 for 2-1/2 inches and larger. Piping shall be factory coated with antibacterial formula (ABF) to provide resistance to microbial colonization on pipe walls.

2.1.2 Screwed fittings: Fittings shall be equal to Grinnell cast iron Class 125 and shall conform to ANSI B16. 4, ductile or malleable Class 150 conforming to ANSI B16.3.

2.1.3 Welded branchlet fittings: Fittings shall be UL listed and rated for 300 lb. service and shall be manufactured by Allied Piping Products Company, Inc.

2.1.4 Grooved pipe couplings & fittings:

1. Couplings shall be equal to Victaulic style 009N (rigid), 75 (flexible), 750 (reducing) and shall be UL listed.
2. Fittings shall be grooved; outlet couplings are not acceptable.
3. Bolted branch outlets are only acceptable with engineer's approval.

2.1.5 Pipe hangers and beam clamps:

1. Pipe hangers shall be Persing and Co., Figure 50, UL listed.
2. Beam clamp shall be equal to Persing and Co., Figure 35, 40,000# tensile strength, ASTM-A-47.
3. Beam clamps must be secured with a restraining strap.
4. Purlin hangers shall be Sammy into side of purlin. (Do not drill bottom or hang from flange of purlin.)

2.1.6 Iron gate valve: Valve shall be outside, screw-and-yoke, bronze mounted, equal to Kennedy Figure 65. At the contractor's option, valves 4" and larger may be Victaulic Series 708 U.L./F.M. butterfly valve with operator and operator switch.

2.1.7 Check valves: Valve shall be bronze mounted with bronze faced disc, equal to Kennedy Figure 126.

2.1.8 Automatic sprinkler heads:

1. Heads shall be equal to Viking standard spray, quick response, standard coverage sprinklers.
2. Pendant mounted heads in lay-in or gyp ceilings shall be white finish and installed with a Viking Micromatic Model E-1 recessed escutcheon with white finish.
3. Where black ceilings are used, heads shall be painted black.
4. Extended coverage heads are not acceptable.

2.1.9 Tamper switch: Switch shall be Potter Roemer Fig. 6220 or equal for gate valve and Fig. 6223 for post indicator valve.

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PART THREE - EXECUTION

3.1 DESIGN AND INSTALLATION STANDARDS

1. Piping in areas having ceilings, other than the underside of the roof deck, shall be concealed.
2. Sprinkler heads in areas with finished ceilings shall be white pendent recessed spray type in center of tile.
3. Sprinkler valves shall be located where indicated on the drawings and be equipped with all necessary items, fittings, identification tags, or plates and accessories, includes alarm valve and electric bell alarm.
4. Design requiring cutting of structural members for passage of sprinkler pipe or hangers shall be avoided. When design, due to economy, appearance, and similar aspects denote the necessity of cutting, it shall be held to an absolute minimum.
5. Before assembly of couplings, lightly coat pipe ends and outside of gaskets with cup grease or graphite paste.
6. Any valves shall be electrically supervised with a tamper switch wired to alarm bell at central panel. Coordinate wiring for tamper switches with electrical contractor.
7. Where exposed piping passes through finish work, chrome plated or other finish acceptable to the Owner, split wall plates or escutcheons shall be installed to fit snugly around piping.
8. Provide sleeves when penetrating footings, floors and walls. Seal pipe and sleeves penetrations to achieve fire resistance equivalent to fire separation required. See detail on plans.
9. Contractor shall complete the automatic sprinkler system ready for operation in all respects as soon as possible. When the system is complete and ready for continuous operation, activate the system for its intended use. After the system has been activated for continuous use, water charges, if any, will be paid by the Owner.

3.2 GUARANTEE AND SERVICE

3.2.1 The entire fire protection installation, as specified under this section of the specifications, shall be guaranteed for one (1) year against defective equipment, materials, and workmanship. The guarantee period is to begin on the date the building is accepted by the Owner and attested by the final payment of substantial completion form.

3.2.2 During the one (1) year period beginning at substantial completion date, the fire protection contractor shall perform services as required.

3.2.3 After completion of sprinkler installation, tests, etc., the sprinkler contractor shall instruct the Owner in the operation of the sprinkler system. Care should be taken to make sure the Owner is able to:

1. Immediately recognize whether the main valve is in an open or closed position.
2. Know how to drain the system.
3. Know how to test the alarm.

END OF SECTION

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Section 22 01 00

PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: This specification includes the furnishing of all labor, materials, tools, equipment, drayage, rigging, fees, etc., unless specifically furnished by others, necessary or reasonably required for the complete installation and operation of all the work as shown on the drawings or as required and/or as herein specified. The entire work shall be delivered complete in perfect working order and to the entire satisfaction of the Architect.

1.1.2 The scope of work shall include the general listings as shown below. This contractor shall furnish and install all required pipe, fittings, valves, hangers, supports, sleeves, inserts, traps, and other such equipment, items, and appurtenances as may be required for complete and operative systems, including all parts auxiliary to the systems whether or not specifically set forth herein and/or shown on the drawings.

a. Systems of sanitary waste and vent piping.
b. Systems of domestic cold and hot water.
c. Systems of storm/roof drain piping.
d. Systems of HVAC condensate piping.
e. Systems of gas piping.
f. Plumbing fixtures and accessories.
g. Insulation.
h. Miscellaneous equipment and accessories.
i. Tests, inspection, balancing and adjustment.

1.1.3 This section includes work on Plumbing and Civil drawings. Reference Section 33 00 00 –Utilities.

1.2 APPLICABLE GENERAL SPECIFICATIONS AND REGULATION

1.2.1 The General Conditions, Supplementary Conditions, Information to Bidders and other pertinent documents, as issued by the Architect, are a part of these specifications and shall be complied with in every respect.

1.2.2 All plumbing work and equipment, in whole or in part, shall conform to the applicable portions of the latest edition of the following ordinances, codes, and regulations in effect on the date of invitation for bids, which shall form a part of this specification.

a. National Electrical Code.
b. American Gas Association Recommended Practices.
c. National Fire Protection Association Recommended Practice.
d. Local, City and State Codes and Ordinances.
e. American Society of Mechanical Engineers Plumbing and Air Conditioning Codes.

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1.2.3 The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only, (i.e.) American Society for Testing and Materials (ASTM). Publications:

D 2665	Poly Vinyl Chloride (PVC) Drain, Waste and Vent Pipe and Fittings.
D 2321	Underground Installation of Thermoplastic Pipe for Sewers & Other Gravity Flow Applications.

1.2.4 Should any part of the drawings or specifications be found to be in conflict with applicable codes or ordinances, the Contractor shall notify the Architect before submitting his bid. After entering into the contract, the contractor shall complete all work necessary to meet the requirements of all codes or ordinances without additional expense to the Owner.

1.2.5 The contractor shall not begin any building construction until possessing a copy of official acceptance of the Arkansas State Department of Health which shall be provided by the Architect.

1.2.6 Prior to final acceptance of the project, the contractor shall provide the Architect a written Certificate of Inspection covering all phases of the installation by the State of local Plumbing Administrative authority.

1.2.7 All potable water system components shall be "Lead Free" in accordance with Section 1417 of the Safe Drinking Water Act (42 U.S.C. 300g-6) and shall be certified as being in compliance with NSF/ANSI 372 or Annex G of NSF/ANSI 61.

1.3 SUBMITTALS

1.3.1 The Contractor shall furnish electronic shop drawings using the submittal procedure as detailed in Section 01 33 23. Provide cover sheet with project name and contractor name along with table of contents.

1.3.2 All submittals must be on the manufacturer's standard certified submittal sheets or other approved sheets; faxed material will not be accepted. Each item must be marked with the symbol, letter, or number designating it in the specifications or on the plans and items must be arranged in the order specified or scheduled.

1.3.3 All performance, data, details, dimensions, special features and accessories must be clearly marked.

1.3.4 All differences between equipment specified and that submitted must be clearly indicated.

1.3.5 Substitutions will not be considered without prior approval from the engineer.

1.3.6 Shop Drawings are required even though the equipment is as specified.

1.3.7 Provide Shop Drawings on the following Items:

a. Plumbing fixtures and accessories.
b. Domestic water heaters.
c. Pumps, valves and regulators.
d. Documentation of water, gas, sewer piping and fittings type and manufacturer.
e. Piping labels and valve tags.
f. Water hammer arrestors.
g. Miscellaneous equipment and accessories.

1.3.8 The type and capacity of the various equipment and material specified herein by manufacturer's name and catalog number indicate the minimum acceptable qualifications required for this installation. Products of other manufacturers, with comparable qualifications, will be acceptable, if approved by the Architect, unless specifically stated otherwise. NO PREFERENCE WILL BE GIVEN TO THE MAKE OF ITEMS LISTED, provided all essential requirements of this specification relative to materials, capacity and performance are met. The bidder will furnish a statement giving a complete description of all points wherein the equipment he proposes to furnish differs from the specification. Failure to furnish such a statement within thirty days after award of the Contract will be interpreted to mean that the bidder agrees to furnish items specified in the specifications or on the plans.

1.3.9 If the substituted equipment actually furnished under these specifications requires the use of larger or more connections, or if they are different arrangement than those shown on drawings, or specified under these specifications, such additional or larger connections shall be installed to the complete satisfaction of the Architect without added cost to the Owner.

1.3.10 Should a substitution be approved for use in lieu of that specified and should the substitute material prove defective or otherwise unsatisfactory, in the judgment of the engineer, for the service required, within the guaranty period, the Contractor shall replace the material or equipment as originally specified without additional cost to the Owner.

1.3.11 If submittals are "not approved" or marked "revise and resubmit", the complete package shall be corrected and returned for review. The contractor may provide a separate bound submittal, with a cover sheet, which includes only the sections marked "not approved", or "revise and resubmit". Any additional submittal data requested shall also be provided in resubmittal.

1.4 COORDINATION

1.4.1 Chases, recesses and other openings in the building construction required for the location of pipes, or other mechanical equipment, will be provided by the General Contractor. The Mechanical Contractor shall advise the General Contractor of the sizes and locations, and furnish the necessary drawings in sufficient time to allow for provision of same; otherwise the additional cost caused thereby shall be paid by the Mechanical Contractor.

1.5 FEES AND PERMITS

1.5.1 Contractor shall pay for all fees, permits and charges for utility connections and initial boiler inspections. This includes all fees required for improvement district non-refundable or refundable contribution. Contractor shall contact utility company prior to bid for connection charges.

1.6 DRAWINGS

1.6.1 The drawings are diagrammatic and indicate the extent and general arrangement of the various systems. If any departures from these drawings are deemed necessary by this contractor, detailed drawings and descriptions of these departures and a statement of the reasons therefore shall be submitted to the Architect for approval as soon as practical. No departures from the arrangements shown on the drawings shall be made without the prior written approval of the Architect.

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1.6.2 Coordination of drawings and work: The drawings showing the extent and arrangement of the work of a particular trade must be used, together with the drawings showing the extent and arrangement of the work of the other trades, and this Contractor shall lay out his work with due consideration for the other trades and shall be responsible for calling to the attention of the Architect any interferences encountered. Such interferences shall be investigated and called to the attention of the Architect before any material is fabricated. Relocation resulting from interferences shall be made at no additional cost to the Owner. This Contractor shall cooperate with the other contractors and subcontractors on the job and shall arrange and carry on his work in such manner that none of the contractors shall be hindered or delayed at any time.

1.7 OPERATION AND MAINTENANCE MANUALS

1.7.1 Refer to Section 01 77 19 – Contract Closeout for closeout requirements.

1.7.2 A complete double index shall be included: (1) listing the products alphabetically by name, and (2) listing the names of the manufacturers of mechanical products alphabetically with their addresses, and the names and addresses of the local sales representative.

1.8 CONTRACTOR REVISED DRAWINGS

1.8.1 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 shall be kept by accurately making all changes on a set of prints in the site construction office during the progress of the job. Exact location of all underground utility service entrances and their connections to utility mains as well as all valves, etc., which will be concealed in the finished work shall be accurately indicated on the drawings by measured distances. Upon completion of the work and prior to final payment, the contractor will furnish to the Architect the set of "as-built" prints, and a photo copy, legibly and accurately marked to indicate all changes, additions, deletions, etc., from the Contract Drawings.

1.9 UTILITIES, LOCATIONS, AND ELEVATIONS

1.9.1 Locations and elevations of the various utilities, included within the scope of this work have been obtained from utility maps and/or other substantially reliable sources and are offered separate from the contract documents as a general guide only, without guarantees as to accuracy. This contractor shall examine the site and shall verify to his own satisfaction the location and elevation of all utilities and shall adequately inform himself of their relation to the work before entering into a contract.

1.10 SOIL CONDITIONS

1.10.1 This specification and drawings in no way implies as to the conditions of the soil to be encountered. When excavating may be required in execution of the work, this contractor agrees that he has informed himself regarding conditions affecting the work and labor and materials required, without recourse to any representation as to soil conditions that may appear, or seem to be implied, in any portion of the contract documents.

1.11 VISITING SITE

1.11.1 The Contractor shall visit the site of this building before submitting a proposal on this work, and shall thoroughly familiarize himself with the existing conditions. Failure on his part to do this will not be cause for extra expense after the contract is signed, by reason of unforeseen conditions.

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1.12 STANDARD PRODUCTS

1.12.1 Each item of equipment furnished under this specification shall be essentially the standard product of the manufacturer. Where two or more units of the same kind or class of equipment are required, these shall be the products of single manufacturer; however, the component parts of the equipment need not to be the products of one manufacturer. All material and equipment shall be of the best quality normally used in good commercial practice and shall be the product of a reputable manufacturer. Each major component shall bear a name plate giving the name and address of the manufacturer and the catalog number of designation.

1.13 STORAGE OF MATERIALS

1.13.1 The Contractor shall be responsible for the proper care of his materials, equipment, etc., delivered at the sites. Building materials, equipment, etc., may be stored on the premises, but the placing of same shall be subject to the approval of the Architect.

1.13.2 When any room in the building is used by the Contractor as a shop, store room, etc., he shall be responsible for any repairs, patching or cleaning arising from such use. He shall protect and be responsible for any damage or loss that may occur during this period. He shall handle all material as desired, so that it may be inspected by the Architect.

1.14 EQUIPMENT FURNISHED UNDER OTHER SECTIONS

1.14.1 This Contractor shall provide all necessary material and labor for the connection to the mechanical and electrical systems of all fixtures and equipment requiring such connections, and which fixtures and equipment are furnished by the Owner or are specified under other sections of these specifications. All drainage connections to these fixtures and this equipment shall be trapped. If any such fixtures or equipment are not delivered prior to final acceptance, the services shall be capped or plugged at walls or floors as directed, and shall be left ready for future connection. All branch water, gas, and other service lines to fixtures and equipment items shall be individually valved.

1.15 CLOSE-OUT DOCUMENTS

a. Operation and maintenance manuals (Section 22 01 00, paragraph 1.7).
b. Approved shop drawings (Section 22 01 00, paragraph 1.3).
c. As-built drawings (Section 22 01 00, paragraph 1.8).
d. Backflow preventer test report.

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PART 2 - PRODUCTS

2.1 PIPE

2.1.1 Soil, waste and vents, interior:

2.1.1.1 Underground and above ground soil, waste and vent pipe, inside building and extending 5'-0" outside shall be schedule 40 PVC complying with ASTM D2665 as manufactured by Eslon Thermoplastics or equal. No PVC waste will be accepted for final connection of lavatories, sinks, water coolers or similar fixtures. PVC cellular core (foam core) pipe and fittings are not acceptable.

2.1.1.2 Fittings shall be solvent welded DWV-PVC, complying with ASTM D2665 Standard, and listed by NSF as manufactured by Lasco Fluid Distribution Products.

2.1.1.3 The bedding and cover material for PVC piping shall be crushed stone (see 3.11.2).

2.1.1.4 PVC closet flanges shall have pre-drilled holes in lieu of adjustable slots.

2.1.2 Domestic water piping, interior:

2.1.2.1 Interior piping shall be type "K" copper below grade to 5'0" beyond building foundation and type "L" copper above grade. 2" and smaller piping below grade shall be factory polyethylene coated type "K" soft copper equal to Streamline as manufactured by Mueller Industries (blue-cold/red-hot); 3" piping shall be rigid type "K" with tubular closed-cell foam insulation. No tee fittings shall be installed below grade. Galvanized pipe shall not be used in any instance. Water piping shall be buried not less than 12" below compacted fill. 24" minimum on exterior; coordinate with grade beam/footing.

2.1.2.2 Water hammer control:

a. Arrestors shall be provided on all gang toilet headers (hot and cold) and as indicated on the drawings, shall be sized and applied in accordance with the Plumbing and Drainage Institute Standard Pdi-WH-201. Equipment shall be Precision Plumbing Products, SC Series or Sioux Chief Hydra-Rester. Locate each arrestor at the end of the branch between the last two fixtures and an additional arrestor at the midway point for branches exceeding 20 feet.
b. All arrestors shall be maintenance free and concealable in wall, pre-tested to last life of system.
c. Air chambers are not acceptable.

2.1.3 Storm/Roof Drain - interior:

2.1.3.1 Storm drain below slab and extending 5'-0" outside shall be schedule 40 PVC complying with ASTM D2665 as manufactured by Elson Thermoplastics or equal. PVC cellular core (foam core) pipe and fittings are not acceptable.

2.1.3.2 Roof drain above slab shall be no-hub service weight cast iron soil pipe and fittings which conforms to CISPI STD. 301 and ASTM A-888 as manufactured by Tyler or Charlotte. All pipe fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute® and listed by NSF® International.

2.1.3.3 Horizontal roof drains and piping shall be insulated per section 3.2 Insulation.

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2.1.4 Soil, waste, storm water and vents - exterior:

2.1.4.1 Defer to civil sheet C1.2

2.1.5 HVAC Condensate Drain Piping – Interior and Exterior:

2.1.5.1 Underground and under slab condensate drain pipe, inside building and outside shall be schedule 40 PVC complying with ASTM D2665 as manufactured by Eslon Thermoplastics or equal. PVC cellular core (foam core) pipe and fittings are not acceptable. Piping above grade on exterior shall be schedule 80 PVC. Condensate piping above slab shall be Type L copper except piping in wall or chase may be schedule 40 PVC. Copper pipe and fittings shall be as specified in Division 23 – HVAC.

2.1.5.2 Fittings shall be solvent welded DWV-PVC, complying with ASTM D2665 Standard, and listed by NSF as manufactured by Lasco Fluid Distribution Products.

2.1.5.3 The bedding and cover material for PVC condensate piping shall be free of any solid material.

2.1.5.4 Piping located in a return air plenum shall be cast iron or enclosed with non-combustible material.

2.1.5.5 Insulate all above slab condensate piping with 1/2" closed cell pipe insulation equal to AP Armaflex. Seal all joints and seams with Armaflex adhesive.

2.1.5.6 Refer to civil sheet C1.1

2.1.6 Exterior water service piping:

2.1.9.1 Refer to civil sheet C1.2

2.1.9.2 Water service entrance piping:

2.1.6.1 Entrance water piping shall be Class 53 flanged ductile iron for sizes four (4") inches and larger and type "K" hard drawn copper for 3" and smaller. Minimum depth to be 24". Any mechanical joints shall have to be coated with mastic and covered with two layers of 6 mil visqueen, secure with duct tape.

a. Flanged Ductile Iron Pipe

Flanged ductile iron pipe shall have a cement mortar lining and seal coat in accordance with ANSI A21.4 (AWWA C104) and NSF 61. The minimum thickness class for flanged pipe shall be Class 53. The pipe and flanges shall conform to ANSI A21.15 (AWWA C115), Class 250 psi. Drilling shall conform to ANSI B16.1, Class 125 flange. The flange gasket shall be high quality molded SBR rubber with properties matching ANSI/AWWA C111/A21.11 and shall meet the description of “Specially Diesigned Gaskets” shown in the Appendices of AWWA C110, C111 and C115 or approved equal.

b. Approved ductile iron manufacturers:
American Pipe
Griffin Pipe
McWane Pipe
U.S. Pipe

2.1.7 Gas Piping:

Above grade:

2.1.7.1 All pipe shall be schedule 40 black steel assembled with 150 pound black malleable iron fittings. Piping exterior of building or exposed in kitchen shall be painted with a rust-retardant, light grey enamel paint. Pipe shall be painted where rising on building. All fittings and joints shall be painted same as pipe. No unpainted pipe or fittings will be allowed. All valves shall be screwed. Pipes 2-1/2" and larger must be welded. Cold press mechanical joint fittings are acceptable for 2" and larger indoor piping only.

2.2 PIPE UNIONS

2.2.1 Unions or flanges shall be used at connections to all equipment and elsewhere as required in the erection of the pipe or installation of valves to facilitate dismantling, but shall not be installed in concealed spaces unless suitable access is provided.

2.2.2 Unions on ferrous pipe 2" or smaller shall be Crane No. 1280, 150 pound, malleable iron, ground joint unions. Unions on brass or copper pipe 2 inches or smaller shall be Crane 125 pound, brass, ground joint cast iron, gasket type, flange unions. Gaskets for flanged unions shall be of the best quality fiber, plastic, or leather. Unions on galvanized piping shall be galvanized and unions on black piping shall be black. Where copper to steel pipe unions, couplings or joints are required, they shall be made outside foundation walls of building, except those joints occurring on equipment inside of building, which shall be placed in accessible places.

2.3 PIPE SUPPORTS

2.3.1 All pipe shall be supported from the building structure by means of approved hangers and supports so as to maintain required grade and pitch, prevent vibration and provide for expansion and contraction.

2.3.2 Where equipment, piping or ducts are to be supported by concrete, install anchor bolts or inserts before concrete is poured. Inserts shall be Grinnell No's. 279 or 282, or approved equal. Expansion shields and power-actuated inserts may be used provided hangers are suspended from an angle which is fastened in place by the bolts and shields, or inserts.

2.3.3 Plumbing piping hangers and supports shall conform to ASME B31.9 and ASTM F708.

a. Hangers for pipe sizes 1/2 inch to 1-1/2 inch shall be malleable iron, adjustable swivel, split ring Grinnell Fig. 104, or approved equal.
b. Hangers for pipe sizes 2 inch and over shall be carbon steel adjustable, clevis type, Grinnell Fig. 260.
c. Wall support shall be welded steel bracket with wrought steel clamp Grinnell Fig. 194, 195 or 199 as required, or approved equal.
d. Vertical support for plumbing piping shall be carbon steel riser clamp, Grinnell Fig. 261, or approved equal. Use Grinnell Fig. CT-121 carbon steel with copper finish for copper pipe.
e. Floor supports for plumbing piping, shall be cast iron adjustable pipe saddles, lock nut, nipple, floor flange and concrete pier or steel support, Grinnell fig. 264, or approved equal.

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f. Hangers for piping which is insulated with fiberglass insulation shall be installed on exterior of insulation.
g. Support vertical pipes at each floor level and at each coupling or union, using riser clamps which are supported by the floor.
h. Provide copper plated hangers and supports for copper piping which is not insulated.
i. Place hangers within 12” of each horizontal elbow.
j. Hanger shall attach to purlins with Sammy in side of purlin. Do not drill hole or hang from flange at bottom of purlin.

2.3.4 Hangers shall be secured to approved inserts where possible and practicable. Expansion shields may be used in special cases only. Spacing of the hangers shall not exceed ten feet for pipe 1-1/4" and larger and eight feet for pipe smaller than 1-1/4", except PVC Schedule 40 pipe which shall have hangers spaced not over 5 feet apart and located near a hub, and copper tubing which shall have hangers spaced not over 6 feet apart. Chain, strap perforated bar, or wire hangers will not be permitted.

2.3.4.1 Hanger rods shall be sized as follows:

Pipe Size	Rod Diameter
1/2" to 2"	3/8"
2-1/2" to 3-1/2"	1/2"
4" to 5"	5/8"

At the contractor's option, trapeze hangers may be used where parallel runs of pipe occur. All rods on trapeze hangers to be 1/2" minimum.

2.3.5 Trapeze hanger shall be constructed from 12 gauge roll formed ASTM A1011 SS Gr.33 structural steel channel, 1-5/8” x 1-5/8” minimum, B-line series B22 strut or stronger as required.

a. Mount pipes to trapeze with two piece pipe straps sized for outside diameter or pipe, B-line series B2000 series.
b. For pipes subjected to axial movement:
c. Strut mounted roller, support, B-line series B3126. Use pipe protection shield or saddles on insulated lines.
d. Strut mounted pipe guide, B-line series B2417.
e. All rods on trapeze hangers shall be 1/2" minimum.
f. Install sheet metal saddles under pipe insulation.

2.4 VALVES

2.4.1 All valves, fittings and other piping specialties, either as shown or required in the connection of the mechanical system or systems, except as may be otherwise specified elsewhere in these specifications, shall be Crane, Nibco, Nordstrom, or Milwaukee.

2.4.2 Threaded bronze ball valves shall be the "primary use" valve for domestic water service and branch isolation. Lubricated plug valves and ball valves shall be used for balancing. Do not use globe valves except where specifically indicated. All valves shall be threaded; sweat valves must be approved by Engineer and no sweat valves larger than 3/4" will be accepted. Install union with every valve. Do not install adaptor fitting in valve prior to soldering. Any valve which indicates direct heat was applied will be replaced.

TYPE	SIZE RANGE	MODEL
Domestic Water		
Ball	2" & smaller (Threaded)	NIBCO NL 999X8 (Lead-Free/Full Port)
Ball	2 1/2" & 3" (Threaded)	NIBCO NL 998XE (Lead-Free/Full Port)
Gate	4" & larger (Flanged)	NIBCO F-607-RW (Epoxy coated)
Globe	2" & smaller	NIBCO T-235-Y
Globe	2 1/2" & larger	NIBCO F-718-B
Check	2" & smaller	NIBCO T-433-B
Check	2 1/2" & larger	NIBCO T-918-B
Gas		
Plug	3" & smaller	Nordstrom 114
Plug	4" & larger	Nordstrom 115
Ball	1/2" & 3/4" (interior only)	A.Y. McDonald 10710 low pressure ball valve with handle

TYPE	SIZE RANGE	MODEL
Plug	1" to 2" (interior only)	A.Y. McDonald 10596 flat/T-head iron bronze body with check, FNPT thread
Plug	exterior (accessible to public)	A.Y. McDonald 10685B flat/T-head iron body plug valve with check stop (-20F to 150F)
Ball	exterior (roof)	Apollo 94A full port ball valve (0F-400F)

2.4.3 Valve identification: Valves, regardless of size, shall have brass or plastic tags at least 1-1/2" in diameter. Legend shall be scheduled to conform to tag and shall include function of the valve, normal position, fluid conveyed and other pertinent data. A framed or laminated legend shall be posted adjacent to valve header or nearest Mechanical Room. Document valve locations on set of as-builts. Note: Valves where the function is obvious to the user are not required to be labeled (i.e. water heater isolation valves).

2.5 CLEANOUTS

2.5.1 General: Furnish and install cleanouts where indicated on plans or as required by local and state codes. Verify floor finish from Architectural schedule. Wall cleanouts shall be connected to PVC waste piping with Fernco flexible coupling and stainless steel clamps.

a. Wall cleanouts: Wade W-8560-E cleanout tee complete with stainless steel access cover and securing screw. Plug shall be countersunk brass with tapping for securing screw.
b. Floor cleanout: (VA tile floor, ceramic tile and concrete) Wade W-6000 Series (model per pipe size) round cast iron floor cleanout with threaded adjustable housing ferrule with plug, inverted Ty-Seal hub connection and secured nickel bronze cover. See Architectural finish schedules for areas required.
c. Cleanout to grade: Wade W-6004-Z-12 cast iron floor cleanout with threaded adjustable housing, ferrule with plug, inverted Ty-Seal hub connection and extra heavy ductile iron tractor top. See detail.

2.6 TRAPS AND DRAINS

2.6.1 P-traps shall be placed under all floor drains, and all plumbing fixtures without integral traps. All traps installed below grade shall be Schedule 40 PVC-DWV with deep seal. Trap and drain piping for kitchen equipment (dishwashers, sinks, collectors, etc.) shall be 2" type 'DWV' copper with solder joints. Acid waste traps shall be polypropylene material.

2.6.2 Drains shall be Wade, or approved equal, in accordance with the schedule on the Drawings. Sizes and locations shall be as indicated on the Drawings. PVC body floor drains are not approved.

2.7 PLUMBING FIXTURES

2.7.1 Furnish and install complete, American Standard, Kohler or Sloan plumbing fixtures as scheduled on drawings. Handicapped lavatories and sinks with exposed hot supply and waste shall be insulated as stated in Paragraph 3.2.2. Kohler Bardon and Sloan SU-1006 urinals shall be considered as equal to American Standard Washbrook urinal.

PART 3 -– EXECUTION

3.1 PIPING INSTALLATION

3.1.1 Pipe cutting:

3.1.1.1 Pipes shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All piping after cutting and before threading shall be reamed and have all burrs removed and shall be cleaned before installation. Nipples shall be of the same material and composition as the adjacent pipe and shall be extra heavy when unthreaded shoulder is less than one inch. No all thread nipples will be allowed.

3.1.2 Piping layout:

3.1.2.1 Exposed lines shall be run parallel with, or perpendicular to, building line and wherever possible shall be grouped together for easier service and identification. Sanitary, waste, and similar lines which require a definite grade for drainage, shall be given precedence in routing over all other lines. Whenever possible, horizontal and vertical runs shall be held as close as possible to the walls, ceilings, struts, members, etc., so as to occupy the minimum space consistent with the proper requirements for insulation, expansion, removal of pipe and access to valves, dampers, etc. All concealed work shall finish off within the limits permitted by the vertical or horizontal chases. This Contractor shall take note of the Architectural and structural features of the building, shall provide for the concealment of all piping in finished areas of the building, and the placement of piping as indicated within the concrete framing system sections.

3.1.2.2 Horizontal soil and waste pipes shall be given an even grade of 1/4 inch per foot where possible, but piping 4" and larger may be run at 1/8 inch per foot. All main vertical soil and waste stacks shall be installed with provisions for expansion and shall be extended full size to and above the roof line as vents, except where otherwise specifically indicated. Horizontal offsets in all sanitary and waste pipe shall be accomplished with one sixteenth (1/16), one eighth (1/8) or one sixth (1/6) bends, with preference given to the order named. Horizontal intersections shall be accomplished with forty-five (45) degree or sixty (60) degree "Y" branches, or combination "Y" and eighth bends with preference given to the order named. Sanitary tees or crosses may be used on vertical lines for fixture connections. Use string line or laser method to grade all sewer lines. No exceptions.

3.1.2.3 Before installing any waste lines below grade, contractor shall furnish to Architect a complete gradation plan of the building with grades shown at each major group of plumbing fixtures and at each line intersection including connection at main line or manhole.

3.1.2.4 Install floor cleanouts and floor drains prior to slab pour; however, if block outs are required, they shall be formed with PVC pipe in lieu of wood blocking. No block-outs will be permitted in areas which are to remain exposed slab.

3.1.2.5

3.1.3 Pipe assembly, domestic water, and gas:

3.1.3.1 All screws joints shall be made with tapered threads properly cut and shall be made perfectly tight with a stiff mixture of graphite and oil, applied with a brush to the pipe threads only, and in no case to the fittings. Caulking screwed joints will not be allowed.

3.1.3.2 Type "K" copper pipe joints shall be made up with the use of "Silfos" solder. Type "L" joints shall be made up using 95/5 solder and a suitable flux. Pipe ends shall be cut square, reamed to remove all burrs and cleaned bright with fine sandpaper and steel wool. Solder shall take up by capillary action and joint shall be made tight without a built-up head. Pulled tees are not acceptable.

3.1.3.3 Soldered joints observed by Engineer and found not acceptable shall be cleaned and resoldered at no additional cost to Owner.

3.1.3.4 Pipe Welding: All joints between sections of black steel pipe and between pipe and fittings two and one half (2-1/2") inches and larger shall be fusion welded. The welding shall be in accordance with recommendations of the American Welding Society. All changes in direction and intersections of lines shall be made with welding fittings. Mitering of pipe to form elbows, notching straight runs to form tees, or any similar construction will not be permitted; however, Weldolet fittings are acceptable. Welders shall be certified with certification passed and dated within 24 months of erection.

3.1.3.5 Insulating couplings: Provide wrapped insulating couplings at all connections between galvanized steel pipe and copper pipe.

3.1.3.6 Press fittings: Mega Press fittings are acceptable for gas 2” and larger on interior only. Copper press fittings are acceptable for copper domestic water piping in lieu of solder fittings. Install in accordance with manufacturers installation instructions.

3.1.4 Pipe assembly, storm sewer/roof drain and sanitary waste and vent:

3.1.4.1 Gasketed Polyvinyl Chloride (PVC) sewer pipe joints shall be assembled per manufacturer's joint assembly procedures. Only the manufacturer's gasket lubricant shall be used. All surfaces of the joint components shall be clean and dry. Use normal force to insert spigot. Contractor may use pipe puller or bucking bar if necessary; however, backhoe is not acceptable.

3.1.4.2 Glued Polyvinyl Chloride (PVC): Schedule 40 PVC fittings shall be solvent welded with schedule 40 PVC cement for 2” diameter or less and schedule 80 PVC cement for piping larger than 2”. Surfaces shall be primed with tetrahydrofuran (THF). Primer shall leave purple residue to indicate the joints were primed. Never use a “dauber” type applicator for piping larger than 2”, only natural bristle brush or roller shall be used (2” to 3” width). Use miterbox saw for cutting pipe square and de-bur end before inserting into fitting.

3.1.4.3 Cast iron "reinforced hub" piping shall be assembled with Tyler "Ty-seal" neoprene joints with piping adequately supported at each joint. At the contractor's option, lead and oakum may be used.

3.1.4.4 Cast iron "no-hub" soil pipe and fittings shall be made with couplings consisting of a stainless steel corrugated shield and clamp assembly over a molded one-piece neoprene sealing sleeve conforming to ASTM C564. Support piping at each joint. NOTE: The use of no-hub pipe is limited to inside the building area only.

3.1.5 Pipe expansion:

3.1.5.1 Swing joints, turns, expansion loops or long offsets shall be provided where shown on the Drawings or where necessary to allow for the proper expansion of piping. Broken pipe fittings due to rigid connections must be removed and replaced at the mechanical contractor's expense. Swing joints shall consist of not less than four fittings on horizontal mains and three fittings on risers and runouts to risers. Connections to equipment shall be made in such a manner that movement of the risers will cause no strain or movement of the equipment.

3.1.5.2 At any point where pipe crosses a roof expansion joint, the contractor shall install an expansion loop without exception.

3.1.6 Exterior Gas pipe supports:

3.1.6.1 Gas piping on concrete slab shall be installed on Dura-Block with unistrut and pipe clamp set. Spacing of blocking shall be 5'0" o.c. and at all turns, junctions and regulators. Provide clamp on pipe loosely connected for expansion. Refer to detail on drawings.

3.1.7 Pipe anchors:

3.1.7.1 Pipe anchors shall consist of heavy steel collars with lugs and bolts for clamping the pipe and for attaching anchor braces, unless otherwise shown on the drawings. Anchor braces shall be installed in the most effective manner to secure the desired results, using turnbuckles where required. No supports, anchors or stays shall be attached in places where they will injure construction either in the installation or by weight or expansion of the pipe.

3.1.8 Sleeves:

3.1.8.1 All pipes passing through masonry construction shall be fitted with 20 gauge galvanized steel sleeves. Each sleeve shall extend through its respective floor or wall, and shall be cut flush with each surface, except floor sleeves which shall be extended to a minimum of 1 inch above the floor. Unless otherwise specified, sleeves shall be two pipe sizes larger than the passing pipe, when the pipe is uninsulated, and one pipe size larger than the overall outside diameter of the pipe insulation when insulated. Sleeves in floor slabs or walls which are not fire-rated may be PVC. Sleeves in walls below grade shall be a pre-engineered assembly equal to Link-Seal as manufactured by Thunderline Corporation; assembly shall be sized and installed in accordance with manufacturer's recommendations. All sleeves shall be securely fastened in place prior to pouring concrete and caulked with flexible caulking or Link-Seal device as applicable. Sleeves or pipes shall not be installed in spread footing. Install pipe below footing; above footing with sleeve; or step footing to accommodate sleeve above. Core drilling will not be permitted without the consent of the structural engineer. Sleeves in grade beams shall be installed near center (additional grade beam depth may be required, coordinate with Structural Engineer).

3.1.8.2 Chrome plated brass escutcheons shall be provided on all pipes passing through building construction in exposed spaces. Pull tight to wall and secure. Lavatory and sink stops may be stamped chrome plated metal.

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3.1.9 Penetration Wall/Floor Firestop:

3.1.9.1 In walls or floors which are designated as fire or smoke walls, the pipes which pass through, into or out of shall be protected with a UL approved system as specified by 3M Fire Protection Products or approved equal manufacturer. Fire proofing method shall be submitted to and approved by Architect.

3.1.9.2 Coordinate penetrations of fire walls, assemblies, barriers, etc. with architectural drawings.

3.1.10 Cold water piping, general:

3.1.10.1 This system shall consist of cold water piping as shown on the drawings including distribution and connection to every fixture furnished, installed, or connected under this contract.

a. Isolation valves shall be provided for each group of fixtures and each separate riser. Valves shall be located in accessible locations and grouped together for ready maintenance and service. Provide Milcor access panels with hinged door where valves are concealed. Doors shall be located so they may be opened without obstruction. Do not locate behind water closets.
b. Provide maintenance free manufactured arrestors for prevention of water hammer.
c. Provide make up water and supply to all equipment furnished by others where shown on the plans and/or as required with stop valves located as required for the equipment supplied.
d. Provide water pressure regulators in the main cold water supply line to the building where indicated on plans. Contractor shall test pressure early and late in the day at times as directed by engineer, and shall provide written documentation of tests to Architect. If the supply pressure exceeds 75 PSIG a pressure regulator must be installed.
e. All water connections and taps shall be made above finish grade. Any connections below the slab shall be removed at the contractor's expense.

3.1.11 Hot water piping, general:

3.1.11.1 This system shall consist of hot water piping from domestic water heaters with connections to fixtures where indicated on the plans and/or risers and/or schedules. General Piping requirements same as cold water.

a. Hot water piping is never run below grade or under concrete floors unless specifically indicated. (See Insulation Specifications 3.2).
b. Furnish all check valves, isolation valves, gauges and piping as indicated.

3.1.12 Gas piping, general:

3.1.12.1 Provide full size dirtlegs at all low points of the system and at each appliance.

3.1.12.2 Provide a gas cock, union and appliance regulator at each gas using appliance.

3.1.12.3 An insulating (isolating) union or other approved insulating fitting shall be installed by the plumbing contractor above grade level on every riser at the building served, and at the connection to the utility's piping on all service replacements unless otherwise directed by the gas utility. It is necessary that the underground gas piping be electrically isolated from house or building piping, and from any unprotected utility company piping.

No gas piping in the service line upstream of the insulating fitting at the building entrance shall be allowed to contact any other metallic structure, such as water services, concrete reinforcing, drain lines, grounding systems, abandoned pipe, or grounded direct-burial electric distribution cables. A minimum clearance of 4 inches should be maintained at crossings with any other metallic piping.

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3.1.12.4 See paragraph 3.1.6 for gas support on concrete slab.

3.1.13 Pipe identification:

3.1.13.1 All pipe located in accessible areas (lay-in ceilings included) shall be labeled, color coded, and have direction of flow indicated per ANSI A13.1-1981. Labels shall be located every 25 feet on horizontal runs; at each passage through wall, floor or ceiling; at each branch or riser takeoff.

3.1.13.2 The following lines shall be labeled:

Natural Gas	Cold Water
Hot Water	Roof Drain

3.1.13.3 Labels shall be equal to Seton Opti-Code Pipe Marker System. Secure to pipe with "Arrows-On-A-Roll" tape on both ends of label.

Natural Gas – Yellow with black letters
Cold Water – Green with white letters
Hot Water – Yellow with black letters

3.2 INSULATION

3.2.1.1 After satisfactory tests upon the piping systems have been made as herein specified and after the systems have been thoroughly cleaned, the following insulation shall be installed by a skilled workman who has several years insulating experience.

Upon inspection, Architect reserves the right to demand an insulation contractor, at the contractor's expense, who specializes in the trade to rework or complete any insulation work which is unacceptable to trade standards and/or meet the intent of these specifications.

3.2.2 Insulation shall be Owens/Corning Fiberglass 23 ASJ/SSL, all service jacket, self-sealing lap, thickness specified.

a. The specification covers the materials required for insulation of plumbing and piping and the general methods of installing this material. The application of all insulation shall be in accordance with the manufacturer's published recommendations and by mechanics regularly employed in this trade only. All piping, fittings, valves and equipment which may be subject to sweating and/or high surface temperatures shall be insulated.

b. Insulation shall be of the highest grade and installed in accordance with National Commercial and Industrial Insulation Standards and these specifications. Surfaces of insulation shall be smooth and even with jackets drawn tightly and smoothly cemented down at all longitudinal and end laps. Cement shall be resistant to vermin and mold and shall be durable. No scrap pieces of insulation will be used where a full length section will fit. Pipe insulation shall be secured with aluminum bands, three per section or staples in addition to the adhesive. Insulation, including finishes and adhesives on the exterior surfaces of ducts, pipes and equipment, shall have a flame spread rating of 25 or less and a smoke developed rating of 150

or less as determined by an independent testing laboratory in accordance with ASTM Standard #84.

c. All surfaces must be clean and dry when insulation is installed. All foreign matter such as rust, scale, dirt, etc., shall be removed. Insulation shall be free of foreign matter and shall be dry when installed and before and during the application of any finish. The insulation may be installed at any time the contractor desires after the cleaning and painting specified in other sections of this Specification have been completed. However, installation of insulation before the piping, etc., has been tested and approved shall be at the risk of the Contractor and should defects in insulated work develop at or before the time of inspection and tests, insulation shall be removed and, after defects have been corrected, shall be reinstalled without expense to the Owner.

d. Hangers for piping which is insulated with fiberglass insulation shall be installed on exterior of insulation. Piping 1-1/2" and larger shall contain a high density insulation "Foamglas" between the pipe and the hanger saddle to prevent crushing of the insulation. A wood block or wood dowel insert may be used in lieu of "Foamglas". All piping shall be provided with a 16-gauge galvanized sheet metal saddle between the fiberglass or "Foamglas" insulation and the hanger. Length of sleeve shall be two (2) inches longer than "Foamglas" section or a minimum of twelve (12) inches. Length of "Foamglas" shall be at least three (3) times the nominal pipe diameter or a minimum length of twelve (12) inches.

e. Insulate all above grade hot, cold and horizontal roof drain lines with fiberglass sectional pipe insulation having a factory applied all service vapor barrier jacket ASJ/SSL. Water piping shall be insulated with thickness as tabulated below. Apply insulation to clean, dry piping with all joints tightly butted. Apply 3 (three) inch wide butt joint strips over all end joints. Insulate all fittings on piping up to 3 (three) inches IPS with insulating cement and on larger sizes with molded fittings or mitered segments to the same thickness as the adjacent insulation vapor seal with two 1/8" wet coats of Vapor Barrier Mastic reinforced with Glass Fabric extending two (2) inches into the adjacent insulation. Each change in direction of piping 1" and larger shall have a factory molded "Zeston" PVC fitting with internal insulation.

MINIMUM PIPE INSULATION (NON-HEAT TRACE)						
INSULATION THICKNESS FOR PIPE SIZES						
COLD WATER AND ROOF DRAIN LINES		0.5" THICKNESS				
		Circulating Main & Runouts (see note)				
Service Water Heating Tempature	Noncirculating runouts 3/4" and less not exceeding 12 ft. in length	PIPE SIZES				
		Up to 1-1/4"	1-1/2-2"	2"	2-1/2"	3"
100-180°F	0.5"	1.0"	1.5"	2.0"	2.5"	3.0"

*Nominal iron pipe size and insulation thickness.

f. Fiberglass insulation shall not be installed where exposed to the elements. Water piping installed in block walls may be insulated with cellular foam equal to Armstrong Armaflex to allow installation prior to getting the building in the dry. All joints and seams shall be completely sealed.

g. Hot water lines shall not be below slab unless specifically indicated. Where indicated as below slab insulate with 3/4" Halstead Insul-tube, coat with Halstead protective coating and install in sand bedding.

h. Insulate bottom of all roof drains.

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i. All water and drain lines shall be insulated below handicapped lavatories and sinks where exposed in knee space area with "P" trap cover, waste arm valve/supply covers and tailpiece cover. Protective pipe covers shall be as manufactured by Truebro, Inc. 100 Series for cast p-traps.

3.3 FLASHING

3.3.1 Where mechanical items penetrate the roofing, the contractor shall coordinate location and size as required for factory vent flashing assembly. The flashing shall be furnished and installed by the Roofing Contractor in strict accordance with the Roof Manufacturer's recommendation.

3.3.2 If single ply membrane roof is used, contractor shall use factory vent flashing assembly as recommended by Roofing Manufacturer. Coordinate locations with Roofing Contractor.

3.4 ELECTRIC MOTORS AND CONNECTIONS, GENERAL

3.4.1 The contractor furnishing the motor shall install it on suitable foundations complete and ready for electrical connections. The Contractor furnishing the motor shall furnish and deliver to the electrical contractor all starting equipment required for operation of the motor, unless otherwise provided for in SECTION SIXTEEN of these specifications. Each and every motor shall be furnished with a starter with over current protection. The labor and material for the electrical connection of all motors and the erection and connection of all motor starters and panelboards shall be done by the electrical contractor. The Contractor furnishing the motors and starters shall provide all labor and materials for the installation of the interlock wiring between starters and all automatic controllers unless otherwise provided for under SECTION SIXTEEN of these specifications.

a. Starters which are interlocked for automatic operation shall have ON-OFF switches. All starters shall have pilot lights.
b. All controls or devices installed outdoors shall be completely weather proofed.
c. Unless otherwise specified, this contractor shall furnish all necessary controls and provide all labor and material for proper installation. All controls shall be installed strictly according to the ELECTRICAL SECTION of these specifications.
d. This contractor shall notify the electrical contractor of any changes required in the electrical plans because of substitution of equipment or variation in electrical requirements due to changes in the equipment manufacturers and shall accept all responsibility for such change and variation.
e. Contractor shall verify on electrical plan any additional starters required. Manual motor starters shall be furnished and installed by the electrical contractor.

3.5 CROSS CONNECTIONS

3.5.1 No plumbing fixtures, device, or piping shall be installed which will provide a cross connection or interconnection between the water supply system for drinking or domestic purpose and a polluted supply or a soil or waste pipe which will permit or make possible the back flow of sewage, polluted water, or waste into the water supply system.

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3.6 TESTING

3.6.1 General: All piping and other mechanical systems provided under this contract shall be tested by the contractor and approved by the Architect before acceptance. All piping located underground shall be tested by the contractor and observed by the Architect and local utility representative before backfilling. All equipment, fuel, water, electricity and personnel required for tests shall be furnished by the contractor without additional cost to the Owner. Testing equipment shall be required for the particular test and all equipment and gauges shall be accurate and in good working order. All equipment subject to damage if given test pressures shall be removed from line before pressure is applied. When tests have been completed, before pipe is covered contractor shall notify Architect for his observation.

3.6.2 Drainage system: The drainage systems shall have all necessary openings plugged to permit the entire system to be filled with water to the level of the highest stack above the roof (10 ft. minimum). The system shall hold this water for a minimum of 15 minutes before inspection of joints. All leaks shall be repaired and the system retested and proved tight before any fixtures are connected. The Contractor shall make any other tests which may be required under the local codes. System may be sectionalized with Architects approval if necessary to construction schedule. Pressure testing is permitted when using cast iron piping only,

3.6.3 Building sewer: The sewer from the building to a manhole or main shall be plugged at the point of connection to manhole or public sewer, filled with water and observed for leakage. The system shall be tight at all points.

3.6.4 Building domestic water system: The water piping system shall be tested under a hydrostatic pressure of 100 p.s.i. applied for one hour and proved tight and free from leaks. Where water piping is located other than in vertical pipe chases, the test shall be extended to 24 hours.

3.6.5 Natural gas system:

3.6.5.1 Each segment of piping intended to be operated at pressure of less than 1 psig shall be given a leak test at a pressure of 25 psig for a period of 15 minutes without any drop in pressure. Use 3 inch gauge with 100 psig maximum scale.

3.6.5.2 Each segment of piping intended to be operated at a pressure of 1 psig or above shall be given a leak test at a pressure of 90 psig for a period of 15 minutes without any drop in pressure. Use 3 inch gauge with 150 psig maximum scale.

3.6.6 Reduced Pressure Backflow Preventer: All backflow assemblies shall be tested by an assembly testing technician certified by the state. Provide backflow assembly test forms to water utility company and Architect.

3.7 STERILIZATION

3.7.1 Domestic water piping systems:

3.7.1.1 The pipe system shall be flushed with clean, potable water until dirty water does not appear at the points of outlet.

3.7.1.2 The entire domestic hot and cold water piping systems shall be thoroughly sterilized with a water/chlorine solution containing at least 50 parts per million (50 mg/L) of chlorine, and the system or part thereof shall be valved off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water/chlorine solution containing at least 200 parts per million (200 mg/L) of chlorine and allowed to stand for 3 hours. After sterilization, the solution shall be flushed from the system with clean water until the residual

chlorine content is not greater than 0.2 part per million, unless otherwise directed, to satisfy all requirements of the Arkansas State Plumbing Code, Section 610. Contractor shall furnish a letter of compliance to the Architect.

3.8 CERTIFICATE OF INSPECTION

3.8.1 This contractor shall furnish to the Architect in duplicate a certificate of inspection issued by the plumbing division of the Arkansas State Health Department and shall also bear the expense for all inspection fees, etc.

3.9 PLUMBING FIXTURES AND EQUIPMENT

3.9.1 Plumbing fixtures shall be furnished and installed complete with all trimmings, escutcheons, and fittings unless otherwise specified under this item. Fixtures shall have smooth impervious surfaces free from defects and concealed fouling surfaces. Generally, all fixtures except water closets and urinals shall have the water supply above the rim. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield loose-key pattern stops for concealed supplies shall be furnished and installed with all fixtures. Exposed traps and supply pipes for all fixtures and equipment shall be connected to the rough piping system at the wall unless otherwise specified under this item. All fixtures and trimmings shall be designed to prevent the backflow of polluted water into the water supply system.

3.9.2 Fixture connections: Connections between earthenware fixtures and flanges on soil pipe shall be made absolutely gas tight and watertight with a high quality closet setting compound or with gaskets. Rubber gaskets or putty will not be permitted. Closet bolts shall be not less than 1/4" in diameter and equipped with brass nuts and washers covered with chromium caps unless otherwise specified. Fixtures and outlet flanges shall be set the proper distance from floor or wall to make a first class joint with the closet setting compound or gasket and fixture. No fixtures shall be set in place until the Architect has examined and approved such flange. All exposed piping, fittings, and trim shall be heavily chromium plated. Caulk around all water closets, lavatories, urinals and service sinks with latex caulk and finish shall be concave and smooth.

3.9.3 Fixture and equipment supports and fastenings: All fixtures and equipment shall be supported and fastened in a satisfactory and workmanlike manner. Where secured to concrete or brick walls, they shall be fastened with brass bolts or machine screws in lead sleeve type anchorage units or with 1/4" brass expansion bolts. Expansion bolts shall be of sufficient length to extend at least 3" into solid concrete or brick work. Where secured to terra cotta walls or partitions, fixtures shall be fastened with 1/4" brass toggle or through bolts. Where wood screws are used, screws shall go into solid wood, such as wood inserts, floor joists, studs, or solid pieces set between studs. Where through bolts are used, they shall be concealed by plaster. Bolts and nuts shall be hexagon and exposed bolts, nuts, cap nuts, and screws shall be chromium plated and shall be provided with chromium plated brass washers.

3.10 EXCAVATING AND TRENCHING FOR PIPING

3.10.1 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 accumulating 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 a trench may be tunneled if the pipe can be safely and properly installed and backfill can be properly tamped in such tunnel sections.

3.10.2 Trench excavation: Bottom of trench for sewer and water 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. Grade 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 overdepth of 4" below trench depths indicated on the drawings or specified. Overdepths in rock excavation and unauthorized overdepths 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.

3.11 BACKFILLING OF TRENCHES

3.11.1 Trenches shall not be backfilled until required pressure and other tests have been performed, inspection by utility and Code officials have been accomplished, and until the utilities systems as installed conform to requirements of Drawings and Specifications.

3.11.2 Backfill trenches with excavated materials consisting of earth, sandy clay, clayey sand, or other approved impervious materials, free from clods of earth or stones over 2-1/2" maximum dimension, deposited in 6" layers and compacted in accordance with the compaction procedures outlined in Section 31 22 00 – Grading. 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 recompact the fill until specified densities are achieved.

3.11.3 The embedment for schedule 40 PVC sanitary sewer below slab and PVC domestic water on exterior shall consist of crushed stone or rock (3/4” maximum) Class 1 material which is 6" below and above the pipe. Embedment for PVC sanitary and storm sewer piping exterior of building shall be manufactured angular, granular material, 1/4 to 1-1/4 inches in size (no fines), 6" below and above the pipe. The remaining backfill shall be compacted as outlined in Section 31 22 00 – Site Grading. The maximum bury of PVC pipe shall be sixteen (16) feet.

3.11.4 Backfill for trenches not below building, paving, sidewalks, etc., may be compacted to 90% Standard Proctor in accordance with ASTM D698. Backfill may be SB-2 below paving or asphalt and select native fill below topsoil. Select fill material used for pressure PVC pipe bedding must meet AWWA-C605 Standards (3/4” maximum for angular rock and 1 1/2” maximum for rounded rock).

3.11.5 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.

3.12 CUTTING AND PATCHING

3.12.1 This Contractor shall do all cutting and patching made necessary by this work, but in no case shall be cut through or into any structural member without written permission from the Architects. This Contractor shall furnish and pay for the installation of all sleeves required for his work.

3.13 DEFECTIVE WORK

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3.13.1 If inspections or tests show defects such defective work or material shall be replaced and inspection and tests repeated. All repairs shall be made with new material. Caulking of screwed joints or holes in piping work will not be acceptable. Floor drains that do not have a floor slope to the strainer shall be removed and reset with slope at no additional charge.

3.14 CLEANUP

3.14.1 When the Contractor's part of the work is finished, he shall remove from the premises all tools, machinery, debris, etc., and shall leave the premises free from all obstructions.

3.15 GUARANTEE

3.15.1 This Contractor shall furnish a written certificate, guaranteeing all materials, equipment, and labor furnished by him to be free of all defects for a period of one (1) year from and after, the date of final acceptance of the work by the Owner, and this Contractor shall further guarantee that if any defects appear within the stipulated guaranty period, such work shall be replaced without charge.

3.15.2 This guarantee shall be extended to include the capacity and integrated performance of the component parts of the various systems, in strict accordance with the true intent and purpose of the specifications. The Contractor shall conduct such tests as are herein before specified, or as may be required by the Architects, to demonstrate the capacity and performance ability of the various systems and their component parts.

3.16 HANDICAPPED MOUNT HEIGHTS

3.16.1 Fixture heights shall be as follows unless noted otherwise in Fixture Schedule:

Urinals	17" AFF to rim
Lavatory	2'10" AFF to rim
Water Closet	17 3/4" AFF to top of seat (Adult)
Drinking Fountain	42”/36” AFF to spout – Hi/Lo (Adult)

3.16.2 All handicapped fixtures to meet requirements of the Americans with Disabilities Act (ADA) 2010.

3.16.3 All water and drain lines shall be insulated on handicapped lavatories where exposed in knee space area. See paragraph 3.2.2.

END OF SECTION

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The Engineer of Record for Classroom Addition, Junior High School, Stuttgart School District, Stuttgart, Arkansas Division 23 of the specifications.

September 14, 2026

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Section 23 00 00

HEATING, VENTILATION,
AND AIR CONDITIONING

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: This specification includes the furnishing of all labor, materials, tools, equipment, drayage, rigging, fees, permits, etc., unless specifically furnished by others, necessary or reasonably required, for the complete installation and operation of all the work as herein specified and/or as shown on the Drawings. The entire work shall be delivered in a complete and perfect working order to the satisfaction of the Architect.

1.1.2 The scope of the work shall include the general listings as shown below in addition to which this contractor shall furnish and install all required pipe, fittings, valves, hangers, supports, sleeves, insets, traps, and other such equipment, items, and appurtenances as may be required for a complete and operative system or systems, including all parts auxiliary to the system or systems whether or not specifically set forth herein and/or shown on the Drawings.

a. Systems of heating and air conditioning
b. Automatic Temperature Controls (Section 23 09 23)
c. Systems of ventilation (Section 23 74 33)
d. Miscellaneous equipment and accessories
e. Tests, inspections, balancing and adjustment

1.2 APPLICABLE GENERAL SPECIFICATIONS AND REGULATIONS

1.2.1 The General Conditions, Supplementary Conditions, Instruction to Bidders and other pertinent documents, as issued by the Architect, are a part of these specifications and shall be complied with in every respect.

1.2.2 All Heating, Ventilation and Air Conditioning work and equipment, in whole or in part, shall conform to the applicable sections of the latest edition of the following ordinances, codes, and regulations which shall form a part of this specification.

a. National Electrical Code
b. American Gas Association Recommended Practices
c. National Fire Protection Association Recommended Practice
d. Local, City and State Codes and Ordinances
e. American Society of Mechanical Engineers, Plumbing and Air Conditioning Codes
f. SMACNA

1.3 SUBMITTALS

1.3.1 The Contractor shall furnish electronic shop drawings using the submittal procedure as detailed in Section 01 33 23. Shop drawings are required even though the equipment is as specified.

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1.3.2 All submittals must be on the manufacturer's standard certified submittal sheets or other approved sheets; faxed material will not be accepted. Each item must be marked with the symbol, letter, or number designating it in the specifications or on the plans and items must be arranged in the order specified or scheduled.

1.3.3 All performance data, details, dimensions, special features and accessories must be clearly marked.

1.3.4 Substitutions will not be considered without prior approval from the engineer.

1.3.5 Shop drawings are required even though the equipment is as specified.

1.3.6 Provide shop drawings on the following items:

a. Heating and Cooling Equipment
b. Outside Air Equipment
c. Duct Insulation, Joint Sealant and Exterior Coating
d. Air Devices and Louvers
e. Automatic Controls
f. Manual Dampers
g. Electric Heaters
h. Exhaust Fans
i. Duct Takeoffs
j. All Accessories

1.3.7 If there are electrical revisions required due to substitute equipment, the Mechanical Contractor shall be responsible for any additional changes incurred by the Electrical Contractor.

1.3.8 When submitting substitute equipment with different rough-in requirements from the specified equipment, i.e. packaged unit ductwork openings, the Mechanical Contractor shall submit a sketch indicating the proposed installation for review by the Engineer. The Engineer may approve, revise or reject the proposal. If rejected, the Contractor shall provide the specified equipment or resubmit another approved substitute.

1.3.9 After shop drawings are approved, this contractor shall advise the General Contractor of any changes required in equipment supports and foundations and provide copies of shop drawings so that necessary provisions can be made.

1.3.10 Should a substitution be approved for use in lieu of that specified and should the substituted material prove defective or otherwise unsatisfactory, in the judgement of the engineer, for the service required within the guaranty period, the contractor shall replace the material or equipment as originally specified without additional cost to the Owner.

1.3.11 If submittals are "not approved" or marked "revise and resubmit", the complete package shall be corrected and returned for review. The contractor may provide a separate bound submittal which includes only the sections marked "not approved, or "revise and resubmit". Any additional submittal data requested shall also be provided in resubmittal.

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1.4 COORDINATION

1.4.1 Chases, recesses and other openings in the building construction required for the location of pipes, or other, mechanical equipment, will be provided by the General Contractor. The mechanical Contractor shall advise the General Contractor of the sizes and locations, and furnish the necessary drawings in sufficient time to allow for provision of same; otherwise the additional cost caused thereby shall be paid by the mechanical contractor.

1.5 FEES AND PERMITS

1.5.1 Contractor shall pay for all fees, permits and charges for utility connections. This includes all fees required for improvement district non-refundable contribution.

1.6 OPERATION AND MAINTENANCE MANUALS

1.6.1 Refer to Section 01 77 19 – Contract Closeout for complete instructions.

1.7 CONTRACTOR REVISED DRAWINGS

1.7.1 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. Exact location of all underground utility service entrances and their connections to utility mains as well as all valves, etc., which will be concealed in the finished work shall be accurately indicated on the drawings by measured distances. Upon completion of the work and prior to final payment, the contractor shall furnish to the Owner one set of "as-built" prints legibly and accurately marked to indicate all changes, additions, deletions, etc., from the Contract Drawings.

1.8 OPERATION AND MAINTENANCE INSTRUCTIONS

1.8.1 Provide complete operation and maintenance instructions on all equipment and instruct Owner's representative in their operation.

1.9 NAME PLATES

1.9.1 All mechanical equipment (furnaces, packaged units, condensing units, energy recovery ventilators, exhaust fans, boilers, pumps, etc.) excluding PTAC units shall be labeled with black and white laminated bakelite nameplates securely fastened to the device.

a. Nameplate size shall be 1” x 2 1/2 “ with beveled edges and 1/4” letters.
b. Nameplate shall have the equipment designation as noted on plans.
c. Nameplates shall be secured to equipment with rivets or sheetmetal screws.
d. Embossed stick back will not be allowed.
e. Nameplates for switches may be omitted for equipment where the disconnect is adjacent to the unit and is labeled by the Electrician.
f. Sample:

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1.10 EQUIPMENT FURNISHED UNDER OTHER SECTIONS

1.10.1 This Contractor shall provide all necessary material and labor for the connection to the mechanical and electrical systems of all equipment requiring such connections, and which equipment is furnished by the Owner or is specified under other sections of these specifications. If any such equipment is not delivered prior to final acceptance, the services shall be capped or plugged at walls or floors as directed, and shall be left ready for future connection.

PART TWO - PRODUCTS

2.1 METAL DUCTWORK

2.1.1 Furnish and install all supply, return, outside air, exhaust and other ductwork shown, together with splitters, deflectors, dampers, etc. All work shall comply with all requirements of NFPA #90-A. All ductwork, supports, bracing, etc., shall be galvanized.

2.1.2 All galvanized ductwork shall be fabricated by using ASTM A90, A568, A653, and A924 commercial grade lock forming G-90/G-60 materials.

2.1.3 All material and gauges can be fabricated per SMACNA's construction standards based on system operating pressure.

2.1.4 Special duct construction materials such as 16 ga. steel, aluminum, stainless steel and spiral shall be as noted on drawings or other areas in this specification.

2.1.5 Refer to paragraph 3.1 – Air Distribution.

2.1.6 Air Devices:

2.1.6.1 Diffusers, Registers and Grilles: All diffusers, registers and grilles shall be E.H. Price, Titus or as specified on the plans. They shall fit tightly against the mounting surfaces and shall be equipped with felt or rubber gaskets and shall have frames to match the mounting surfaces. All registers, diffusers and exhaust registers shall have opposed blade dampers unless otherwise noted. All supply diffusers shall be insulated on back or top with a minimum of 1/2" thick fiberglass duct wrap.

2.1.6.2 Vanes: Furnish and install, at any change of direction, elbows with single thickness vanes. This applies to supply as well as return ducts. Radius elbows may be used in lieu of turning vanes for ducts less than 36" in width. Where sharp throat elbows are constructed a single turning vane shall be installed adjacent to the throat.

2.2 DUCT SUPPORTS

2.2.1 All materials shall be galvanized. Hangers shall be steel straps or rods and trapeze hangers, when concealed, on rods and trapeze hangers when exposed. Straps shall be connected to the duct with 2 sheet metal screws on side and one on the bottom. Spacing of hangers shall be 6' on center, or closer when necessary. Size of hangers for rectangular duct shall be:

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Duct	Min. Rod	Strap	Trapeze
Up to 36"	1/4"	1" x 20 ga.	1-1/2" x 1-1/2" x 3/16"
37" to 60"	3/8"	1" x 16 ga.	1-1/2" x 1-1/2" x 3/16"
61" up	3/8"	1-1/2" x 12 ga.	2" x 2" x 1/4"

2.2.2 Duct passing through roofs shall be supported with galvanized steel-structural angles of adequate bearing surfaces and size for support.

2.2.3 Strap hangers used on externally insulated ductwork shall be installed loose around duct with 6" wide sheet metal saddle. Strap may be installed prior to insulation; however, strap penetration shall be sealed to maintain vapor barrier.

2.3 DUCT INSULATION

2.3.1 Furnish and install on all square and rectangular supply, and return air ducts, internally (unless otherwise noted), 1" thick, Owens/Corning type 150 duct liner. Exterior ducts internally lined shall be with 1 1/2" thick type 200 duct liner.

2.3.2 Round duct work shall be insulated externally with 2 3/16", 3/4 lb. fiberglass stapled 4" o.c. and seal seams and joints with 4" wide aluminum tape. Insulation for outside air ductwork may be 1-1/2" thick.

2.4 AUTOMATIC CONTROLS

2.4.1 Refer to Section 23 09 23 for Automatic Temperature Controls.

2.4.2 Low voltage wiring between outside air/condensing units, furnace/condensing units and heat pump/fan coil units shall be provided under this section (23 00 00).

2.4.3 Low voltage control wiring from indoor air handling unit to exterior condensing unit shall be secured to insulated suction line with plastic cable ties. Apply protective coating on exterior refrigerant insulation prior to attaching control wiring. Provide 1/2" EMT in exterior wall or chase for routing of low voltage control wiring from interior to exterior.

2.4.4 Refer to equipment operational sequence on drawings.

2.6 CONDENSING FURNACE EXHAUST, CONDENSATE AND INTAKE PIPING AND FITTINGS

2.6.1 Piping and fittings shall be schedule 40 PVC conforming to ASTM D1785, D2466 and D2665. PVC primer and cement shall be per ASTM D2564.

2.6.2 Piping and fittings, including intake and exhaust piping terminations, shall be sized and installed in strict accordance with manufacturer's recommendation.

2.6.3 Exhaust piping shall be sloped back to furnace with a sufficient amount of hangers in order to prevent sagging and collecting of condensation. (Minimum 5 feet spacing).

2.6.4 When using a Wall Mounted Termination Kit, insert a No. 2 or 3 mesh painted galvanized hardware cloth bird screen inside exhaust opening of exterior or factory furnished screen.

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2.6.5 Pipe hangers shall be carbon steel adjustable Clevis type, Grinnell Fig. 260 with all-thread rod to structure.

2.6.6 Insulate PVC intake and exhaust piping with ¾" Armaflex II pipe insulation as specified for refrigerant piping (2.10.3)

2.7 ROOF CURBS AND FLASHING

2.7.1 On Metal Roofs where mechanical items require curbs or flashing when penetrating roof, the Mechanical Contractor shall coordinate location and size for roofing Contractor to furnish and install a factory vent flashing assembly or curb in strict accordance with the Roof Manufacturer's recommendation.

2.7.2 On Single Ply Roofs where mechanical items require curbs, the Mechanical Contractor shall furnish a factory curb to the Roofing Contractor for installation. Flashing for piping penetrations shall be as detailed on the drawings. Coordinate curb and flashing sizes and locations with Roofing Contractor.

2.7.3 Fresh air intakes shall be located 10'-0" minimum from flues, exhaust fans, plumbing vents, gas regulators, etc., which could affect the air quality.

2.9 CONDENSATE LINES

2.9.1 Condensate lines shall be Schedule 40 PVC insulated with armaflex or equal, sized as shown on drawings (interior) and 80 PVC (exterior) with factory 90 degree elbows for deep traps on negative pressure drains and single piece shallow traps for positive pressure drains. Lines shall be vented, graded and securely anchored. Interior condensate drains which are condensing on the exterior surface after start up shall be insulated per cold water or refrigerant pipe insulation specification.

2.10 REFRIGERANT PIPING AND FITTINGS

2.10.1 Furnish and install piping, provide refrigerant and test the piping. Refrigerant piping, including liquid and hot gas lines, shall be hard drawn copper, Type "L" pipe (degreased). Soft copper will be permitted when sleeving below grade or installing in wall to eliminate fittings. Soft copper may also be installed on units less than 1 1/2 tons.

2.10.2 Joints shall be made with wrought copper fittings and silfos or copper pressure-seal fittings.

2.10.2.1 Copper Pressure-Seal Fittings for Refrigerant Piping:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Rapid Locking System (RLS), LLC Press Fittings or comparable product approved by engineer.
2. Fittings: UL 207 Listed: certified by UL for field installation. Certification as a UL-recognized component alone is unacceptable.
3. Fitting Body: Refrigerant Grade Copper in accordance with ASTM B75 or ASTM B743.
4. O-Rings: HNBR, or compatible with specific refrigerant.
   a. Temperature Rating: Minus 40 deg F to plus 300 deg F (minus 40 deg C to plus 149 deg C).
5. Maximum Continuous Operating Temperature: 250 deg F (121 deg C).
6. Tools: Manufacturer's approved jaw(s) and tool.
   a. Approved jaw's display two circular 360 deg (400 g) press bands, with circular groove to either side, along with a manufacturer's witness mark embossed on the bands.
7. Maximum Allowable Working Pressure: In accordance with UL 207: 700 psig.

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8. Minimum Allowable Burst Pressure: In accordance with UL 207: 2100 psig.

2.10.3 All suction lines to be insulated with 3/4" Armaflex II pipe insulation. (Suction and liquid lines shall be insulated on ductless split systems.) Tubular insulation shall be slipped on to piping and sealed with Armstrong 520 adhesive. Insulate all valves, tees and other fittings with AP Armaflex insulation tape and secure in place with black plastic cable ties. If it is necessary to slit the tubular insulation because of specific construction requirements, insulation shall be sealed along entire length with Armstrong 520 adhesive and secured with plastic ties 12" o.c. All exterior insulation shall be thoroughly coated with weather resistant protective finish as manufactured by Armstrong. Finish is a water base latex enamel coating for use over all forms of Armaflex. Install finish prior to installation of insulation and touch up damaged areas after installation is complete. Secure control wiring, not in conduit, to suction line with plastic ties at 12" o.c.

2.10.4 Do not run refrigerant lines thru return air plenum unless approved by engineer.

2.10.5 Hangers shall be carbon steel light weight Clevis hangers equal to Grinnell Fig. 65 with all-thread rod to structure at 6'-0" maximum spacing. Suction and liquid lines can be supported by same hanger. Multiple lines in parallel shall be supported on unistrut trapeze hanger with all-threads to structure.

2.10.6 Moisture-Liquid Indicators: Forged brass, single port, removable cap, polished optical glass, solder connections, UL-listed, 200 degrees F (93 degrees C) temperature rating, 500 psi working pressure as manufactured by Sporlan Valve Company or Parker-Hannifin Corp.

2.10.7 Filter Driers: Sporlan HPC-100 Series Catch-All Liquid Line Dryer. Size per manufacturer's recommendation. Provide reversible type for heat pump applications. Driers shall be solid core desiccant.

2.10.8 Filter dryers and sight glasses are not required for ductless split systems.

2.11 MECHANICAL EQUIPMENT

2.11.1 All mechanical equipment shall be supplied as scheduled on plans. Substitutions must be approved in writing one week prior to bid date. No exception. All condensing units to have filter-drier, L.L. sight glass with moisture indicator, thermostatic expansion valve on coil, and crankcase heater.

2.11.2 All electrical wall heaters shall be mounted at 12" A.F.F. unless noted otherwise.

2.14 MANUAL DAMPERS

2.14.1 Round dampers, unless integral to duct takeoff, shall be equal to Ruskin MDRS25, 20 ga. galvanized steel, 3/8" square axle shaft and molded synthetic bearings.

2.14.2 Rectangular dampers shall be equal to Ruskin MD25, 22 ga. galvanized steel 3/8" square axle shaft and molded synthetic bearings.

2.14.3 Provide lever handle operator with locking nut and mounting plate shown "OPEN" and "CLOSED" positions. Lever handle shall indicate damper position between open and closed. Lever handle shall be provided with a stand-off bracket to extend lever above external insulation where applicable. Shop fabricated dampers are not acceptable.

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2.15 TAKE-OFF FITTINGS

2.15.1 Round supply take-off fittings shall be 45° transi fitting equal to Flexmaster Model STD with 1" wide mounting flange and adhesive coated gasket, damper, 3/8" square axle shaft, nylon bearings, quadrant indicator and 2" standoff bracket. Return and exhaust fittings shall be air-track gasketed type. All flanged/adhesive fittings shall be attached with sheet metal screws at 4" spacing around circumference of flange.

PART THREE - EXECUTION

3.1 AIR DISTRIBUTION

3.1.1 Metal Ductwork:

A. Ducts shall be installed with special care and shall present a neat appearance. Plenum chambers shall be 22 gauge, reinforced with structural angles. Exterior ductwork and all exposed, rectangular interior ductwork shall have all joints made watertight equal to Ductmate 25/35/45 connection system with roll-formed flanges, corner pieces, gasket and cleat.

B. All ducts with one side over 24 inches shall be cross broken for rigidity.

C. All duct dimensions are outside dimensions.

D. Flash and counter-flash all piping, ductwork, etc., penetrating walls and roof, using minimum 20 gauge galvanized steel, unless shown otherwise.

E. Duct locations, sizes and proportions shown on the Drawings shall be followed as nearly as practicable. However, locations and width x height ratios of ducts may be changed a reasonable amount to fit the job conditions without additional cost to the Owner.

F. All four (4) sides of return air plenums, excluding ceiling plenums, shall be completely lined with 1" duct-liner.

G. Wall louvers shall be furnished to General Contractor for installation. This Contractor shall furnish and install ductwork and dampers behind louvers, as shown on the Drawings.

H. Plastic duct tape shall not be used to hold joints together. Seal all joints in sheet metal supply, return and exhaust ductwork with "Hardcast" type DT sealing tape and type FTA adhesive, installed in strict accordance with manufacturer's instruction. Clean all dirt, oil, moisture, etc., before applying adhesive. At contractor's option, Hardcast Iron Grip IG-601, Foil Grip 1402 or Aluma Grip AFT-701 may be used on joints. However, if these products are substituted for DT mesh and adhesive, it is critical that the area of application is clean from dirt, oil, grease and moisture. Failure to do so will require reapplication of sealant. All joints on round duct to be screwed prior to sealant application. Seal all joints around equipment which permit leakage of conditioned air with Hardcast Foil Grip 1402.

I. Exterior supply and return air ducts shall be coated with protective coating equal to Silver Dollar Fibered Aluminum Roof Coating. Ducts shall be cross broken on top to eliminate any standing water. No seams on top or sides are acceptable.

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J. Flexible duct connections: On duct connections of air moving equipment greater than 2000 CFM or as required for equipment installation, provide 30 ounce woven glass fabric, double coated with neoprene "Ventglas", or equal, canvas connections to give no less than 3" clear break between metals jointed. Insulate with 1" minimum fiberglass duct wrap with a vapor barrier facing of foil reinforced kraft. Seal with reinforced aluminum tape. Flexible connections on exterior shall be protected from weather with sheetmetal cover which shall be coated for protection same as ductwork.

K. Flexible duct runouts: Permitted only to provide final ceiling grille placement with length not to exceed 3'0". Flexible duct shall not be used to replace elbow at ceiling grille. Flexible ductwork shall have a trilaminate of aluminum foil, fiberglass and aluminized polyester inner liner which is mechanically locked without adhesives, a thick insulation blanket and a fire retardant reinforced aluminum outer jacket, as manufactured by Flexmaster Type 5M.

L. Splitter dampers: Splitter dampers shall be furnished and installed at certain branches from main ducts and at certain elbow takeoffs to air outlets, where specifically shown on the Drawings.

M. Damper adjusting devices: Each splitter or volume extractor, unless specified for automatic operation shall be fitted with an adjusting device having a locking mechanism of all galvanized construction.

N. Metal ductwork shall not be installed until building roof is in place and interior is in the dry. Failure to comply will result in replacement of ductwork at no additional cost to Owner.

O. All ductwork penetrations thru masonry walls shall be sleeved, including cans at sidewall supply and return grilles. Penetrations thru fire rated walls shall be sleeved and dampered in accordance with NFPA 90A and UL555. All fire dampers shall be accessible thru duct mounted access doors. Grille and duct size shall be verified prior to sleeve size selection to allow clearance for duct, insulation and grille neck.

3.1.2 Duct insulation:

3.1.2.1 Application:

A. Method 1: All ducts requiring insulation liner shall be lined by cutting pieces to fit snugly against the interior duct surfaces. The liner shall be fastened to the duct with a heavy coat of quick tacking rubber based adhesive spread over the entire duct surface. The top and bottom pieces are to lap the side piece and all exposed edges of the insulation at the duct ends shall be coated with adhesives. The heavy density surface shall face the air stream. The strength of Ultra-liner fiber assures positive attachment to adhesive and will not shear.

B. Method 2: All ducts requiring insulation liner shall be lined by carefully adhering to the liner in a continuous piece to clean flat metal sheets with a quick-tacking rubber based adhesive and forming the liner with the metal through the brake. The smooth heavy density surface shall face the air stream.

C. Method 3: All ducts over 24" in width or breadth shall be lined in accordance with Method 1 or Method 2 and in addition, the liner shall be secured with sheet metal screws and washers, or stud welded pins and clips.

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D. All transfer ducts shall be in a "U" configuration and fully insulated with grilles located on both ends of the duct.

3.1.3 Penetration Wall/Floor Firestop:

3.1.3.1 All fire walls, fire barriers, fire partitions, and upper floors (multi-story building) where pipes or ducts pass through, into or out of shall be protected by an approved penetration firestop system installed as tested in accordance with ASTM E 814, with a minimum positive pressure differential of 0.01 inch of water and shall have an F rating of not less that the required fire-resistance rating of the assembly penetrated.

3.1.3.2 A UL approved firestop system shall be as specified by 3M Fire Protection Products, SpecSeal Firestop Products, or approved equal.

3.1.3.3 Fireproofing material and method shall be submitted to the Architect for approval.

3.1.3.4 Ductwork penetrations shall be protected with manufactured fire damper assembly installed in accordance with manufacturer's installation instructions.

3.1.4 Balancing and adjusting:

A. Testing, adjusting and balancing (TAB) of the heating, ventilating and air conditioning system will be performed by an impartial National Environmental Balancing Bureau NEBB firm whose operations are limited to the field of professional TAB.

B. The firm shall have operated a minimum of one year under its current firm name.

C. The firm shall be capable of performing the service specified at the location of the facility described within the time specified, of preparing and submitting the detailed report of the actual field work performed, and following up the basic work as may be required.

D. All air quantities shall, after completion of the job, be adjusted to provide air quantities shown on plans. After complete adjustment, additional readjustment shall be performed if necessary to satisfy desired temperature.

E. The balance procedure shall include the checking of each supply, return, outside air, 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.

F. After all adjustments and corrections have been performed to balance 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.

G. 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.

H. Prior to balancing, verify that filters have been recently replaced (if not, contact mechanical contractor for replacement). Packaged wall units have 1" filter grille as well as 2" filter inside unit.

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I. Packaged air conditioning system shall be balanced to provide performance specified. Amount of fresh air shall be noted based on minimum/maximum CO^2 level. (Refer to outside air schedule and sequence of operation.) Provide minimum of three (3) readings at different levels of CO^2.

J. Check all systems for noise and vibration which may be objectionable.

K. When Contractor is satisfied that all systems may be acceptable to the design engineer, the Contractor shall call for an inspection.

L. Systems shall not be accepted until properly balanced.

M. Air balance of each system shall be performed with air device dampers in full open position. Air adjustment shall be made at manual damper on runout duct.

N. THE TAB REPORT

1. All measurements and recorded readings (of all water, electricity, etc. that appear in the reports must be done on-site by the permanently employed technician or engineers of the firm.
2. The report shall be certified and approved by the NEBB certified personnel for the firm. The report shall provided in triplicate.
3. The TAB report shall include the following as a minimum:
    a. Preface: A general discussion of the system with an outline of normal and ventilation cycles of operation.
    b. Pitot Tube Traverses: All exhaust ducts and main supply ducts, and return ducts will have air velocity and volume measured and recorded by the traverse method. Locations of these traverse test stations will be described on the sheet containing the data.
    c. Temperature Tabulation: Of all conditioned spaces on a room-by-room basis. Record outside ambient temperature at two hour intervals. The total variation in conditioned space temperatures shall not exceed two degrees variance from the thermostat settings.
    d. Air Volumes and Velocities: As measured at each supply grille, return air grille, and exhaust air grille or air handling device, it shall be the obligation of the Division 23 Contractor to furnish or revise fan drive and/or motors if necessary, without cost to the Owner, to obtain the specified air volumes.
    e. Static Pressure Drops: As measured across each supply fan, cooling coil, heating coil, return air fan, air handling unit filter and exhaust fan.
    f. Electrical Current/Voltage: Measurements to be taken at the drive motor on each piece of equipment.
    g. Fan Speeds: To be measured in RPM.
    h. Instrumentation List: A list of instruments by type and make used in gathering the TAB data.
    i. Packaged air conditioning system with outside air economizer shall be balanced to provide performance specified. Amount of fresh air shall be noted based on minimum/maximum CO^2 level. (Refer to outside air schedule and sequence of operation.) Provide minimum of three (3) readings at different levels of CO^2.

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j. Packaged Air Conditioning system with Dehumidification System (hot gas reheat) shall be tested for proper operation. Adjust space temperature sensor to deactivate cooling cycle and lower Relative Humidty Sensor setting as required to activate Dehumidifation Cycle. Document Supply Air temperature and space Relative Humidity decrease.

k. Drawings:
   1) Mark a set of drawings to have the duct systems and supply air openings numbered and/or lettered to correspond to the numbers and letters used on the report.
   2) If room numbers actually used in the building differ from those on the plans, the final building room numbers shall be marked on the plans.

Only one such marked up set of drawings need to be provided with the two copies of the TAB report.

3.1.5 Grilles and registers:

3.1.5.1 Contractor shall refer to reflected ceiling plan for exact location of ceiling grilles and shall verify with Architect the exact location of all wall mounted registers and grilles.

3.1.5.2 Contractor shall thoroughly clean all grilles and registers prior to final inspection, and touch up all chipped or scratched units. Equipment with rust evident will be completely removed from job site and replaced with new equipment.

3.1.5.3 Contractor shall paint the duct and/or insulation flat black behind the face of the grilles.

3.1.6 Filters:

3.1.6.1 Provide filters for all air conditioning systems and permanent medium retainers and frames with access doors as required for easy access.

A. Units must not be operated temporarily without filters. When the job is accepted, all used filters shall be replaced with clean, unused filters.

B. Provide one (1) extra set of filters for each unit which does not have permanent filters to the Owner.

C. Permanent filters shall not be used during construction.

D. Provide temporary filter media over return air grilles during construction. If excessive dirt and dust is allowed to enter system as determined by the job inspector, the Contractor shall be responsible for cleaning ductwork, plenum and coils.

3.2 REFRIGERANT PIPING TESTING

3.2.1 Testing shall be done during progress of work or at completion to insure tight seams. Soap Test R-22 hot gas at 235 psi and liquid and suction lines at 300 PSI; R-500 liquid and suction lines at 245 PSI. Allow system to stand for 24 hours under pressure and, if no change in pressure, system may be considered tight.

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3.2.2 Testing shall be done during progress of work or at completion to insure tight seams. Soap Test R-410A Suction and Liquid lines at 535 PSIG; R-407C Suction and Liquid lines at 380 PSIG. Allow system to stand for 24 hours under pressure and, if no change in pressure, system may be considered tight.

3.2.3 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.

3.3 GUARANTEE

3.3.1 This Contractor shall furnish a written certificate, guaranteeing all materials, equipment, and labor furnished by him to be free of all defects for a period of one (1) year from and after, the date of final acceptance of the work by the Owner, and this Contractor shall further guarantee that if any defects appear within the stipulated guaranty period, such work shall be replaced without charge.

3.3.2 This guarantee shall be extended to include the capacity and integrated performance of the component parts of the various systems, in strict accordance with the true intent and purpose of the specifications. The Contractor shall conduct such tests as are herein before specified, or as may be required by the Architect, to demonstrate the capacity and performance ability of the various systems and their component parts.

END OF SECTION

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Section 23 09 23

DIRECT DIGITAL CONTROL
SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes control equipment and installation for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-furnished controls.

B. The control system shall be extension of the existing Siemens Building Automation System and all controllers and software shall match existing or be the latest version of existing.

C. See "Sequences of Operation" in construction documents for requirements that relate to this Section.

2.1 RELATED DOCUMENTS

A. Drawings and Specification Sections of the Contract, including General and Supplementary Conditions, apply to this Section.
1. Division 01 – General and Special Requirements
2. Division01 – Submittal Requirements
3. Division01 – Materials and Equipment
4. Division23 – Common Work Results for HVAC
5. Division 23 – Variable Frequency Drives
6. Division 23 – Sequences of Operation
7. Division23 – Testing, Adjusting, and Balancing for HVAC
8. Division26 – General Electrical Provisions for Electrical Work
9. Division26 – Common Work Results for Electrical
10. Division26 – Low Voltage Electrical Power Conductors and Cables
11. Division26 – Hangers and Supports for Electrical Systems
12. Division26 – Raceway and Boxes for Electrical Systems
13. Division26 – Identification for Electrical Systems
14. Division 26 – Wiring Devices

3.1 ABBREVIATIONS

A. AAC: Advanced Application Controller

B. AHU: Air Handling Unit.

C. ALN: Automation Level Network

D. ASC: Application Specific Controller

E. ASHRAE: American Society of Heating Refrigerating and Air-Conditioning Engineers

F. BAS: Building Automation System

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G. BC: Building Controller

H. BIBB: BACnet Interoperability Building Blocks

I. BIM: Building Information Modeling

J. BMS: Building Management System.

K. CFM: Cubic Feet per Minute.

L. DCIM: Data Center Infrastructure Management

M. DCV: Demand Controlled Ventilation

N. DDC: Direct digital controls

O. EIA: Electronics Industries Alliance

P. EMI: Electro-Magnetic Interference

Q. EP: Electric-to-Pneumatic

R. EPMS: Electrical Power Monitoring System

S. FAS: Fire Alarm System.

T. FLN: Floor Level Network

U. FCU: Fan Coil Unit

V. HMI: Human Machine Interface

W. HVAC: Heating, Ventilating and Air Conditioning.

X. IEEE: Institute of Electrical and Electronic Engineers

Y. I/O: Input/Output

Z. IP: Internet Protocol

AA. IT: Information Technology

BB. LAN: Local area network.

CC. LCD: Liquid Crystal Display

DD. LED: Light Emitting Diode

EE. MER: Mechanical Equipment Room.

FF. MLN: Management Level Network

GG. MS/TP: Master-slave/token-passing.

HH. NEMA: National Electric Manufacturers' Association

II. NFPA: National Fire Protection Association

JJ. OEM: Operator Equipment Manufacturer

KK. PC: Personal Computer

LL. PICS: Protocol Implementation Conformance Statement

MM. PID: Proportional Integral Derivative.

NN. POT: Portable Operators Terminal.

OO. RAM: Random Access Memory

PP. RFI: Radio Frequency Interference

QQ. RTD: Resistance Temperature Device

RR. SNMP: Simple Network Management Protocol

SS. TAB: Testing and Balancing

TT. TCP: Transfer Control Protocol

UU. UDP: User Datagram Protocol

VV. UL: Underwriters Laboratories

WW. UPS: Uninterruptable Power Supply

XX. VAV: Variable Air Volume

YY. VFD: Variable Frequency Drive.

ZZ. WAN: Wide Area Network.

4.1 DEFINITIONS

A. BACnet: An industry standard data communication protocol for Building Automation and Control Networks. Refer to the latest version of AHSRAE standard 135.

B. Scope Terminology
1. Provide = Furnish equipment, engineer, program and install
2. Furnish = Furnish equipment, engineer and program
3. Mount = securely fasten or pipe
4. Install = mount and wire
5. Wire = wire only

5.1 WORK INCLUDED

A. The BAS Contractor shall provide a complete and operational system that will perform the sequences of operation as described herein.

B. Furnish a complete distributed direct digital control system in accordance with this specification section. This includes all system controllers, logic controllers, and all input/output devices. Items of work included are as follows:
   1. Provide a submittal that meets the requirements below for approval.
   2. Coordinate installation schedule with the mechanical contractor and general contractor.
   3. Provide installation of all panels and devices unless otherwise stated.
   4. Provide power for panels and control devices unless otherwise stated.
   5. Provide all low voltage control wiring for the DDC system.
   6. Provide miscellaneous control wiring for HVAC and related systems regardless of voltage.
   7. Provide engineering and technician labor to program and commission software for each system and operator interface. Submit commissioning reports for approval.
   8. Provide testing, demonstration and training as specified below.

C. The installation of the control system shall be performed under the direct supervision of the controls manufacturer with the shop drawings, flow diagrams, bill of materials, component designation, or identification number and sequence of operation all bearing the name of the manufacturer.

6.1 SUBMITTALS

A. Provide submittals for fast track items that need to be approved and released to meet the schedule of the project. Provide submittals for the following items separately upon request:
   1. Valve schedule and product data
   2. Damper schedule and product data
   3. Mounting and wiring diagrams for factory-installed control components
   4. Thermostat locations

B. Provide a complete submittal with all controls system information for approval before construction starts. Include the following:
   1. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
   2. Wiring Diagrams: Power, signal, and control wiring. Detail the wiring of the control devices and the panels. Show point-to-point wiring from field devices to the control panel. Show point-to-point wiring of hardwired interlocks. Show a ladder diagram or schematic of wiring internal to the panels, including numbered terminals. Clearly designate wiring that is done at a factory, at a panel shop or in the field.
   3. Details of control panel faces, including sizes, controls, instruments, and labeling.
   4. Schedule of dampers and actuators including size, leakage, and flow characteristics. If dampers are furnished by other, submit a damper actuator schedule coordinating actuator sizes with the damper schedule.
   5. Schedule of valves including leakage and flow characteristics.
   6. Written description of the Sequence of Operations.
   7. Network riser diagram showing wiring types, network protocols, locations of floor penetrations and number of control panels. Label control panels with network addresses and BACnet device instance numbers. Show all routers, switches, hubs and repeaters.

8. Point list for each system controller including both inputs and outputs (I/O), point numbers, controlled device associated with each I/O point, and location of I/O device.
9. Starter and variable frequency drive wiring details of all automatically controlled motors.
10. Reduced size floor plan drawings showing locations of control panels, thermostats and any devices mounted in occupied space.
11. Product Data: Include manufacturer's technical literature for each control device indicated, labeled with setting or adjustable range of control. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated. Submit a write-up of the application software that will be used on the operator workstation including revision level, functionality and software applications required to meet the specifications.
12. Submit BACnet Protocol Implementation Conformance Statements (PICS) for all direct digital controllers, software and other system components that will communicate on the BAS utilizing BACnet.

C. Submit a description of the application software that will be used on the operator workstation including revision level, functionality and software applications required to meet the specifications.

D. Submit blank field check-out and commissioning test reports, customized for each panel or system, which will be filled out by the technician during start-up.

E. Variance letter: Submit a letter detailing each item in the submission that varies from the contract specification or sequence of operation in any way.

F. After the BAS system is approved for construction, submit sample operator workstation graphics for typical systems for approval. Print and submit the graphics that the operator will use to view the systems, change setpoints, modify parameters and issue manual commands. Programming shall not commence until typical graphics are approved.

G. Operation and Maintenance Data: In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
1. Product data with installation details, maintenance instructions and lists of spare parts for each type of control device.
2. Keyboard illustrations and step-by-step procedures indexed for each operator function.
3. Inspection period, cleaning methods, cleaning materials recommended and calibration tolerances.
4. Calibration records and list of set points.

7.1 PROJECT RECORD DOCUMENTS

A. Project Record Documents: Submit three (3) copies of record (as-built) documents upon completion of installation. Submittal shall consist of:
1. Project Record Drawings. As-built versions of the submittal shop drawings provided as AutoCAD compatible files in electronic format and as 11 x 17 inch prints.
2. Testing and Commissioning Reports and Checklists. Completed versions of reports, checklists, and trend logs used to meet requirements in the Control System Demonstration and Acceptance section of this specification.
3. Operation and Maintenance (O & M) Manual.
   a. As-built versions of the submittal product data.

b. Names, addresses, and 24-hour telephone numbers of installing contractors and service representatives for equipment and control systems.
c. Operator's Manual with procedures for operating control systems, logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.
d. Programming manual or set of manuals with description of programming language and of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
e. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.
f. Documentation of all programs created using custom programming language, including setpoints, tuning parameters, and object database.
g. Graphic files, programs, and database on electronic media.
h. List of recommended spare parts with part numbers and suppliers.
i. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware, including computer equipment and sensors.
j. Complete original original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
k. Licenses, guarantees, and warranty documents for equipment and systems.

B. Operating manual to serve as training and reference manual for all aspects of day-to-day operation of the system. As a minimum include the following:
1. Sequence of operation for automatic and manual operating modes for all building systems. The sequences shall cross-reference the system point names.
2. Description of manual override operation of all control points in system.
3. BMS system manufacturers complete operating manuals.

C. Provide maintenance manual to serve as training and reference manual for all aspects of day-to-day maintenance and major system repairs. As a minimum include the following:
1. Complete as-built installation drawings for each building system.
2. Overall system electrical power supply schematic indicating source of electrical power for each system component. Indicate all battery backup provisions.
3. Photographs and/or drawings showing installation details and locations of equipment.
4. Routine preventive maintenance procedures, corrective diagnostics troubleshooting procedures, and calibration procedures.
5. Parts list with manufacturer's catalog numbers and ordering information.
6. Lists of ordinary and special tools, operating materials supplies and test equipment recommended for operation and servicing.
7. Manufacturer's operation, set-up, maintenance and catalog literature for each piece of equipment.
8. Maintenance and repair instructions.
9. Recommended spare parts.

D. Provide Programming Manual to serve as training and reference manual for all aspects of system programming. As a minimum include the following:
1. Complete programming manuals, and reference guides.
2. Details of any custom software packages and compilers supplied with system.
3. Information and access required for independent programming of system.

8.1 QUALITY ASSURANCE

A. Codes
1. Perform all wiring in accordance with Division 26, NEC, local codes and Owner's requirements.
2. 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.
3. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."
4. Comply with ASHRAE 135-2010 BACnet: A Data Communication Protocol for Building Automation and Control Networks.
5. Comply with ASHRAE 90.1-2007 Energy Standard for Buildings Except Low-Rise Residential Buildings.
6. All equipment shall be UL listed and approved and shall meet with all applicable NFPA standards, including UL 916 - PAZX Energy Management Systems,
   a. Provide written approvals and certifications after installation has been completed.
7. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.
8. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing) and ISO-140001 (The application of well-accepted business management principles to the environment). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.

B. Qualifications
1. Installing contractor shall be in the business of installing and servicing DDC controls for mechanical systems, temperature and ventilation control, environmental control, lighting control, access and security, life safety and energy management as their primary business.
2. 1Installer Qualifications: An experienced installer who is the authorized representative of the automatic control system manufacturer for both installation and maintenance of controls required for this Project.
3. 2Engineering, drafting, programming, and graphics generation shall be performed by the local branch engineers and technicians directly employed by the Building Automation System Contractor.
4. Supervision, checkout and commissioning of the system shall be by the local branch engineers and technicians directly employed by the Building Automation System Contractor. They shall perform commissioning and complete testing of the BAS system.

C. The BAS contractor shall maintain a service organization consisting of factory trained service personnel and provide a list of ten (10) projects, similar in size and scope to this project, completed within the last five years.

D. Final determination of compliance with these specifications shall rest solely with the Engineers and Owner who will require proof of prior satisfactory performance.

E. For any BAS system and equipment submitted for approval, the BAS contractor shall state what, if any, specific points of system operation differ from these specifications.

F. All portions of the system must be designed, furnished, installed, commissioned and serviced by manufacturer approved, factory trained employees.

G. The system shall have a documented history of compatibility by design for a minimum of 15 years. Future compatibility shall be supported for no less than 10 years. Compatibility shall be defined as the ability for any existing control system component including but not limited to building controllers, advanced application controllers, application specific, personal operator workstations and portable operator's terminals, to be connected and directly communicate with any new BAS system equipment without bridges, routers or protocol converters.

9.1 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to unit manufacturer.

B. Deliver, store, protect, and handle products to site under provisions of the contract Documents. Coordinate all site delivers with Construction project Manager.

C. Protect products from construction operations, dust, and debris, by storing materials inside, protected from weather in a conditioned space.

10.1 COORDINATION

A. Coordinate IP drops, network connections, user interfaces, firewall, etc with Owner's IT representative.

B. Coordinate location of thermostats, humidistats, panels, and other exposed control components with plans and room details before installation.

C. Coordinate equipment with Division 28 "Fire Alarm" to achieve compatibility with equipment that interfaces with that system.

D. Coordinate power for control units and operator workstation with electrical contractor.

E. Coordinate equipment with provider of starters and drives to achieve compatibility with motor starter control coils and VFD control wiring.

F. Coordinate scheduling with the mechanical contractor and general contractor. Submit a schedule for approval based upon the installation schedule of the mechanical equipment.

G. Coordinate installation of taps, valves, airflow stations, etc. with the mechanical contractor.

H. Products Furnished but Not Installed Under This Section
   1. Hydronic and Refrigerant Piping accessories:
      a. Control Valves
      b. Temperature Sensor Wells and Sockets
      c. Pressure Sensor Wells and Sockets
      d. Flow Switches
      e. Flow Meters
      f. Differential Pressure Transmitters
   2. Sheet metal accessories

a. Dampers
b. Airflow Stations
c. Terminal Unit Controls

I. Products Installed but Not Furnished Under This Section
1. Refrigeration Equipment:
a. Refrigerant Leak Detection System
b. Proof of flow pressure switches
2. Rooftop Air Handling Equipment:
a. Thermostats
b. Duct Static Pressure Sensors

J. Products Integrated To but Not Furnished or Installed Under This Section

11.1 WARRANTY

A. Provide warranty per Division 20 Section "General Mechanical Requirements" and as supplemented in this section.

B. Warranty shall cover all costs for parts, labor, associated travel, and expenses for a period of 12 months from completion of system demonstration.

C. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours.

D. During normal building occupied hours, failure of items that are critical for system operation shall be provided within 4 hours of notification from the Owner's Representative.

E. This warranty shall apply equally to both hardware and software.

PART 2 - PRODUCTS

1.1 SYSTEM DESCRIPTION

A. The Building Automation System (BAS) contractor shall furnish and install a networked system of HVAC controls. The contractor shall incorporate direct digital control (DDC) for central plant equipment, building ventilation equipment, supplemental heating and cooling equipment, and terminal units.

B. The control system for this project shall be an extension of the Owner's existing Siemens Building Automation System and all controllers and software shall match existing or be latest version of existing.

C. Provide networking to new DDC equipment using industry accepted communication standards. System shall utilize BACnet communication according to ANSI/ASHRAE standard 135-2010 for interoperability with smart equipment, for the main IP communication trunk to the BAS Server and for peer-to-peer communication between DDC panels and devices. The system shall not be limited to only standard protocols, but shall also be able to integrate to a wide variety of third-party devices and applications via drivers and gateways.

D. Provide stand-alone price for full control system to bidding contractor.

E. The BAS shall be the Siemens APOGEE system as manufactured by Siemens Building Technologies.

2.1 BUILDING AUTOMATION SYSTEM NETWORK

A. All networked control products provided for this project shall be comprised of an industry standard open protocol internetwork. Communication involving control components (i.e. all types of controllers and operator interfaces) shall conform to ASHRAE 135-2010 BACnet standard. Networks and protocols proprietary to one company or distributed by one company are prohibited.

B. Access to system data shall not be restricted by the hardware configuration of the building management system. The hardware configuration of the BMS network shall be totally transparent to the user when accessing data or developing control programs.
   1. Software applications, features, and functionality, including administrative configurations, shall not be separated into several network control engines working together.

C. BAS Server shall be capable of simultaneous direct connection and communication with BACnet/IP, OPC and TCP/IP corporate level networks without the use of interposing devices.

D. Any break in Ethernet communication from the server to the controllers on the Primary Network shall result in a notification at the server.

E. Any break in Ethernet communication between the server and standard client workstations on the Primary Network shall result in a notification at each workstation.

F. The network architecture shall consist of three levels of networks:
   1. The Management Level Network (MLN) shall utilize BACnet/IP over Ethernet along with other standardized protocol, such as web services, html, JAVA, SOAP, XML, etc., to transmit data to non-BAS software applications and databases. The BAS Server and Operator Workstations shall reside on this level of the network architecture.
   2. The Automation Level Network (ALN) shall utilize BACnet/IP over Ethernet. It shall connect BACnet Building Controllers to the BAS Server and Operator Workstations. Controllers for central plant equipment and large infrastructure air handlers shall reside on the ALN backbone BACnet/IP network. The building's Ethernet LAN shall be utilized for the ALN backbone and all ALN devices shall be connected to the building's LAN. Coordinate IP drops with Owner.
   3. The Floor Level Network shall utilize BACnet/IP over Ethernet or BACnet MS/TP over RS-485 to connect all of the DDC-controlled terminal heating and cooling equipment on a floor or in a system that are controlled with BACnet Advanced Application Controllers or BACnet Application Specific Controllers. FLN devices are networked to a router that connects to the Automaton Level Network backbone.

G. Provide a router for each RS-485 subnetwork to connect them to the base building backbone level network. The router shall connect BACnet MS/TP subnetworks to BACnet over Ethernet. Routers shall be capable of handling all of the BACnet BIBBs that are listed for the controller that reside on the subnetwork.

H. The Building Level Controllers shall be able to support subnetwork protocols that may be needed depending on the type of equipment or application. Subnetworks shall be limited to :
   1. BACnet MS/TP
   2. Apogee FLN
   3. Modbus

I. BACnet MSTP Setup rules
   1. Addressing for the MSTP devices shall start at 00 and continue sequentially for the number of devices on the subnetwork.
   2. No gaps shall be allowed in the addresses.
   3. Set the MaxMaster property to the highest address of the connected device.
   4. MaxMaster property shall be adjusted when devices are added to the subnetwork.

J. Provide all communication media, connectors, repeaters, bridges, switches, and routers necessary for the internetwork.

K. Controllers and software shall be BTL listed at the time of installation.

L. The system shall meet peer-to-peer communication services such that the values in any one BACnet Building Controller or BACnet Advanced Application Controller can be read or changed from all other controllers without the need for intermediary devices. The software shall provide transparent transfer of all data, control programs, schedules, trends, and alarms from any one controller through the internetwork to any other controller, regardless of subnetwork routers.

M. Systems that use variations of BACnet using Point-to-Point (PTP) between controllers, gateways, bridges or networks that are not peer-to-peer are not allowed.

N. Remote Communications: Provide a TCP/IP compatible communication port for connection to the Owner's network for remote communications. Provide coordination with the Owner for addressing and router configuration on both ends of the remote network.

O. The system shall be installed with a 10% spare capacity on each subnetwork for the addition of future controllers.

P. On each floor, wing or major mechanical room provide an Ethernet RJ45 connection that allows connection to the BACnet network. An open port shall always be available and shall not require any part of the network to be disconnected. The location shall be accessible to the base building personnel and not in a location where the tenant can restrict the access.

Q. Distributed Control Requirements:
   1. The loss of any one DDC controller shall not affect the operation of other HVAC systems, only for the points connected to the DDC controller.
   2. The system shall be scalable in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, DDC Controllers, and operator devices.
   3. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each DDC Controller shall operate independently by performing its own specified control, alarm management, operator I/O, and data collection. The failure of any single component or network connection shall not interrupt

the execution of any control strategy, reporting, alarming and trending function, or any function at any operator interface device.

4. DDC Controllers shall be able to access any data from, or send control commands and alarm reports directly to, any other DDC Controller on the network without dependence upon a central processing device. DDC Controllers shall also be able to send alarms to multiple operator workstations without dependence upon a central or intermediate processing device.
5. Operators shall have the ability to make database changes at the central system server while operator workstations are on-line without disrupting other system operations.
6. The DDC control panel shall be mounted in the same mechanical room as the equipment being controlled, or an adjacent utility room.
7. Multiple systems can be programmed on the same controller as long as they are in the same room. Systems on separate floors shall have separate controllers.
8. VAV boxes subnetworks shall be connected to the AHU controller that feeds those boxes. If multiple subnetworks are needed, then the VAV shall be grouped into subnetworks in an orderly method, such as per floor, per wing, etc.
9. Remote sensors shall be wired to the control panel of the equipment it is controlling, not across the network.
10. Signals to remote motor control centers shall be hard wired to the control panel, not across the network.
11. Terminal units shall each have their own controller. Only exceptions are:
    a. Groups of reheat coils
    b. Groups of exhaust fans
    c. Groups of chilled beams serving same zone or several adjacent zones

3.1 BUILDING AUTOMATION SYSTEM SERVER HARDWARE

A. Provide a PC for the BAS Server database. Provide the latest model of the nominal speed, RAM and memory for a commercial office grade PC from a named brand manufacturer. Minimum requirements and accessories shall be:
    1. Processor: Intel Core i7 series or AMD equal
    2. 16GB RAM
    3. 1TB Hard disk space, 7200RPM
    4. Video Card with 2 GB RAM
    5. At least 2 USB Ports
    6. NIC Card
    7. 101 key enhanced keyboard, Mouse, power strip

B. Provide a wide screen, active matrix LCD, flat panel type monitor that supports a minimum display resolution of no less than 1920 × 1080 pixels, Energy Star compliant 32-bit color. The display shall have a minimum of 21-inch visible area in diagonal measurement. Separate controls shall be provided for color, contrasts and brightness. The screen shall be non-reflective.

C. Locate the BAS Server in a clean, secure, dry and temperature controlled environment

D. The server shall reside on the same BACnet/IP protocol network as the System Controllers.

E. Provide software licenses for interfacing to the BAS.

F. Load software, configure and setup for viewing the BAS system.

G. Provide with the PC an operating system, such as Windows 8.1 64-or Windows 2012 R2.

H. Software: Provide the following application software licenses, preloaded on the server for the Owner: MS Office Professional, Internet Explorer, Acrobat Reader, ACAD Viewer, Microsoft IIS server. Set up an icon on the desktop to take the Owner directly to the BAS system login page.

I. Provide a copy of the software (or all software's if there are multiple) used to program and download sequences to controllers.

J. Provide a backup of the all of the programs used in the system for storage by the Owner.

4.1 OPERATOR WORKSTATION HARDWARE

A. Provide a PC for a BAS operator workstation. Provide the latest model of the nominal speed, RAM and memory for a commercial office grade PC from a named brand manufacturer. Minimum requirements and accessories shall be:
1. Processor: Intel Core i7 series or AMD equal
2. 16GB RAM
3. 320 GB Hard disk space, 7200RPM
4. Video Card with 2 GB RAM
5. At least 2 USB Ports
6. NIC Card
7. 101 key enhanced keyboard, Mouse, power strip

B. Locate operator workstation as located on plans.

C. Provide a monitor of flat panel type and shall support a minimum display resolution of no less than 1920 x 1080 pixels. The display shall have a minimum of 21-inch visible area in diagonal measurement. Separate controls shall be provided for color, contrasts and brightness. The screen shall be non-reflective.

D. Locate the Operator Workstations in a clean, secure, dry and temperature controlled environment

E. Provide software licenses for interfacing to the BAS.

F. Load software, configure and setup for viewing the BAS system.

G. Provide the PC with an operating system, such as Windows 8.1 or other operating systems compatible with the BAS software.

H. Software: Provide the following application software licenses, preloaded on the client for the Owner: MS Office Professional, Internet Explorer, Acrobat Reader, CAD Viewer. Set up an icon on the desktop to take the Owner directly to the BAS system login page.

5.1 BACNET ADVANCED WORKSTATION SOFTWARE

A. Interface Description
1. The software shall provide, as a minimum, the following functionality:
a. Real-time graphical viewing and control of the BMS environment.

b. Reporting of both real-time and historical information.
c. Scheduling and override of building operations.
d. Collection and analysis of historical data.
e. Point database editing, storage and downloading of controller databases.
f. Configuration of and navigation through default and personalized hierarchical “tree” views that include workstation and control system objects.
g. Event reporting, routing, messaging, and acknowledgment.
h. Definition and construction of dynamic color graphic displays.
i. Online, context-sensitive help, including an index, glossary of terms, and the capability to search help via keyword or phrase.
j. On-screen access to User Documentation, via online help or PDF-format electronic file.
k. Automatic database backup at the operator interface for database changes initiated at Building Controllers.
l. Display dynamic trend data graphical plot.
    1) Must be able to run multiple plots simultaneously.
    2) Each plot must be capable of supporting 10 pts/plot minimum.
    3) Must be able to command points from selection on dynamic trend plots.
    4) Must be able to plot real-time data without prior configuration.
    5) Must be able to plot both real-time and historical trend data simultaneously.
m. Program editing
n. Transfer trend data to third-party spreadsheet software
o. Scheduling reports
p. Operator Activity Log

2. Operator interface software shall minimize operator training through the use of user-friendly and interactive graphical applications.
3. Users must be able to build multiple, separate, personalized hierarchical “tree” views that represent the workstation, control systems, geographical facility layouts, and mechanical equipment relationships.
4. 256-character point identification (names) must be supported to provide clearly descriptive identification.
5. On-line help must be available.
6. The user interface shall display relevant information for a selection in multiple panes of a single window without the need for opening multiple overlapping windows on the desktop
7. Provide a graphical user interface that shall minimize the use of keyboard through the use of a mouse or similar pointing device, with a "point and click" approach to menu selection and a “drag and drop” approach to inter-application navigation.
8. Software navigation shall be user friendly by utilizing “forward & back” capability between screens and embedded links to graphics, documents, drawings, trends, schedules, as well as external documents (.doc, .pdf, .xls, etc.) or web addresses that are related to any selected object.
9. Primary selection of objects in the operator interface software shall be available from user defined hierarchical Views, from graphics, or from events in an Event List.
10. Secondary selection of objects in the operator interface software shall be available from links to any objects or external documents related to the primary selection.
11. Links to information related to any selected objects shall be displayed in a consistent manner and automatically defined based on where an object is used in the system.
12. The operator workstation shall be capable of displaying web pages and common document formats (.doc, .xls, .pdf) within the operator workstation application.

13. The software shall provide a multi-tasking type environment that allows the user to run several applications simultaneously.
14. System database parameters shall be stored within an object-oriented database.
15. Standard Windows applications shall run simultaneously with the BMS software.
16. The operator shall be able to work in Microsoft Word, Excel, and other Windows based software packages, while concurrently annunciating on-line BMS alarms and monitoring information.
17. Provide automatic backup and restore of all Building Controller databases on the workstation hard disk.
18. System configuration, programming, editing, graphics generation shall be performed on-line from the operator workstation software.
19. User shall be able to edit point configuration of any configurable BACnet point that resides in a devices that supports external editing.
20. The software shall also allow the user to configure the alarm management strategy for each point.
21. Users shall have the ability to view the program(s) that is\are currently running in a Building Controller. The display shall mark the program lines with the following: disabled, comment, unresolved, and trace bits.

B. Certifications and Approvals
   1. BAS software shall have been tested against the following norms and standards:
      a. BACnet Revision 1.13, certified by BACnet Testing Laboratory as BACnet Advanced Workstation Software (BTL B-AWS)
      b. IT security compliant with the ISA-99/IEC 62443 Security Level: SL1
      c. OPC DA V2.05a and V3.0 Server, certified by the OPC Foundation certification program
      d. UL-listed to UL864 9th edition Standard for Control Units and Accessories (when installed on a UL-approved computer)

C. Client-Server Connectivity
   1. Client sessions must be allowed to run on the server and on other devices connected to the server via Intranet, Extranet, or Internet connections.
   2. Internet connections, ISP services, as well as necessary firewalls or proxy servers shall be provided by the owner as required to support remote access features.
   3. The following client options must be supported
      a. Installed Client.
         1) Software application installed from installation media on to the client machine.
         2) Installed client software must be configurable to allow it to run in a Closed Mode such that the BAS software can lock down the client machine and prevent users without permission from minimizing the application or running other Windows applications that might cover the BAS software interface.
         3) Communication between the server and Installed Clients must be monitored so that any break in communication between the server and an installed client results in notification at the Server and Installed Client machine
         4) Installed client machines communicate directly with the BAS server
      b. Web Client.
         1) Software that runs in a browser on the client machine as a Full Trust client application.
         2) Connected to the BAS software server via Microsoft IIS Server.

c. Windows App.
    1) Software application downloaded from the BAS server to run on the client machine like an installed application
    2) Application must be automatically updated whenever new apps are available at the server.
    3) Connected to the BAS software server via Microsoft IIS Server.

4. Each of the client options shall provide the same functionalities including operation and configuration capabilities.

D. Access Rights and User Privileges
1. Access to any client user session must be password protected.
2. Users shall be able to create local user accounts specific to the application software.
3. Users shall be able to link application user accounts to Active Directory user accounts for consistent management with domain user accounts.
4. Operator-specific password access protection shall be provided to allow the administrator/manager to limit users' workstation control, display and data base manipulation capabilities as deemed appropriate for each user, based upon an assigned user name and password.
5. Operator privileges shall follow the operator to any workstation logged onto.
6. The administrator or manager shall be able to further limit operator privileges based on which console an operator is logged on to.
7. The administrator or manager shall be able to grant discrete levels of access and privileges, per user, for each point, graphic, report, schedule, and BMS workstation application.

E. Activity Logging
1. The operator interface software shall maintain a log of the actions of each individual operator.
2. The software shall provide an application that allows querying based on object name, operator, action, or time range.
3. The software shall provide the ability to generate reports showing operator activity based on object name, operator, action, or time range.

F. Graphics Application
1. All graphics shall be available with the same look and functionality whether they are displayed at an installed client console or in a browser.
2. User shall be able to add/delete/modify system graphics for floor plan displays and system schematics for each piece of mechanical equipment (including, air handling units, chilled water systems, hot water boiler systems, and room level terminal units) from standard user interface without the need of any external or specialized tools.
3. The software shall include all necessary tools and procedures for the user to create their own graphics.
4. The software shall provide the user the ability to display real-time point values by animated motion or custom picture control visual representation.
5. The software shall provide animation that depicts movement of mechanical equipment, or air or fluid flow.
6. The software shall provide users the ability to depict various positions in relation to assigned point values or ranges.
7. The software shall provide the ability to add custom gauges and charts to graphic pages.

8. The software must include a library of at least 400 standard control application graphics and symbols for visualizing common mechanical systems, including fans, valves, motors, chillers, AHU systems, standard ductwork diagrams, piping, and laboratory symbols.
9. The Graphics application shall include a set of standard Terminal Equipment controller application-specific background graphic templates. Templates shall provide the automatic display of a selected Terminal Equipment controller's control values and parameters, without the need to create separate and individual graphic files for each controller.
10. The Graphics application shall be capable of automatically assigning the appropriate symbol for an object (point) selected to be displayed on the graphic based on what the object represents (fan, duct sensor, damper, etc.) when the object is placed on a graphic.
11. The Graphics application shall allow a user to manually override the automatically assigned symbol for an object when a different symbol is desired.
12. The user shall have the ability to add custom symbols to the symbol library.
13. The software shall permit the importing of AutoCAD or scanned pictures for use in graphics.
14. Graphics must be automatically associated to any points or system objects that are rendered on the graphic, so that selection of a system object will allow a user to simply navigate to any associated graphic, without the need for manual association.
15. The software must allow users to command points directly off graphics application.
16. Graphic display shall include the ability to depict real-time point values dynamically with text or animation.
17. Navigation through various graphic screens shall be optionally achieved through a hierarchical "tree" structure
18. Graphics viewing shall include dynamic pan zoom capabilities.
19. Graphics viewing shall include the ability to switch between multiple layers with different information on each layer.
20. Graphics shall include a decluttering capability that allows layers to be programmatically hidden and displayed based on zoom level.
21. Graphics shall be capable of displaying the status of points that have been overridden by a field HAND switch, for points that have been designed to provide a field HAND override capability.
22. The software must provide the ability to create dashboard views consisting of gauges and charts that graphically display system and/ or energy performance.

G. System Performance
1. Comply with the following performance requirements:
    a. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 5 seconds.
    b. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 5 seconds.
    c. Object Command: Reaction time of less than 5 seconds between operator command of a binary object and device reaction.
    d. Object Scan: Transmit change of state and change of analog values to control units or workstation within 5 seconds.
    e. Alarm Response Time: Annunciate alarm at workstation within 2 seconds. Multiple workstations must receive alarms within five seconds of each other.
    f. Program Execution Frequency: Programmable controllers shall execute DDC PI control loops, and scan and update process values and outputs at least once per second.
    g. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:

1) Water Temperature: Plus or minus 1 deg F.
2) Water Flow: Plus or minus 5 percent of full scale.
3) Water Pressure: Plus or minus 2 percent of full scale.
4) Space Temperature: Plus or minus 1 deg F.
5) Ducted Air Temperature: Plus or minus 1 deg F.
6) Outside Air Temperature: Plus or minus 2 deg F.
7) Dew Point Temperature: Plus or minus 3 deg F.
8) Temperature Differential: Plus or minus 0.25 deg F.
9) Relative Humidity: Plus or minus 2 percent.
10) Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
11) Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
12) Airflow (Terminal): Plus or minus 10 percent of full scale.
13) Air Pressure (Space): Plus or minus 0.01-inch wg.
14) Air Pressure (Ducts): Plus or minus 0.1-inch wg.
15) Carbon Monoxide: Plus or minus 5 percent of reading.
16) Carbon Dioxide: Plus or minus 50 ppm.
17) Electrical: Plus or minus 5 percent of reading.

H. Reports
1. The software must allow reports shall be executed on demand.
2. The software must allow reports shall be executed via pre-defined schedule.
3. As a minimum, the system shall allow the user to easily obtain the following types of reports:
   a. A general listing of all or selected points in the network
   b. A status report showing present value and alarm status
   c. List of all points currently in alarm
   d. List of all points currently in override status
   e. List of all disabled points
   f. System diagnostic reports including, list of Building panels on line and communicating, status of all Building terminal unit device points
   g. List of alarm strategy definitions
   h. List of Building Control panels
   i. Point totalization report
   j. Point Trend data listings
   k. Initial Values report
   l. User activity report
   m. Event history reports

I. Scheduling
1. The software shall provide a calendar type format for simplification of time and date scheduling and overrides of building operations.
2. The software shall support the definition of BACnet schedules that are defined at the workstation and are downloaded to Building Controller to ensure time equipment scheduling when PC is off-line, such that the operating software is not required to execute time scheduling. The software must provide the following capabilities for BACnet scheduling capabilities as a minimum:
   a. Fully support all BACnet Schedule, Calendar, and Command objects.
   b. Daily and Weekly schedules
   c. Ability to combine multiple points into a logical Command Groups for ease of scheduling (e.g., all Building 1 lights)
   d. Ability to schedule for a minimum of up to ten (10) years in advance.

3. The software shall support the definition of schedules that are configured and executed to run at the workstation, to support scheduling of workstation software activities and to support field systems that do not include internal scheduling mechanisms. The software must provide the following capabilities for BACnet scheduling capabilities as a minimum:
    a. Schedule predefined reports
    b. Schedule Trend collections
    c. Schedule automated system backups
    d. Schedule commands to be sent to field panels
    e. Daily and weekly schedules
    f. Setting up and executing Holiday schedules
    g. Ability to combine multiple points into a logical Command Groups for ease of scheduling (e.g., all Building 1 lights)
    h. Ability to schedule for a minimum of up to ten (10) years in advance.
4. The software shall support the definition of Apogee Equipment Schedules Objects that are defined at the workstation and are downloaded to Building Controller to ensure time equipment scheduling when PC is off-line, such that the operating software is not required to execute time scheduling The software must provide the following capabilities for BACnet scheduling capabilities as a minimum:
    a. Apogee equipment schedule Zones
    b. Apogee equipment schedule Events
    c. Configuration of Daily, Weekly, Monthly schedules
    d. Configuration of Replacement Days
5. The software shall provide the ability for users to override regular weekly schedules through menu selection, graphical mouse action or function key.
6. The software shall provide a timeline view, showing the results of any number of combined selected workstation and field panel controller schedules for an overview of facility operation.

J. Trending
1. Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time.
2. Any system point may be trended automatically at time-based intervals or change of value, both of which shall be user-definable.
3. Trend data shall be collected and stored on hard disk for future diagnostics and reporting.
4. Automatic Trend collection may be scheduled at regular intervals through the same scheduling interface as used for scheduling of equipment.
5. System shall support trending in the same device as the monitor point or in an external device.
6. The software must support configuration of panels that have a trending level threshold, above which the data will be automatically uploaded to the BMS server to prevent overwriting the data in the field panel. The trending level will be user defined in % of available space (e.g., automatically upload when the trend buffer is at 75% of allocated space).
7. Trend data reports shall be provided to allow the user to view all trended point data.
8. Trend data reports may be customized to include individual points or predefined groups of selected points.
9. The software shall allow the user to view real-time trend data on trend graphical plot displays.
    a. A minimum of ten points may be plotted
    b. A combination of real-time and historical data may be plotted
    c. Dynamic graphs shall continuously update point values

d. At any time the user may redefine sampling times or range scales for any point
e. The user may pause the display and take "snapshots" of plot screens to be stored on the workstation disk for future recall and analysis
f. Exact point values may be viewed on the Trend plot
g. Trend graphs may be printed
h. Operator shall be able to command points by selecting them on the trend plot. Operator shall be able to zoom in on a specific time range within a plot.
i. The Trend Viewer must allow users to configure separate left and right axis for easier differentiation of point values.
j. The Trend Viewer must allow users to display historical data for the same group of points at different times simultaneously for easy comparison of system behavior over time.

K. Event Management
1. Event Notification shall be presented to each workstation in a tabular format application, and shall include the following information for each event: name, value, event time and date, event status, priority, acknowledgement information, and alarm count.
2. Only events for which the logged on user has privileges to view shall be displayed on each workstation.
3. The software shall provide the ability to users to limit the list of events displayed at each workstation (e.g. only show fire events at this workstation, no matter who is logged on)
4. Each event shall have the ability to sound an audible notification based on the category of the event.
5. Event List shall have the ability to list and sort the events based on event status, point name, ascending or descending activation time.
6. Directly from the Event List, the user shall have the ability to acknowledge, silence the event sound, print, or erase each event.
7. The interface shall provide the option to inhibit the erasing of active acknowledged events, until they have returned to normal status.
8. The user shall have the ability to navigate to all information related to a selected point in order to command, launch an associated graphic or trended graphical plot, or run a report on a selected point directly from the Event List.
9. Each event shall have a direct link from the Event List to further user-defined point informational data.
10. The user shall have the ability to also associate real-time electronic annotations or notes to each event.
11. Software shall provide the option to configure detailed operating procedures that guide a user through predetermined standard operating procedures for handling critical events. Users shall be able to log completion of each operating step as it is performed.

L. Remote Notification (RENO)
1. Workstations shall be configured to send out messages to numeric pagers, alphanumeric pagers, SMS (Simple Messaging Service, text messaging) Devices, and email accounts based on a point's alarm condition.
2. Email notification must support POP3, IMAP, and SMTP with SSL/TSL
3. Communication with external software must be encrypted.
4. There shall be no limit to the number of points that can be configured for remote notification of alarm conditions and no limit on the number of remote devices which can receive messages from the system.

5. On a per point basis, system shall be configurable to send messages to an individual or group and shall be configurable to send different messages to different remote devices based on alarm message priority level.
6. System must be configurable to send messages to an escalation list so that if the first device does not respond, the message is sent on to the next device after a configurable time has elapsed.
7. Workstation shall have the ability to send manual messages allowing an operator to type in a message to be sent immediately.
8. Workstation shall have a feature to send a heartbeat message to periodically notify users that they have communication with the system.

M. External Data Access
1. The software shall provide the ability to expose configuration properties and real-time values through CSV files, OPC DA, OPC UA, or REST-based Web Services.
2. The software shall provide the ability for external applications to change configuration and real-time values through OPC DA, OPC UA, or REST-based Web Services.
3. The software shall provide the ability for external applications to access historical Trend data through CSV files or REST-based Web Services.
4. External data access must be secured using the level of permissions configured for users and operator workstations.
5. Web service interfaces must allow for exchanging data (object's values, events and trend series) between workstation and external applications such as facility management systems, enterprise applications, mobile applications or other value-added services.
6. Documentation describing web services interfaces must be included to allow external developers to write applications that leverage the data exchange.

N. Licensing
1. Software licensing must be allowed to be bound to a dongle or to physical PC hardware.
2. User licenses from all client types shall be from a common pool of client licenses. Licenses for installed and browser-based clients shall not be in separate pools.
3. Provide the number of client licenses as called for here or in the Sequence of Operations.

O. Data Security
1. The BAS software must allow that all communication paths between clients and the server are encrypted and protected against replay attacks as well as data manipulation.
2. Any runtime data transfer between the system server and Web Server (IIS) must be allowed to be encrypted by Desigo CC.
3. Communication between any Web Server (IIS) and the Web Clients must be allowed to be encrypted.
4. Passwords must be handled with encrypted storage and transmission
5. The software must support the use of public domain algorithms for cryptographic functions, including AES, DiffieHellmann, RSA, and SHA-2. No self-coded algorithms shall be allowed.
6. All symmetrical encryption must use 256 bit AES or stronger.
7. All asymmetrical encryption must use 2048 bit or stronger.
8. The software must support the use of commercial certificates for securing client-server communications.
9. The software must support the use of self-signed certificates to allow local deployments without the overhead of obtaining commercial certificates.

10. When using self-signed certificates, the owner of the Desigo CC system is responsible for maintaining their validity status, and for manually adding them to and removing them from the list of trusted certificates.
11. The BAS software shall be compatible with the following Virus Scanners:
    a. Kaspersky
    b. Avira
    c. McAfee
    d. Bitdefender
    e. TrendMicro Office Scan

P. Virtualization
1. The BAS software must be compatible with following Virtualization software packages:
    a. VMware®:
        1) Virtualization platform: VSphere 6.0 or higher
        2) Fault-tolerant software: ESXi 6.0b managed by VCenter Server Appliance v6.0.0 or higher
    b. Stratus®:
        1) Virtualization platform: KVM for Linux CentOS v7.0 or higher
        2) Fault-tolerant software: everRun Enterprise 7.2 or higher
        3) Virtualization platform: Citrix XenServer 6.0.2 or higher
        4) Fault-tolerant software: everRun MX 6.2 or higher

Q. Subsystem Connectivity
1. The BAS application software must be capable of connecting simultaneously to multiple control systems and data sources.
2. Interface software shall simultaneously communicate with and share data between multiple Ethernet-connected building level networks.
3. The BAS application software must support the following standard protocols:
    a. BACnet IP (standard Revision 1.13)
    b. OPC (OLE for Process Control) OPC DA 2.05, 3.0
    c. Modbus TCP
    d. SNMP (Agent V1 and V2)
    e. Siemens Apogee P2
    f. Siemens XNET
4. Any break in system controller communication must result in a notification at the server.

R. BACnet
1. The Operator Workstation Software shall be capable of BACnet IP communications.
2. The Operator Workstation Software shall have demonstrated interoperability during at least one BTL Interoperability Workshop.
3. The Operator Workstation Software shall have demonstrated compliance to BTL B-AWS device classification through BTL listing as specified in ANSI/ASHRAE 135 under revision 1.13 or higher.
4. The BAS software shall meet the BACnet device profile of an Advanced Workstation Server (B-AWS) and Operator Workstation (B-OWS) and shall support the following BACnet BIBBs:
    a. Data Sharing
        1) DS-RP-A Data Sharing-ReadProperty-A
        2) DS-RP-B Data Sharing-ReadProperty-B
        3) DS-RPM-A Data Sharing-ReadPropertyMultiple-A
        4) DS-RPM-B Data Sharing-ReadPropertyMultiple-B

5) DS-WP-A Data Sharing-WriteProperty-A
6) DS-WP-B Data Sharing-WriteProperty-B
7) DS-WPM-A Data Sharing-WritePropertyMultiple-A
8) DS-COV-A Data Sharing-ChangeofValue-A
9) DS-COVP-A Data Sharing – ChangeofValueProperty-A
10) DS-V-A Data Sharing - View - A
11) DS-AV-A Data Sharing - Advanced View - A
12) DS-M-A Data Sharing - Modify - A
13) DS-AM-A Data Sharing - Advanced Modify - A

b. Scheduling
1) SCHED-VM-A Scheduling-View and Modify-A
2) SCHED-AVM-A Scheduling-Advanced View and Modify-A
3) SCHED-WS-A Scheduling-Weekly Schedule-A

c. Alarm and Event Management
1) AE-N-A Alarm and Event-Notification-A
2) AE-ACK-A Alarm and Event-ACK-A
3) AE-LS-A Alarm and Event-LifeSafety - A
4) AE-VM-A Alarm and Event Management - View and Modify - A
5) AE-AVM-A Alarm and Event Management - Advanced View and Modify - A
6) AE-VN-A Alarm and Event Management - View Notifications - A
7) AE-AVN-A Alarm and Event Management - Advanced View Notifications - A

d. Trending
1) T-V-A Trending-Viewing and Modifying Trends-A
2) T-ATR-A Trending-Automated Trend Retrieval-A
3) T-AVM-A Trending-Advanced View and Modify -A

e. Network Management
1) NM-CE-A Network Management-Connection Establishment-A

f. Device Management
1) DM-DDB-A Device Management-Dynamic Device Binding-A
2) DM-DDB-B Device Management-Dynamic Device Binding-B
3) DM-DOB-A Device Management-Dynamic Object Binding-A
4) DM-DOB-B Device Management-Dynamic Object Binding-B
5) DM-DCC-A Device Management-DeviceCommunicationControl-A
6) DM-TM-A Device Management-Text Message-A
7) DM-MTS-A Device Management-Manual Time Synchronization-A
8) DM-ATS-A Device Management-Automatic Time Synchronization-A
9) DM-TS-A Device Management-TimeSynchronization-A
10) DM-UTC-A Device Management-UTCTimeSynchronization-A
11) DM-RD-A Device Management-ReinitializeDevice-A
12) DM-BR-A Device Management-Backup and Restore-A
13) DM-LM-A Device Management-List Manipulation-A
14) DM-LM-B Device Management-List Manipulation-B
15) DM-OCD-A Device Management-Object Creation and Deletion-A
16) DM-ANM-A Device Management-Automatic Network Mapping-A
17) DM-ADM-A Device Management-Automatic Device Mapping-A

5. The BAS Server and Workstations shall support the following Data Link Layers:
a. BACnet IP Annex J
b. BACnet IP Annex J Foreign Device
c. ISO 8802-3, Ethernet (Clause 7)

6. The BAS Server and Workstations shall be able to interact with all of the BACnet objects in the controllers. In addition, the software shall be able to support the following objects as they relate to features in the workstation software:
    a. Calendar – Creatable, Deletable
    b. Command – Creatable, Deletable
    c. Event Enrollment – Creatable, Deletable
    d. Notification Class – Creatable, Deletable
    e. Schedule - Creatable, Deletable
7. The BAS Server and Workstations shall support transmitting and receiving segmented messages.
8. The BAS Server and Workstation shall have the capability to be the BACnet/IP Broadcast Management Device (BBMD) and support foreign devices.

6.1 DIRECT DIGITAL CONTROLLER SOFTWARE

A. Provide a full capability user license to the owner for the operator to be able to see, modify, create, upload, download and save control programs to the DDC controllers.

B. The software program shall be provided as an integral part of DDC Controllers and shall not be dependent upon any higher level computer or another controller for execution.

C. The software shall be provided with an interactive HELP function to assist operators with syntax, abbreviations, commands and saving programs.

D. Point naming and communication format:
1. All points, panels, and programs shall be identified by a 30-character name. All points shall also be identified by a 16-character point descriptor. The same names shall be displayed at both Building Controller and the Operator Interface.
2. All digital points shall have a consistent, user-defined, two-state status indication with 8 characters minimum (e.g., Summer, Enabled, Disabled, Abnormal).
3. The Building Controller Software shall be capable of BACnet communications. The BACnet Building Controller (B-BC) shall have demonstrated interoperability during at least one BTL Interoperability Workshop, have demonstrated compliance to BTL through BTL listing and shall substantially conform to BACnet Building Controller (B-BC) device profile as specified in ANSI/ASHRAE 135-2004, Annex L.

E. System Security
1. User access shall be secured using individual security passwords and user names.
2. Passwords shall restrict the user to the objects, applications, and system functions as assigned by the system manager.
3. Building Controllers shall be able to assign a minimum of 50 passwords access and control priorities to each point individually. The logon password (at any Operator Interface or portable operator terminal) shall enable the operator to monitor, adjust and control only the points that the operator is authorized for. All other points shall not be displayed at the Operator Interface or portable terminal. Passwords and priorities for every point shall be fully programmable and adjustable.
4. User Log On/Log Off attempts shall be recorded.
5. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user-definable.

6. Use of workstation resident security as the only means of access control is not an acceptable alternative to resident system security in the DDC controller software.

F. User Defined Control Applications: The applications software shall program DDC routines to meet the sequences of operations.
   1. Building Controllers shall have the ability to perform energy management routines including but not limited to time of day scheduling, calendar-based scheduling, holiday scheduling, temporary schedule overrides, start stop time optimization, automatic daylight savings time switch over, night setback control, enthalpy switch over, peak demand limiting, temperature-compensated duty cycling, heating/cooling interlock, supply temperature reset, priority load shedding, and power failure restart.
   2. The Building Controllers shall have the ability to perform the following pre tested control algorithms:
      a. Two position with differential control and time delays
      b. Floating control
      c. Proportional control
      d. Proportional plus integral control
      e. Proportional, integral, plus derivative control
      f. Automatic tuning of control loops
      g. Model-free adaptive control
      h. Start Stop Time Optimization
   3. Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
   4. Each controller shall support plain language text comment lines in the operating program to allow for quick troubleshooting, documentation, and historical summaries of program development.

G. Peer-to-peer access to other DDC controllers
   1. It shall be possible to use any actual or virtual point data or status, any system calculated data, a result from any process, or any user-defined constant in any controller in the system.
   2. Any process shall be able to issue commands to points in any and all other controllers in the system.
   3. Processes shall be able to generate operator messages and advisories to other operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of an advanced annunciation feature, such as:
      a. Generate a report
      b. Annunciate an alarm
      c. Issue a text message or email

H. Alarm Management
   1. Alarm management shall be provided within the controller software to monitor and direct alarm information to operator devices.
   2. Each Building Controller shall perform distributed, independent alarm analysis, minimize network traffic and prevent alarms from being lost. At no time shall the Building Controllers ability to report alarms be affected by either operator or activity at a PC workstation, local I/O device or communications with other panels on the network.
   3. Conditional alarming shall allow generation of alarms based upon user defined multiple criteria.
   4. An Alarm “shelving” feature shall be provided to disable alarms during testing. (Pull the Plug, etc.).

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5. Binary Alarms. Each binary alarm object shall be set to alarm based on the operator-specified state. Provide the capability to automatically and manually disable alarming.
6. Analog Alarms. Each analog alarm object shall have both high and low alarm limits. Alarming must be able to be automatically and manually disabled.
7. All alarm shall include the point's user-defined language description and the time and date of occurrence.
8. Alarm reports and messages shall be routed to user-defined list of operator workstations, or other devices based on time and other conditions. An alarm shall be able to start programs, print reports, be logged in the event log, generate custom messages, and display graphics.
9. The user shall be able to add a 200-character alarm message to each alarm point to more fully describe the alarm condition or direct operator response. Each Building Controller shall be capable of storing a library of at least 50 alarm messages. Each message may be assigned to any number of points in the Controller.
10. Operator-selected alarms shall be capable of initiating a trigger to an advanced annunciation, such as text, email, etc.
11. An alarm history log shall report the start of the alarm condition, acknowledgement by a user and return of the alarm to normal condition.

I. Scheduling:
1. Provide a comprehensive menu driven program to automatically start and stop designated multiple objects or events in the system according to a stored time.
2. Schedules shall reside in the building controller and shall not rely on external processing or network.
3. It shall be possible to define a group of objects as a custom event (i.e., meeting, athletic activity, etc.). Events can then be scheduled to operate all necessary equipment automatically.
4. For points assigned to one common load group, it shall be possible to assign variable time delays between each successive start and/or stop within that group.
5. The operator shall be able to define the following information:
    a. Time, day
    b. Commands such as on, off, auto, etc.
    c. Time delays between successive commands.
    d. There shall be provisions for manual overriding of each schedule by an authorized operator.
6. It shall be possible to schedule calendar-based events up to one year in advance based on the following:
    a. Weekly Schedule. Provide separate schedules for each day of the week. Each of these schedules should include the capability for start, stop, optimal start, optimal stop, and night economizer. When a group of objects are scheduled together as an Event, provide the capability to adjust the start and stop times for each member.
    b. Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed, it will be discarded and replaced by the standard schedule for that day of the week.

J. Peak Demand Limiting (PDL):
1. The Peak Demand Limiting (PDL) program shall limit the consumption of electricity to prevent electrical peak demand charges.

2. PDL shall continuously track the amount of electricity being consumed, by monitoring one or more electrical kilowatt-hour/demand meters. These meters may measure the electrical consumption (kWh), electrical demand (kW), or both.
3. PDL shall sample the meter data to continuously forecast the demand likely to be used during successive time intervals.
4. If the PDL forecasted demand indicates that electricity usage is likely to exceed a user preset maximum allowable level, then PDL shall automatically shed electrical loads.
5. Once the demand peak has passed, loads that have been shed shall be restored and returned to normal control.

K. Temperature-compensated duty cycling
1. User defined conditions shall be able to initiate a Duty Cycle Control Program.
2. The Duty Cycle Control Program (DCCP) shall be configured to periodically stop and start loads according to various patterns.
3. The loads shall be cycled such that there is a net reduction in both the electrical demands and the energy consumed.

L. Automatic Daylight Savings Time Switchover. The system shall provide automatic time adjustment for switching to/from Daylight Savings Time.

M. Night setback control. The system shall provide the ability to automatically adjust setpoints for night control.

N. Enthalpy switchover (economizer). The Building Controller Software (BCS) shall control the position of the air handler relief, return, and outside air dampers. If the outside air dry bulb temperature falls below changeover setpoint the BCS will modulate the dampers to provide 100 percent outside air. The user will be able to quickly change over to an economizer system based on dry bulb temperature and will be able to override the economizer cycle and return to minimum outside air operation at any time.

O. Control Loop Algorithm
1. Provide a PID (proportional-integral-derivative) closed-loop control algorithm with direct or reverse action and anti-windup. The algorithm shall calculate a time-varying analog value that is used to position an output or stage a series of outputs. The controlled variable, setpoint, and weighting parameters shall be accessible from the operator workstation.

P. Adaptive Loop Tuning
1. Building Controllers shall also provide high resolution sampling capability for verification of DDC control loop performance. Documented evidence of tuned control loop performance shall be provided on a monthly, seasonal, quarterly, annual period.
2. For Model-Free Adaptive Control loops, evidence of tuned control loop performance shall be provided via graphical plots or trended data logs. Graphical plots shall minimally include depictions of setpoint, process variable (output), and control variable (e.g., temperature). Other parameters that may influence loop control shall also be included in the plot (e.g., fan on/off, mixed-air temp).
3. For PID control loops, operator-initiated automatic and manual loop tuning algorithms shall be provided for all operator-selected PID control loops. Evidence of tuned control loop performance shall be provided via graphical plots or trended data logs for all loops.

a. In automatic mode, the controller shall perform a step response test with a minimum one-second resolution, evaluate the trend data, calculate the new PID gains and input these values into the selected LOOP statement.
b. Loop tuning shall be capable of being initiated either locally at the Building Controller, from a network workstation or remotely using dial-in modems. For all loop tuning functions, access shall be limited to authorized personnel through password protection.

Q. Logic programming: Provide a software routine that can build ladder logic to control using many conditional statements.
1. The logic programming syntax shall be able to combine ladder logic with other software features, such as combining status, scheduling, PDL and alarm conditions into one conditional decision.
2. Logic programming shall be able to reference conditions in any other controller in the system.

R. Staggered Start:
1. This application shall prevent all controlled equipment from simultaneously restarting after a power outage. The order in which equipment (or groups of equipment) is started, along with the time delay between starts, shall be user definable in an application and shall not require written scripts or ladder logic.
2. Upon the resumption of power, each Building Controller shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling and turn equipment on or off as necessary to resume normal operations.

S. Totalization Features:
1. Run-Time Totalization. Building Controllers shall automatically accumulate and store run-time hours for all digital input and output points. A high runtime alarm shall be assigned, if required, by the operator.
2. Consumption totalization. Building Controllers shall automatically sample, calculate and store consumption totals on a daily, weekly or monthly basis for all analog and digital pulse input type points.
3. Event totalization. Building Controllers shall have the ability to count events such as the number of times a pump or fan system is cycled on and off. Event totalization shall be performed on a daily, weekly or monthly basis for all points. The event totalization feature shall be able to store the records associated with events before reset.

T. Data Collection:
1. A variety of historical data collection utilities shall be provided to manually or automatically sample, store, and display system data for all points.
2. Building Controllers shall store point history data for selected analog and digital inputs and outputs:
3. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each Building Controllers point group.
4. Two methods of collection shall be allowed: either by up to four pre-defined time intervals or upon a pre-defined change of value. Sample intervals of l minute to 7 days shall be provided.
5. Each Building Controller shall have a dedicated RAM-based buffer for trend data and shall be capable of storing a minimum of 10,000 data samples.

6. Trend data shall be stored at the Building Controllers and uploaded to the workstation when retrieval is desired. Uploads shall occur based upon either user-defined interval, manual command or when the trend buffers are full. All trend data shall be available for use in third-party personal computer applications.

7.1 BACNET BUILDING CONTROLLERS

A. Provide all necessary hardware for a complete operating system as required. The Building Controller shall be able to operate as a standalone panel and shall not be dependent upon any higher level computer or another controller for operation.

B. Basis of design is Siemens PX Modular and Compact Controllers (PXC).

C. This controller shall have the BTL listing and meet the BACnet device profile of a Building Controller (B-BC) and shall support the following BACnet BIBBs:
   1. Data Sharing
      a. Data Sharing-Read Property-Initiate, Execute (DS-RP-A,B)
      b. Data Sharing-Read Property Multiple- Initiate, Execute (DS-RPM-A,B)
      c. Data Sharing-Write Property- Initiate, Execute (DS-WP-A,B)
      d. Data Sharing-Write Property Multiple- Execute (DS-WPM-B)
      e. Data Sharing-COV- Initiate, Execute (DS-COV-A,B)
      f. Data Sharing-COV-Unsolicited- Initiate, Execute (DS-COVU-A,B)
   2. Scheduling
      a. Scheduling-Internal- Execute (SCHED-I-B)
      b. Scheduling-External- Execute (SCHED-E-B)
   3. Trending
      a. Trending-Viewing and Modifying Trends - Initiate (T-VMT-A)
      b. Trending-Viewing and Modifying Trends Internal- Execute (T-VMT-I-B)
      c. Trending-Viewing and Modifying Trends-External- Execute (T-VMT-E-B)
      d. Trending-Automated Trend Retrieval- Execute (T-ATR-B)
   4. Network Management
      a. Network Management-Connection Establishment- Initiate (NM-CE-A)
   5. Alarming
      a. Alarm and Event-Notification- Initiate (AE-N-A)
      b. Alarm and Event-Notification Internal- Execute (AE-N-E-B)
      c. Alarm and Event-Notification External- Execute (AE-N-E-B)
      d. Alarm and Event-ACK- Initiate, Execute (AE-ACK-A,B)
      e. Alarm and Event –Alarm Summary- Execute (AE-ASUM-B)
      f. Alarm and Event –Enrollment Summary- Execute (AE-ESUM-A,B)
      g. Alarm and Event –Information- Initiate, Execute (AE-ESUM-A,B)
   6. Device Management
      a. Device Management-Dynamic Device Binding- Initiate, Execute (DM-DDB-A,B)
      b. Device Management-Dynamic Object Binding- Initiate, Execute (DM-DOB-A,B)
      c. Device Management-Device Communication Control- Execute (DM-DCC-B)
      d. Device Management-Private Transfer- Initiate, Execute (DM-PT-A,B)
      e. Device Management-Text Message- Initiate, Execute (DM-TM-A,B)
      f. Device Management-Time Synchronization- Execute (DM-TS-B)
      g. Device Management-Reinitialize Device- Execute (DM-RD-B)
      h. Device Management-Backup and Restore- Execute (DM-RD-B)
      i. Device Management-List Manipulation- Execute (DM-RD-B)
      j. Device Management-Object Creation and Deletion- Execute (DM-OCD-B)

7. The Building Level Controller shall support the following Data Link Layers:
    a. BACnet IP Annex J
    b. BACnet IP Annex J Foreign Device
    c. MS/TP Master (Claus 9)
8. The Building Level Controller shall be able to interact with all of the BACnet objects in the controllers. In addition, the software shall be able to support the following objects as they relate to features in the workstation software:
    a. Calendar – Creatable, Deletable
    b. Command – Creatable, Deletable
    c. Event Enrollment – Creatable, Deletable
    d. Notification Class – Creatable, Deletable
    e. Schedule - Creatable, Deletable
9. The Building Level Controller shall support transmitting and receiving segmented messages.
10. The Building Level Controller shall have the capability to be the BACnet/IP Broadcast Management Device (BBMD) and support foreign devices.
11. The Building Level Controller shall have the capability to act as a BACnet router between MS/TP subnetworks and BACnet/IP.

D. This level of controller shall be used for the following types of systems:
1. Chiller plant systems
2. Heating plant systems
3. Cooling Towers
4. Pumping systems
5. VAV air handlers
6. Air handlers over 15,000 cfm
7. Systems with over 24 input/output points
8. Rooftop systems

E. Computing power and memory minimum:
1. A 32-bit, stand-alone, multi-tasking, multi-user, real-time 100MHz digital control microprocessor module.
2. Inputs shall be 16-bit minimum analog-to-digital resolution
3. Outputs shall be 10-bit minimum digital-to-analog resolution
4. Memory module (24 Megabyte, minimum) to accommodate all Primary Control Panel software requirements, including but not limited to, its own operating system and databases (see Controllers Software section), including control processes, energy management applications, alarm management applications, historical/trend data for points specified, maintenance support applications, custom processes, operator I/O, dial-up communications.
5. Real time clock and battery
6. Data collection/ Data Trend module sized for 10,000 data samples.
7. Flash Memory Firmware: Each Building Level Control Panel shall support firmware upgrades without the need to replace hardware.

F. Onboard or Modular hardware and connections:
1. Primary Network communication module, if needed for primary network communications.
2. Secondary Network communication module, if needed for secondary network communications.
3. RJ45 port 10/100Mbaud

4. RS485 ports for subnetworks and point expansion
5. Man to Machine Interface port (MMI)
6. USB Port

G. Input and Output Points Hardware
1. Input/output point modules as required including spare capacity.
2. Input/output point modules shall have removable terminal blocks.
3. Monitoring of the status of all hand-off-auto switches.
4. Monitoring of all industry standard types of analog and digital inputs and outputs, without the addition of equipment to the primary control panel.
5. Local status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Each primary control panel shall perform diagnostics on all inputs and outputs and a failure of any input or output shall be indicated both locally and at the operator workstation.
6. Graduated intensity LEDs or analog indication of value for each analog output.

H. Code compliance
1. Approvals and standards: UL916; CE; FCC
2. Provide UL864-UUKL where called for in the sequences of operations.

I. Accessories:
1. Appropriate NEMA rated metal enclosure.
2. Power supplies as required for all associated modules, sensors, actuators, etc.

J. The operator shall have the ability to manually override automatic or centrally executed commands at the primary control panels via local, point discrete, on-board hand/off/auto operator override switches. If on board switches are not available, provide separate control panels with HOA switches. Mount panel adjacent to primary control panel. Provide hand/off/auto switch for each digital output, including spares.

K. Each Building Level Control Panel shall continuously perform self-diagnostics on all hardware modules and network communications. The System Level Control Panel shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication with any system.

L. Panel setup, point definitions and sequencing diagrams shall be backed up on EEPROM memory.

M. Power loss. In the event of the loss of power, there shall be an orderly shutdown of all Building Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 30 days.

N. Building Level control panels shall provide at least two serial data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals. Primary control panels shall allow temporary use of portable devices without interrupting the normal communications, operation of permanently connected modems, printers or terminals.

O. Building Level Controllers shall have the capability to serve as a gateway between Modus subnetworks and BACnet objects. Provide software, drives and programming.

P. Isolation shall be provided at all primary control panel terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standards 587-1980.

Q. Spare Capacity: Provide enough inputs and outputs to handle the equipment shown to be "future" on drawings and 10% more of each point type. Provide all hardware modules, software modules, processors, power supplies, communication controllers, etc. required to ensure adding a point to the spare point location only requires the addition of the appropriate sensor/actuator and field wiring/tubing.

R. Environment.
1. Controller hardware shall be suitable for the anticipated ambient conditions.
2. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at 0°C to 49°C (32°F to 120°F).
3. Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 49°C (32°F to 120°F).
4. Controller hardware shall be optionally suitable for rooftop environments.

S. Immunity to power and noise.
1. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage.
2. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).
3. Isolation shall be provided at all primary network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:
   a. RF-Conducted Immunity (RFCI) per ENV 50141 (IEC 1000-4-6) at 3V.
   b. Electro Static Discharge (ESD) Immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact.
   c. Electrical Fast Transient (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500V signal, 1 kV power.
   d. Output Circuit Transients per UL 864 (2,400V, 10A, 1.2 Joule max).
4. Isolation shall be provided at all Building Controller's AC input terminals to suppress induced voltage transients consistent with:
   a. IEEE Standard 587 1980
   b. UL 864 Supply Line Transients
   c. Voltage Sags, Surge, and Dropout per EN 61000-4-11 (EN 1000-4-11)

8.1 BACNET ADVANCED APPLICATION CONTROLLERS

A. Provide all necessary hardware for a complete operating system as required. The Advanced Application level control panel shall be able to operate as a standalone panel and shall not be dependent upon any higher level computer or another controller for operation.

B. Basis of design is Unitary Equipment Controller (PXCxx-UCM).

C. The Advanced Application Controller Software shall be capable of BACnet communications. The BACnet Advanced Application Controller (B-AAC) shall have demonstrated compliance to BTL through BTL listing and shall substantially conform to BACnet Advanced Application Controller (B-AAC) device profile as specified in ANSI/ASHRAE 135-2004 or ANSI/ASHRAE 135-2008. Supported BIBBS shall include:
1. Data Sharing
   a. Data Sharing-Read Property-Initiate, Execute (DS-RP-A,B)

b. Data Sharing-Read Property Multiple- Initiate, Execute (DS-RPM-A,B)
c. Data Sharing-Write Property- Initiate, Execute (DS-WP-A,B)
d. Data Sharing-Write Property Multiple- Execute (DS-WPM-B)
e. Data Sharing-COV- Initiate, Execute (DS-COV-A,B)

2. Scheduling
   a. Scheduling-Internal- Execute (SCHED-I-B)
3. Trending
   a. Trending-Viewing and Modifying Trends Internal- Execute (T-VMT-I-B)
   b. Trending-Automated Trend Retrieval- Execute (T-ATR-B)
4. Network Management
   a. Network Management-Connection Establishment- Initiate (NM-CE-A)
5. Alarming
   a. Alarm and Event-Notification Internal- Execute (AE-N-I-B)
   b. Alarm and Event-ACK- Initiate, Execute (AE-ACK-A,B)
   c. Alarm and Event –Enrollment Summary- Execute (AE-ESUM-B)
   d. Alarm and Event –Information- Execute (AE-INFO-B)
6. Device Management
   a. Device Management-Dynamic Device Binding- Initiate, Execute (DM-DDB-A,B)
   b. Device Management-Dynamic Object Binding- Initiate, Execute (DM-DOB-A,B)
   c. Device Management-Device Communication Control- Execute (DM-DCC-B)
   d. Device Management-Time Synchronization- Execute (DM-TS-B)
   e. Device Management-Reinitialize Device- Execute (DM-RD-B)
   f. Device Management-Backup and Restore- Execute (DM-BR-B)
   g. Device Management-List Manipulation- Execute (DM-LM-B)
   h. Device Management-Object Creation and Deletion- Execute (DM-OCD-B)
7. The Advanced Application Controller shall be able to interact with all of the BACnet objects in the controllers. In addition, the software shall be able to support the following objects as they relate to features in the workstation software:
   a. Calendar – Creatable, Deletable
   b. Command – Creatable, Deletable
   c. Event Enrollment – Creatable, Deletable
   d. Notification Class – Creatable, Deletable
   e. Schedule - Creatable, Deletable
8. The Advanced Application Controller shall support transmitting and receiving segmented messages.

D. Communication:
   1. BAS Network: The Advanced Application Controller shall support the following Data Link Layers:
      a. MS/TP Master
   2. Serial Communication: Temporary use of portable devices shall not interrupt the BAS communication, nor the normal operation of permanently connected printers or terminals.
      a. Provide at least one EIA-232C serial data communication port for operation of operator I/O devices such as industry standard printers, operator terminals, and portable laptop operator's terminals.
      b. A USB port shall alternatively be available to support local HMI tools connection.

E. Software
   1. The software programs specified in this section shall be provided as an integral part of Advanced Application Controllers and shall not be dependent upon any higher level computer or another controller for execution.

2. Advanced Application Controllers shall have the ability to perform energy management routines including but not limited to
    a. scheduling, calendar-based scheduling, holiday scheduling, temporary schedule overrides
    b. automatic daylight savings time switch over
    c. night setback control
    d. economizer switch over using enthalpy, dry bulb or a combination
    e. peak demand limiting,
    f. temperature-compensated duty cycling
    g. heating/cooling interlock
    h. supply temperature reset
    i. priority load shedding
    j. power failure restart
3. The software shall have a routine for automatic tuning of control loops
4. System Security in the Field Panel
    a. User access shall be secured using individual security passwords and user names.
    b. Passwords shall restrict the user to the objects, applications, and system functions as assigned by the system manager.
    c. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user-definable.
    d. Use of workstation resident security as the only means of access control is not an acceptable alternative to resident system security in the field panel.
5. User Defined Control Applications:
    a. Controllers shall be fully-programmable. Controllers shall execute custom, job-specific sequences to automatically perform calculations and special control routines. Factory installed or pre-configured sequences shall only be allowed if they exactly match the sequence specified herein.
    b. Programs shall combine control logic, control loop algorithms, and energy management routines
    c. Each controller shall support plain language text comment lines in the operating program to allow for quick troubleshooting, documentation, and historical summaries of program development.
    d. Controller shall provide a HELP function key, providing enhanced context sensitive on-line help with task oriented information from the user manual.

F. Adaptive Loop Control.
1. Each AAC controller shall come standard with an Adaptive Control Loop Algorithm
    a. Tuning parameter shall automatically adjust for non-linear applications
2. Model-Free Adaptive (MFA) algorithm
    a. The algorithm shall not require modeling of the non-linear system in order to maintain control at all points of the non-linear load.
    b. The controlled variable, setpoint, and weighting parameters shall be user-selectable.
3. Output shall be analog or shall stage a series of outputs.
4. Adaptive Control shall take the place of Proportional, Proportional + Integral, and PID type algorithms for non-linear applications. Adaptive Control routines shall :
    a. Improve response time
    b. Improve System efficiency
    c. Improve Stability
    d. Result in Consistent outputs
    e. Reduce cycling and repositioning
    f. Reduce wear and tear on actuators

5. Adaptive control shall auto-adjust to compensate for
    a. mode changes
    b. load changes
    c. seasonal changes
    d. Heating and cooling changeover
    e. Heating or cooling capacity changes on the primary side
    f. Flow changes on the primary or secondary side
    g. Airflow changes across coil
    h. Flow across a heat exchanger
6. Adaptive control shall auto-adjust to compensate for
    a. Non-linear coils and heat exchangers
    b. Hot water and chilled water reset routines
    c. Water flow reset routines
    d. Duct Static reset routines
7. Auto-Tune PID loops are not acceptable substitutions.
8. If Adaptive Loop Control is not available, then the BAS contractor shall provide re-tuning of the control loops for coils and heat exchangers for each of the following conditions:
    a. Low heating supply water, high heating supply water
    b. Low load on steam coil, high load on steam coil
    c. Chilled water coil, non dehumidification and condensing
    d. Chilled water coil, low airflow, high airflow, economizer
    e. Dual temperature systems tune for heating and cooling modes
    f. Each of 4 seasons

G. This level of controller shall be used for the following types of systems:
1. Systems with custom sequences that meet all of the criteria below:
2. No primary pumping systems
3. Secondary Pumping systems that are remote from Central Plants
4. Air handlers up to 15,000 cfm
5. Systems up to 20 input/output points
6. Room control sequences that cannot be achieved with an application specific controller
7. BAS Network or Architecture or Sequences do not require the system to be on an IP network
8. No systems that require integration to meters, VFDs or other smart equipment
9. Integration to smart thermostats is allowed

H. Input/Outputs
1. Inputs shall be 16-bit minimum digital resolution
2. Outputs shall be 10-bit minimum digital resolution
3. The following I/O port types shall be available on the controller
    a. Universal Input (software configurable):
        1) Digital Input choices:
            a) Pulse Accumulator
            b) Contact Closure Sensing
            c) Dry Contact/Potential Free inputs only
            d) Digital Input (10 ms settling time)
            e) Counter inputs up to 20 Hz, minimum pulse duration 20 ms (open or closed)
        2) Analog Input Choices:
            a) 0-10 Vdc

b) 4-20 mA
c) 1K Ni RTD @ 32°F (Siemens, JCI, DIN Ni 1K)
d) 1K Pt RTD (375 or 385 alpha) @ 32°F
e) 10K NTC Type 2 or Type 3 Thermistor
f) 100K NTC Type 2 Thermistor

b. Universal Input or Output (software configurable):
1) All of the above input types
2) Analog Output Types:
a) 0 to 10 Vdc @ 1 mA max

c. Super Universal Input or Output (software configurable):
1) All of the above input types
2) All of the above output types
3) Super digital output type:
a) 0 to 24 Vdc, 22 mA max. (for controlling pilot relay)
4) Super Analog Output Choices:
a) 0 to 20 mA @ 650 Ω max.

4. Provide software configurable I/O ports such that a programmer make a port either an input or an output

I. Each System Level Control Panel shall, at a minimum, be provided with:
1. Appropriate NEMA rated metal enclosure.
2. A 32-bit,multi-tasking, real-time 100 MHz digital control microprocessor with plug-in, enclosed processors.
3. Each Advanced Application Controller shall have sufficient memory, a minimum of 24 megabyte, to support its own operating system and databases, including control processes, energy management applications, alarm management applications, historical/trend data for points specified, maintenance support applications, custom processes, and operator I/O.
4. Real time clock and battery
5. Data collection/ Data Trend module sized for 10,000 data samples.
6. Power supplies as required for all associated modules, sensors, actuators, etc.
7. Monitoring of all industry standard types of analog and digital inputs and outputs, without the addition of equipment to the primary control panel.
8. Local status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device.
9. Each control panel shall perform diagnostics on all inputs and outputs and a failure of any input or output shall be indicated both locally and at the operator workstation.
10. Graduated intensity LEDs or analog indication of value for each analog output.

J. Power loss. In the event of the loss of power, there shall be an orderly shutdown of all controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for the operating system software and firmware.
1. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage.
2. Brownout protection and power recovery circuitry protect the controller board from power fluctuations.
3. Battery backup shall be provided to support the real-time clock for 10 years
4. The program and database information stored SDRAM memory shall be battery backed for a minimum of 30 days and up to 60 days. This eliminates the need for time consuming program and database re-entry in the event of an extended power failure.

K. Database Restore: Each AAC controller shall automatically save the latest programmed database. The controller shall be able to automatically restore a lost or corrupt database without involvement from the operator.

L. Each System Level Control Panel shall continuously perform self-diagnostics on all hardware modules and network communications. The System Level Control Panel shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication with any system.

M. Each Control Panel shall support firmware upgrades without the need to replace hardware.

N. System Level control panels shall provide at least two RS-232C serial data communication ports for operation of operator I/O devices such as operator terminals, and additional memory. Control panels shall allow temporary use of portable operator interface devices without interrupting the normal communications.

O. Immunity to noise.
1. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).
2. Isolation shall be provided at all primary network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:
   a. RF-Conducted Immunity (RFCI) per ENV 50141 (IEC 1000-4-6) at 3V.
   b. Electro Static Discharge (ESD) Immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact.
   c. Electrical Fast Transient (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500V signal, 1 kV power.
   d. Output Circuit Transients per UL 864 (2,400V, 10A, 1.2 Joule max).
3. Isolation shall be provided at all Advanced Application Controller's AC input terminals to suppress induced voltage transients consistent with:
   a. IEEE Standard 587 1980
   b. Voltage Sags, Surge, and Dropout per EN 61000-4-11 (EN 1000-4-11)

P. Agency Compliance
1. UL UL916 PAZX (all models)
2. UL916 PAZX7 (all models)
3. FCC Compliance CFR47 Part 15, Subpart B, Class B

Q. Spare Capacity: Provide enough inputs and outputs to handle the equipment shown to be "future" on drawings and 10% more of each point type. Provide all hardware modules, software modules, processors, power supplies, communication controllers, etc. required to ensure adding a point to the spare point location only requires the addition of the appropriate sensor/actuator and field wiring/tubing.

9.1 CONTROL PANELS

A. Controllers in mechanical rooms shall be mounted in NEMA 1 enclosures.

B. Controllers in areas where moisture is a concern shall be mounted in NEMA 12 enclosures.

C. Controllers installed outdoors shall be mounted in NEMA 4X enclosures. Provide heaters where freezing temperatures are normally experienced.

D. Mount on walls at an approved location or provide a free standing rack.

E. Panels shall be constructed of 16 gauge, furniture-quality steel, or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with ANSI 61 gray polyester-powder painted finish, UL listed. Provide common keying for all panels.

F. Provide power supplies for control voltage power.

G. Dedicate 1 power supply to the DDC controller. Other devices shall be on a separate power supply, unless the power for the control device is derived from the controller terminations.

H. Power supplies for controllers shall be a transformer with a fuse or circuit breaker. Power supplies for other devices can be plain transformers.

I. All power supplies for 24V low voltage wiring shall be class 2 rated and less than 100VA. If low voltage devices require more amps, then provide multiple power supplies. If a single device requires more amps, then provide a dedicated power supply in a separate enclosure and run a separate, non-class 2 conduit to the device.

J. Surge transient protection shall be incorporated in design of system to protect electrical components in all DDC Controllers and operator's workstations.

K. All devices in a panel shall be permanently mounted, including network switches, modems, media converters, etc.

L. Provide a pocket to hold documentation.

10.1 SENSORS

A. General
1. Provide mounting hardware for all devices, including actuator linkages, wells, installation kits for insertion devices, wall boxes and fudge plates, brackets, etc.
2. If a special tool is required to mount a device, provide that tool.

B. Terminal Unit Space Thermostats
1. Each controller performing space temperature control shall be provided with a matching room temperature sensor.
   a. Plain Space Temperature Sensors – Wired: Where called for in the sequences or on the drawings, provide sensors with plain covers.
   b. The sensing element for the space temperature sensor shall be thermistor type providing the following.
      1) Element Accuracy: + /- 1.0°F
      2) Operating Range: 55 to 95°F
      3) Set Point Adjustment Range: 55 to 95°F
      4) Calibration Adjustments: None required
      5) Installation: Up to 100 ft. from controller
      6) Auxiliary Communications Port: as required
      7) Local LCD Temperature Display: as required
      8) Setpoint Adjustment Dial as required
      9) Occupancy Override Switch as required

c. Auxiliary Communication Port. Each room temperature sensor shall include a terminal jack integral to the sensor assembly. The terminal jack shall be used to connect a portable operator's terminal to control and monitor all hardware and software points associated with the controller. RS-232 communications port shall allow the operator to query and modify operating parameters of the local room terminal unit from the portable operator's terminal.

2. Digital Display temperature sensor specifications – Wired:
   a. As called for in the sequences of operations or on the drawings, provide temperature sensors with digital displays.
   b. The sensing element for the space temperature sensor must be IC-based and provide the following.
      1) Digitally communicating with the Application Specific Controller.
      2) Mountable to and fully covering a 2 x 4 electrical junction box without the need for an adapter wall plate.
      3) IC Element Accuracy: +/- 0.9°F
      4) Operating Range: 55 to 95°F
      5) Setpoint Adjustment Range: User limiting, selectable range between 55 and 95°F
      6) Display of temperature setpoint with numerical temperature values
      7) Display of temperature setpoint graphically, with a visual Hotter/Colder setpoint indication
      8) Calibration: Single point, field adjustable at the space sensor to +/- 5°F
      9) Installation: Up to 100 ft. from controller
      10) Auxiliary Communications Port: included
      11) Local OLED Temperature Display: included
      12) Display of Temperature to one decimal place
      13) Temperature Setpoint Adjustment included
      14) Occupancy Override Function included
   c. Auxiliary Communication Port. Each room temperature sensor shall include a terminal jack integral to the sensor assembly. The terminal jack shall be used to connect a portable operator's terminal to control and monitor all hardware and software points associated with the controller. RS-232 communications port shall allow the operator to query and modify operating parameters of the local room terminal unit from the portable operator's terminal.

3. Provide the following options as they are called for in the sequences or on the drawings:
   a. Setpoint Adjustment. The setpoint adjustment function shall allow for modification of the temperature by the building operators. Setpoint adjustment may be locked out, overridden, or limited as to time or temperature through software by an authorized operator at any central workstation, Building Controller, room sensor two-line display, or via the portable operator's terminal.
   b. Override Switch. An override button shall initiate override of the night setback mode to normal (day) operation when activated by the occupant and enabled by building operators. The override shall be limited to two (2) hours (adjustable.) The override function may be locked out, overridden, or limited through software by an authorized operator at the operator interface, Building Controller, room sensor two-line display or via the portable operator's terminal.
   c. Space Combination Temperature and Humidity Sensors. Each controller performing space temperature control shall be provided with a matching room

temperature sensor, which also includes the ability to measure humidity for either monitoring or control purposes. The combination temperature and humidity sensors shall have the same appearance as the space temperature sensors. Humidity elements shall measure relative humidity with a +/- 2% accuracy over the range of 10 to 90% relative humidity. Humidity element shall be an IC (integrated circuit) sensing element. Humidity sensing elements shall be removable and field replaceable if needed.

C. Temperature Sensors
   1. All temperature sensors shall meet the following specifications:
      a. Accuracy: Plus or minus 0.2 percent at calibration point.
      b. Wire: Twisted, shielded-pair cable.
      c. Vibration and corrosion resistant
   2. Space temperature sensors shall meet the following specifications:
      a. 10k ohm type 2 thermistors
   3. Insertion Elements in Ducts shall meet the following specifications:
      a. Single point 10k ohm thermistor
      b. Use where not affected by temperature stratification
      c. The sensor shall reach more that 1/3 the distance from the duct wall
      d. Junction box for wire splices
   4. Averaging Elements in Ducts shall meet the following specifications:
      a. 72 inches (183 cm) long
      b. Flexible
      c. Use where prone to temperature stratification, in front of coils, or where ducts are larger than 9 sq. ft.
      d. Junction box for wire splices
   5. Insertion Elements for Liquids shall meet the following specifications:
      a. Platinum RTD with 4-20mA transmitter
      b. Threaded mounting with matching well
      c. Brass well with minimum insertion length of 2-1/2 inches for pipes up to 4” diameter
      d. Brass well with insertion length of 6 inches for pipes up to 10” diameter
      e. Junction box for wire splices
   6. Outside-Air Sensors Platinum RTD with 4-20mA transmitter:
      a. Watertight enclosure, shielded from direct sunlight
      b. Circulation fan
      c. Watertight conduit fitting

D. Where called for in the sequences of operations, provide the following feature on space sensors and thermostats:
   1. Security Sensors: Stainless-steel cover plate with insulated back and security screws
   2. Space sensors with setpoint adjust: Plain white plastic cover with slide potentiometer to signal a setpoint adjustment to the DDC
   3. Space Sensors with LCD display:
      a. Operator buttons for adjusting setpoints, setting fans speeds and overriding unit to on/off
      b. Graphical LCD icons for signaling heating/cooling mode, fans speed, schedule mode, actual temperature and current setpoint

E. Humidity Sensors shall meet the following specifications:
   1. Bulk polymer sensor element

2. Accuracy: 2 percent full range with linear output
3. Room Sensors: With locking cover matching room thermostats, span of 0 to 100 percent relative humidity
4. Duct and Outside-Air Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity

F. Air Static Pressure Transmitter shall meet the following specifications:
1. Non-directional sensor with suitable range for expected input, and temperature compensated.
2. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
3. Output: 4 to 20 mA.
4. Building Static-Pressure Range: 0 to 0.25 inches wg.
5. Duct Static-Pressure Range: 0 to 5 inches wg.

G. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; proportional output 4 to 20 mA.

H. Equipment operation sensors as follows:
1. Status Inputs for Fans: Differential-pressure switch with adjustable range of 0 to 5 inches wg.
2. Status Inputs for Pumps: Differential-pressure switch piped across pump with adjustable pressure-differential range of 8 to 60 psig.
3. Status Inputs for direct drive electric motors: Current-sensing relay with current transformers, adjustable and sized for 175 percent of rated motor current.
4. Status inputs for belt drive electric motors: Current sensing transmitter with linear 4-20mA output

I. Electronic Valve/Damper Position indication: Visual scale indicating percent of travel and 0 to 10 V dc, feedback signal.

J. Water-Flow Switches: Pressure-flow switches of bellows-actuated mercury or snap-acting type, with appropriate scale range and differential adjustment, with stainless-steel or bronze paddle. For chilled-water applications, provide vapor proof type.

K. Air Differential Pressure Switches: Diaphragm type air differential pressure switches with die cast aluminum housing, adjustable setpoint, minimum 5 amp switch rating at 120VAC, SPDT switches, and the switch pressure range shall be suited for the application. Provide Dwyer or equal. These switches shall be utilized for filter status.

L. Leak detectors: Provide spot leak detectors that can be secured to the floor or secured to a drain pan. The detection shall used a microchip controlled energized probes. The detector shall operate on 24Vor less. Provide a way to adjust the height of the leak probes. The SPDT contacts shall be inside a watertight enclosure.

11.1 ELECTRO-MECHANICAL THERMOSTATS

A. Fire-Protection Thermostats: UL listed with fixed or adjustable settings to operate at not less than 75 deg F above normal maximum operating temperature, with the following:
1. Reset: Automatic with control circuit arranged to require manual reset at central control panel, with pilot light and reset switch on panel labeled to indicate operation.

B. Electric Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point. Setpoint shall be adjustable.
   1. Bulb Length: Minimum 20 feet.
   2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

C. Electric space thermostats: Provide a charged element type stat with snap acting SPDT switch. The switch shall be rated for 16A or 1HP at 120V.

D. Aquastat: Provide a charged element type stat with snap acting SPDT switch. The switch shall be rated for 16A or 1HP at 120V.

12.1 AUTOMATIC CONTROL VALVES

A. General:
   1. All automatic control valves shall be fully proportioning, unless specified otherwise. The valves shall be quiet in operation and fail-safe in either normally open or normally closed position in the event of control air failure. All valves shall be capable of operating at varying rates of speed to correspond to the exact dictates of the controllers and variable load requirements. The valves shall be capable of operating in sequence with other valves and/or dampers when required by the sequence of operation. All control valves shall be sized by the control vendor and shall be guaranteed to accommodate the flow rates as scheduled. All control valves shall be suitable for the pressure conditions and shall close against the differential pressures involved. Body pressure rating and connection type construction shall conform to fitting and valve schedules. Control valve operators shall be sized to close against a differential pressure equal to the design pump heads plus 10 percent.
   2. Cold water, hot water and steam valves, throttling type, and bypass valves shall have equal percentage flow characteristics.
   3. Unless otherwise specified, control valves 2 inches and smaller shall have cast iron or bronze bodies with screwed NPT connections.
   4. Valves between 2-1/2 inch and 4 inch shall have cast iron bodies with flanged connections.
   5. All automatic control valves installed exposed to the elements shall be provided with electric actuators with operating characteristics and accessories as described in herein. Coordinate with electrical contractor for power availability and point of connection.
   6. All automatic control valves controlled by the BAS shall be furnished by the controls contractor unless noted otherwise in these documents.
   7. All automatic control valves shall be installed by the mechanical trade.
   8. The controls contractor shall provide wiring as follows:
      a. All line voltage power for electric valve actuators shall be wired by the controls contractor from the nearest available power panel. Coordinate with electrical trade.
      b. All wiring between the central control system (ATC/BMS) and the valve actuator shall be wired by the controls contractor.
      c. All wiring between the valve actuator and their associated thermostats, pressure switches, control devices, etc. shall be wired by the controls contractor.
      d. All wiring shall comply with code requirements. Segregate high and low voltage wiring & circuits and segregate the FAS and controls (BMS) terminals.

B. Characterized Ball Valves

1. All control valves shall be sized by the control vendor. All control valve bodies shall be suitable for the static and dynamic pressures of the system. Control valve operators shall be sized to close against a differential pressure equal to the design pump head plus 10 percent.
2. Body pressure rating and connection type construction shall conform to fitting and valve schedules.
    a. Design body pressure shall be determined by the adding the static pressure due to the height of the system plus the compression tank charge plus the maximum head of the system pump at cut off. Provide 10% design factor.
3. The valve seat differential pressure rating shall exceed the pump dynamic head design pressure.
4. All automatic control valves controlled by the BAS shall be furnished by the controls contractor unless otherwise noted in these documents.
5. All automatic control valves shall be installed by the mechanical trade.
6. The controls contractor shall provide wiring as follows:
    a. All line voltage power for electric valve actuators shall be wired by the controls contractor from the nearest available power panel. Coordinate with electrical trade.
    b. All low voltage wiring between the controller and the valve actuator shall be wired by the controls contractor.
    c. All wiring between safeties and the valve actuator shall be wired by the controls contractor.
    d. All wiring shall comply with code requirements. Segregate high and low voltage wiring and circuits and segregate the Fire Alarm (FACS) and BAS controls wiring.

C. Manufacturer
1. Siemens 599 series valves bodies, SSD, SAX, SQV Actuators, Series 230, 231, 232, 233, 238, 239, 371, and 373 assemblies

D. Threaded Valves, line size ½" to 2"
1. Controlled Media Specific Items
    a. The control valve shall be suitable for chilled water to a minimum of 35°F (2°C) and hot water to a maximum temperature of 250°F (121°C). 3-way 1-1/2 inch and 2 inch valves shall be suitable for chilled water to a minimum of 35°F (2°C) and hot water to a maximum temperature of 230°F (110°C).
    b. The control valve shall be suitable for up to 50% ethylene or propylene glycol solutions, chilled glycol/water solutions to a minimum of 35°F (2°C) and hot glycol/water solutions to a maximum temperature of 250°F (121°C). 3-way 1-1/2 inch and 2 inch valves shall be suitable for up to 50% ethylene or propylene glycol solutions, chilled glycol/water solutions to a minimum of 35°F (2°C) and hot glycol/water solutions to a maximum temperature of 230°F (110°C).
2. General Construction Materials/Applicable Standards
    a. Control valve bodies shall be constructed of forged brass according to ASTM B283 (C37700, CuZn39Pb2 or equivalent), and shall meet requirements of ANSI 250 and 600WOG pressure classes.
    b. Inlets and outlets shall be clearly marked on the valve bodies.
    c. Valve ball shall consist of nickel-plated brass, chrome-plated brass or stainless steel.
    d. End connections shall be NPT internally threaded according to ANSI B1.20.1.
    e. The control valve flow rate (Cv) shall meet the requirements of ANSI/ISA S75.02.

f. The control valve shall have an equal percentage flow characteristic, according to ANSI/ISA S75.11. A single glass filled PTFE V port insert shall provide both the ball seal and shall establish the flow coefficient of the valve. The V port insert shall be retained by the valve body itself, not requiring additional retaining components. Flow coefficient adapters requiring a retainer clip, or installed after final assembly of the valve or as inserts in the ball shall not be allowed.

g. 2-way valves and the A-AB path on 3-way valves shall meet the requirements of ANSI Class IV (0.01% of rated Cv) seat leakage, or better, according to ANSI/FCI 70.2, at the specified close-off pressure. Bypass path (B-AB) on 3-way valves shall meet the requirements of ANSI Class III (0.1% of rated Cv) seat leakage, or better, according to ANSI/FCI 70.2.

h. Chilled and Hot water valve shall have a blow-out proof stem with two EPDM (peroxide cured) O-rings. External stem retainers will not be allowed.

i. Valve stem shall be made of brass or stainless steel.

j. Valve shall have the ability to be manually operated in the event of a power failure.

E. Actuators - Electric

1. The valves shall be provided with an actuator by the same manufacturer, factory installed.
2. All actuators shall have visual position indication.
3. No external programming device shall be required.
4. Actuator shall be electric motor driving, microprocessor signal controlled.
5. Modulating valves shall be positive positioning, responding to a 0-10VDC, 2-10VDC or 4-20mA signal. Floating modulating signals are acceptable for modulation on terminal units and radiation units. There shall be a visual valve position indicator.
6. Power: All actuators shall be 24VAC power and less than 100VA draw. Power shall be via Class 2 wiring. Actuators requiring more than 100VA shall have a dedicated conduit for power wiring, not mixed with the signal wiring.
7. Fail Safe: Valves actuators shall position the valve in a fail-safe position when the power supply is disrupted or the signal goes to 0. Fail-safe according to the following guidelines unless otherwise stated in the sequence of operations
   a. Power fail safe shall be via spring loaded mechanical means
   b. Any AHU hot water exposed to ventilation air shall fail open
   c. AHU Chilled water coils exposed to ventilation air in possible freezing conditions shall be fail open
   d. AHU Chilled water coils that are drained in winter months or are in climate zones without freezing conditions shall be fail-in-place
   e. Terminal unit valves shall fail-in-place
8. Fail in Safe valves on primary equipment such as chilled water systems, hot water systems and condenser water systems shall have a means to manually open the valve when power is not available, such as a hand wheel or a geared crank with a clutch.
9. The actuator shall be designed with a current limiting motor protection. A release button (clutch) or handle on the actuator shall be provided to allow for manual override (except when actuator is spring return type).
10. Actuator shall provide minimum torque required for proper valve close-off. The close-off differential pressure rating of the valve shall exceed the highest possible head pressure available at the pump plus 10%, and still be rated for a Class IV leakage.
11. The actuator shall have the capability of adding auxiliary switches or feedback potentiometer if specified.
12. All automatic control valves installed in locations exposed to the elements shall be provided with weather resistant housings and heaters for climates that reach below freezing.

13. Actuators shall be UL and CSA listed.

F. Hot Water / Condenser Water / Control Valves
1. Single-seated.
2. Fully proportioning with modulating plug or V-port inner valves.
3. Body pressure rating and connection type construction shall conform to fitting and valve schedules. The ANSI rating of the valve shall match the ANSI rating of the piping in which the valve is installed. Minimum ANSI rating shall be ANSI 125.
4. Stainless steel stems and trim.
5. Spring loaded Teflon packing
6. Quiet in operation.
7. Fail-safe in either normally open or normally closed position in the event of power failure.
8. Capable of operating in sequence with other valves and/or dampers when required by the sequence of operation.
9. Capable of operating at varying rates of speed to correspond to the exact dictates of the controller and variable load requirements.

G. Differential Pressure Control Valves :
1. Provide for all water systems where modulating water flow conditions are required to prevent excessive pump pressure build-up. Provide a valve for each closed loop water system. Valve to be globe type. Provide valves 2" and smaller with screwed end bodies and provide valves 2-1/2" and larger with flanged ends.

H. Steam Valves:

1. Steam control valves shall be of linear flow characteristics for modulating service.

2. Sizing Criteria:
a. 15 psig or less; pressure drop 80% of inlet psig.
b. 16 to 50 psig; pressure drop 50% of inlet psig.
c. Over 50 psig; pressure drop as scheduled on plans.
d. Steam valves shall fail normally open or closed, as scheduled on plans, or as follows:
1) Heating coils in air handlers:normally open.
2) Steam to hot water heat exchanger: normally closed.
3) Other applications: as required by sequences of operation.

13.1 ELECTRONIC ACTUATOR SPECIFICATION

A. ELECTRONIC VALVE ACTUATORS
1. Actuator shall be fully modulating, floating (tri-state), two position, and/or spring return as indicated in the control sequences. Specified fail safe actuators shall require mechanical spring return.
2. Modulating valves shall be positive positioning, responding to a 2-10VDC or 4-20mA signal. There shall be a visual valve position indicator.
3. The actuator shall have the capability of adding auxiliary switches or feedback potentiometer if specified.
4. Actuator shall provide minimum torque required for proper valve close-off. The actuator shall be designed with a current limiting motor protection. A release button (clutch) or handle on the actuator shall be provided to allow for manual override (except when actuator is spring return type).

5. Actuators shall be UL listed.

B. ELECTRONIC DAMPER ACTUATORS

1. Actuator shall be direct coupled (over the shaft), enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The actuator-to-shaft clamp shall use a "V" bolt and "V" shaped, toothed cradle to attach to the damper shaft for maximum holding strength. Single bolt or set screw type fasteners are not acceptable.
2. Actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator. End switches to deactivate the actuator at the end of rotation or magnetic clutch are not acceptable.
3. For power-failure/safety applications, a mechanical, spring return mechanism shall be used.
4. Actuators with spring return mechanisms shall be capable of either clockwise or counterclockwise spring return operation by simply changing the mounting orientation.
5. Proportional actuators shall accept a 2-10VDC, 4-20mA signal, or be of the 2 point floating type and provide a 2-10VDC actuator position feedback signal.
6. All actuators shall have an external manual gear release (clutch) or manual crank to aid in installation and for allowing manual positioning when the actuator is not powered.
7. All actuators shall have an external direction of rotation switch to aid in installation and to allow proper control response.
8. Actuators shall be provided with a factory-mounted 3-foot electrical cable and conduit fitting to provide easy hook-up to an electrical junction box.
9. Actuators shall be listed under Underwriters Laboratories Standard 873 and Canadian Standards Association. They must be manufactured under ISO 9001.

PART 3 - EXECUTION

1.1 EXAMINATION

A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the architect/engineer for resolution before rough-in work is started.

B. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started.

C. The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate—or if any discrepancies occur between the plans and the contractor's work and the plans and the work of others—the contractor shall report these discrepancies to the engineer and shall obtain written instructions for any changes necessary to accommodate the contractor's work with the work of others.

2.1 INSTALLATION

A. Provide all relays, switches, and all other auxiliaries, accessories and connections necessary to make a complete operable system in accordance with the sequences specified. All field wiring shall be by this contractor.

B. Install controls so that adjustments and calibrations can be readily made. Controls are to be installed by the control equipment manufacturer.

C. Mount surface-mounted control devices on brackets to clear the final finished surface on insulation.

D. Install equipment level and plumb.

E. Install control valves horizontally with the power unit up.

F. Unless otherwise noted, install wall mounted thermostats and humidistat 60" above the floor measured to the center line of the instrument, or as otherwise directed by the Architect.

G. Install averaging elements in ducts and plenums in horizontal crossing or zigzag pattern.

H. Install outdoor sensors in perforated tube and sunshield.

I. Install damper motors on outside of duct in protected areas, not in locations exposed to outdoor temperatures.

J. Install labels and nameplates on each control panel listing the name of the panel referenced in the graphics and a list of equipment numbers served by that panel.

K. Furnish hydronic instrument wells, valves, and other accessories to the mechanical contractor for installation.

L. Furnish automatic dampers to mechanical contractor for installation.

3.1 GRAPHIC DISPLAY GENERATION

A. All software shall be capable of providing color graphics. All software shall include a graphical viewing and control environment and definition and construction of dynamic color graphic displays.

B. Provide a main default screen showing the basic layout of the building. Each color graphic screen shall have transfer links to allow the building operator to transfer between system associated screens (both forward and backward), as well as a transfer link back to the main default screen.

C. Basic CAD floor plans with layers for walls, windows, low pressure ductwork only, supply diffusers and room numbers shall be provided for all CV, VAV, and FPVAV terminal units. Floor plans shall show the location of each space temperature sensor with a dashed line to the associated terminal unit. Display in real time the difference between the space temperature and the current setpoint.
   1. Display the
      a. cooling %,
      b. heating % (if applicable)
      c. current CFM of each terminal unit.
   2. Provide a transfer link for each terminal unit to allow the operator to access the flow graphic for each individual terminal unit. Use a different color to shade the background area for each part of a floor plan graphic served by a different air handling unit.

D. Thermal floor plan graphics:
   1. Show heating and cooling zones throughout the building in a range of colors (minimum 5) that provide a visual display of temperatures relative to their respective setpoints. The colors shall be updated dynamically as zones' comfort conditions change. Locations of space sensors shall also be shown for each zone. Floor plan humidity's shall be represented similarly to zone temperatures. Setpoint adjustment and color band displays shall be provided as a tool for user adjustment.
   2. These full screen plans shall be accessible by rolling over the floor on the building elevation rendering. This will provide the viewer a quick and accurate overview of which zones are at setpoint, near setpoint, or need attention.
   3. The viewer may then click on any zone to be brought to the terminal unit that is related to that zone. Rolling over any zone will bring up the zone description and temperature in a pop-up flag. Flags are used to keep the zone information legible regardless of how small the zone is depicted on the plan
   4. All floor plans shall be vector based to allow for zooming in and out of floor plans without pixelization.
   5. If zone lighting controls are tied into the BAS, then produce the same floor viewing and control for lights.
   6. If a Web-based graphical interface is specified, then the floor plan graphics shall be accessible through the Web Browser Interfaces.

E. All control set points shall be easily adjustable from the system's color graphic screen by operators with the proper access level. Each controlled point on the BAS operator workstation color graphic screens shall have the set point indicated along with the actual controlled variable reading (preferred set point on top and actual reading on bottom). All points shall indicate the associated engineering unit. All analog outputs points shall indicate engineering units such as "%-open" or "%-closed" as required by the application. All normally-closed or normally-open points shall indicate the normal position (such as "N.C." or "N.O." next to the controlled device).

F. Provide system color graphics for each HVAC system and for each electrical, plumbing and/or piping system that is monitored and/or controlled by the BMS. Provide scaled floor plans indicating equipment location, service, and system data as required.

G. Provide color graphic floor plan displays and system schematics for each piece of mechanical equipment, including but not limited to air handling units, chilled water systems and hot water systems to optimize system performance analysis and speed alarm recognition.

H. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection or text-based commands.

I. Dynamic temperature values, humidity values, flow values and status indication shall be shown in their actual respective locations and shall automatically update to represent current conditions without operator intervention.

J. The windowing environment of the operator interface shall allow the user to simultaneously view several graphics at a time to analyze total building operation or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.
   1. Provide libraries of pre-engineered screens and symbols depicting standard air handling unit components (e.g., fans, cooling coils, filters, dampers, etc.), complete mechanical systems (e.g., constant volume-terminal reheat, VAV, etc.) and electrical symbols.

2. Graphical displays can be created to represent any logical grouping of system points or calculated data based upon building function, mechanical system, building layout or any other logical grouping of points which aids the operator in the analysis of the facility.

K. Provide an automatically updated, dynamic display of the site-specific BMS architecture indicating the status of primary and secondary controllers.

L. Provide a separate dynamic display page of each HVAC (AHU, AC, chiller, cooling tower, fuel oil, etc.), electrical, and/or plumbing system connected to the BMS.

M. Provide a separate dynamic display page of each piece of terminal equipment (VAV box, fan coil unit, etc.) connected to the BMS.

N. Provide an additional dynamic, graphic display pages as required by the operating staff to further assist in daily system operations.

O. Graphics shall incorporate all system integration points communicated via hardware or software gateways and/or interfaces. Origin of information shall be transparent to the operator and shall be controlled, displayed, trended, etc. as if the points were hardwired to the BMS.

P. Each graphic shall have a "BACK" button and a "HOME" or "MAIN" button located in the same location on all graphics.

Q. The operator shall be able to clearly distinguish the difference between the following types of points on a graphic either by color, shape, icon or text label:
1. Real-time sensor reading
2. Setpoint
3. Manually set vs. program set Setpoint
4. Real-time output reading
5. Manually Overridden or commanded output vs program set output
6. Status feedback from a piece of equipment vs the output command

R. Make appear links to additional information associated with the system on the graphic, such as:
a. Controls as-built schematics and wiring diagrams
b. As-built Sequence of Operation
c. Mechanical drawings
d. Electrical drawings

S. Integration graphics shall be representative of personnel standing in front of equipment. The graphics for equipment specified in the Building Systems Integration paragraph shall be representative of the manufacturers' local display panel and each shall be completely operable from the computer workstation.

4.1 ELECTRICAL WIRING SCOPE

A. This contractor shall be responsible for power that is not shown on the electrical drawings, to controls furnished by this contractor. If power circuits are shown on the electrical drawings, this contractor shall continue the power run to the control device. If power circuits are not shown, this contractor shall coordinate with the electrical contractor to provide breakers at distribution panels for power to controls. This contractor is then responsible for power from the distribution panel.

1. Coordinate panel locations. If enclosures for panels are shown on the electrical drawings, furnish the enclosures according to the electrician's installation schedule.

B. This contractor shall not be responsible for power to control panels and control devices that are furnished by others, unless it is part of the control interlock wiring.

C. Refer to Coordination section for what devices this contractor is responsible to mount and which are turned over to others to mount.

D. This contractor shall be responsible for wiring of any control device that is furnished as part of this section of specification.

E. Interlock wiring shall be run in separate conduits from BAS associated wiring.

F. Provide network wiring for equipment that is called to be integrated to the BAS.

5.1 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. All low voltage control wiring shall be class 2. Control wiring that is not class 2 shall be run in separate conduits from class 2 wiring.

B. Floor level network wiring between terminal units can be combined with thermostat and other low voltage wiring in the same conduit. All other network wiring shall be in dedicated conduits.

C. Install raceways, boxes, and cabinets according to Division 26 Section "Raceways and Boxes."

D. Install building wire and cable according to Division 26 Section "Conductors and Cables."

E. Installation shall meet the following requirements:
1. Conceal cable and conduit, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install exposed cable in raceway or conduit.
3. Install concealed cable using plenum rated cable.
4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
7. All wiring in lab areas shall be in conduit.
8. All unsupported risers shall be rigid steel conduit. Supported risers shall be EMT.

F. Rigid conduit shall be steel, hot dip galvanized, threaded with couplings, ¾ inch minimum size, manufactured in accordance with ANSI C-80-1. Electrical metallic tubing (EMT) with compression fittings or intermediate metallic conduit (IMC) may be used as conduit or raceway where permitted by the NEC.

G. Concealed control conduit and wiring shall be provided in all spaces except in the Mechanical Equipment Rooms and in unfinished spaces. Install in parallel banks with all changes in directions made at 90 degree angles.

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H. Install conduit adjacent to machine to allow service and maintenance.

I. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

J. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

K. Ground equipment.

6.1 COMMUNICATION WIRING

A. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.

B. Do not install communication wiring in raceway and enclosures containing Class 1 wiring.

C. Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.

D. Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.

E. Cable bundling:
1. RS485 cabling run open air in accessible areas can be bundled with other class 2 low voltage cabling.
2. RS485 cabling run between terminal units in conduits above ceilings or under floors or in inaccessible areas can be bundled with other class 2 low voltage cabling.
3. RS485 cabling run between floors shall be in a communication only conduit.
4. RS485 conduit run long distances between utility rooms or between buildings shall be in a communication only conduit.
5. Ethernet cabling shall be in a communication only conduit.
6. Ethernet and RS485 can be run together.
7. Fiber optics can be run with Ethernet and RS485 cabling as long as the conduit is bent to fiber optic standards and junction boxes are sized for fiber optic use.

F. RS485 Cabling
1. RS485 cabling shall be used for BACnet MS/TP networks.
2. RS485 shall use low capacitance, 20-24 gauge, twisted shielded pair.
3. The shields shall be tied together at each device.
4. The shield shall be grounded at one end only and capped at the other end.
5. Provide end of line (EOL) termination devices at each end of the RS485 network or subnetwork run, to match the impedance of the cable, 100 to 120ohm.

G. Ethernet Cabling
1. Ethernet shall not be run with any Class 1 or low voltage Class 2 wiring.
2. CAT6, unshielded twisted pair (UTP) cable shall be used for BAS Ethernet.
3. Solid wire shall be used for long runs, between mechanical rooms and between floors. Stranded cable can be used for patch cables and between panels in the same mechanical room up to 50 feet away.

4. When the BAS Ethernet connects to an Owner's network switch, document the port number on the BAS As-builts.

H. Fiber-Optic Cabling
1. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post-installation residual cable tension shall be within cable manufacturer's specifications.
2. All cabling and associated components shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii, as specified by cable manufacturer, shall be maintained.
3. All terminations shall to be made into a patch panel, designed for such use. Free air terminations with patch panels are prohibited.

I. When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lighting arrestor shall be installed according to the manufacturer's instructions.

J. All runs of communication wiring shall be unspliced length when that length is commercially available.

K. All communication wiring shall be labeled to indicate origination and destination data.

L. Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

7.1 IDENTIFICATION

A. Permanent warning labels shall be affixed to all equipment that can be automatically started by the DDC system.
1. Labels shall use white lettering (12-point type or larger) on a red background.
2. Warning labels shall read as follows: C A U T I O N This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing.

B. Permanent warning labels shall be affixed to all motor starters and all control panels that are connected to multiple power sources utilizing separate disconnects.
1. Labels shall use white lettering (12-point type or larger) on a red background.
2. Warning labels shall read as follows: C A U T I O N This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.

C. Control Equipment and Device labeling:
1. Labels and tags shall match the unique identifiers shown on the as-built drawings.
2. All Enclosures shall be labeled to match the as-built drawing by either control panel name or the names of the DDC controllers inside.
3. All sensors and actuators not in occupied areas shall be tagged.
4. Airflow measurement arrays shall be tagged to show flow rate range for signal output range, duct size, and pitot tube AFMS flow coefficient.
5. Duct static pressure taps shall be tagged at the location of the pressure tap.
6. Each device inside enclosures shall be tagged.
7. Terminal equipment need only have a tag for the unique terminal number, not for each device. Match the unique number on:

a. First, the design drawings, or
b. Second, the control as-builts, or
c. Third, the DDC addressing scheme

8. Tags on the terminal units shall be displayed on the Operator Workstation Graphics.

D. Tags shall be mechanically printed on permanent adhesivebacked labeling strips, 12 point height minimum.

E. Manufacturers' nameplates and UL or CSA labels are to be visible and legible after equipment is installed.

F. Identification of Wires
1. Tag each wire with a common identifier on each end of the wire, such as in the control panel and at the device termination.
2. Tag each network wire with a common identifier on each end.
3. Tag each 120V power source with the panel and breaker number it is fed by.

G. Identification of Conduits:
1. Identify the low voltage conduit runs as BAS conduit, power feeds not included.
2. Identify each electric box, junction box, utility box and wiring tray with a blue paint mark or blue permanent adhesive sticker.
3. For conduit runs that run more than 8 ft between junction boxes in 1 room, place a blue identifier at least every 8 feet.
4. Place a blue identifier on each side of where a conduit passed through a wall or other inaccessible path.
5. Identify all BAS communication conduits the same as above.

8.1 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment, and retest.
3. Calibration test controllers by disconnecting input sensors and stimulating operation with compatible signal generator.

B. Engage a factory-authorized service representative to perform startup service.

C. Replace damaged or malfunctioning controls and equipment.
1. Start, test, and adjust control systems.
2. Demonstrate compliance with requirements, including calibration and testing, and control sequences.
3. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

9.1 SYSTEM CHECKOUT AND STARTUP

A. Inspect each termination in the MER control panels and devices to make sure all wires are connected according to the wiring diagrams and all termination are tight.

B. After the controls devices and panels are installed and power is available to the controls, perform a static checkout of all the points, including the following:
   1. Inspect the setup and reading on each temperature sensor against a thermometer to verify its accuracy.
   2. Inspect the setup and reading on each humidity sensor against a hygrometer to verify its accuracy.
   3. Inspect the reading on each CO2 sensor using a calibration kit to verify the sensor range accuracy matches the DDC setup.
   4. Inspect the reading of each status switch to verify the DDC reads the open and close correctly.
   5. Command each relay to open and close to verify its operation.
   6. Command each 2-position damper actuator to open and close to verify operation.
   7. Command each 2-position valve to open and close to verify operation.
   8. Ramp each modulating actuator to 0%, 25%, 50%, 75% and 100% to verify its operation.
   9. Ramp each modulating output signal, such as a VFD speed, to verify its operation.
   10. Test each safety device with a real life simulation, for instance check low temperature detectors with ice water, water detectors with water, etc.

C. Document that each point was verified and operating correctly. Correct each failed point before proceeding to the dynamic startup.

D. Verify that each DDC controller communicates on its respective network correctly.

E. After all of the points are verified, and power is available to the mechanical system, coordinate a startup of each system with the mechanical contractor. Include the following tests:
   1. Start systems from DDC.
   2. Verify that each setpoint can be met by the system.
   3. Change setpoints and verify system response.
   4. Change sensor readings to verify system response.
   5. Test safety shutdowns.
   6. Verify time delays.
   7. Verify mode changes.
   8. Adjust filter switches and current switches for proper reactions.
   9. Adjust proportional bands and integration times to stabilize control loops.

F. Perform all program changes and debugging of the system for a fully operational system.

G. Verify that all graphics at the operator workstations correspond to the systems as installed. Verify that the points on the screens appear and react properly. Verify that all adjustable setpoints and manual commands operate from the operator workstations.

H. After the sequence of operation is verified, setup the trends that are listed in the sequence of operations for logging and archiving for the commissioning procedure.

10.1 SYSTEM COMMISSIONING, DEMONSTRATION AND TURNOVER

A. The BAS Contractor shall prepare and submit for approval a complete acceptance test procedure including submittal data relevant to point index, functions, sequence, inter-locks, and

associated parameters, and other pertinent information for the operating system. Prior to acceptance of the BAS by the Owner and Engineer, the BAS contractor shall completely test the BAS using the approved test procedure.

B. After the BAS contractor has completed the tests and certified the BAS is 100% complete, the Engineer shall be requested, in writing, to approve the satisfactory operation of the system, sub-systems and accessories. The BAS contractor shall submit Maintenance and Operating manuals at this time for approval. An acceptance test in the presence of the Engineer and Owner's representative shall be performed. The Owner will then shake down the system for a fixed period of time (30 days).

C. The BAS contractor shall fix punch list items within 30 days of acceptance.

D. When the system performance is deemed satisfactory in whole or in part by these observers, the system parts will be accepted for beneficial use and placed under warranty.

11.1 TRAINING

A. During System commissioning and at such time as acceptable performance of the Building Automation System hardware and software has been established, the BAS contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction during normal working hours shall be performed by a competent building automation contractor representative familiar with the Building Automation System's software, hardware and accessories.

B. At a time mutually agreed upon, during System commissioning as stated above, the BAS contractor shall give 40 hours of onsite training on the operation of all BAS equipment. Describe its intended use with respect to the programmed functions specified. Operator orientation of the automation system shall include, but not be limited to:
1. Explanation of drawings and operator’s maintenance manuals.
2. Walk-through of the job to locate all control components.
3. Operator workstation and peripherals.
4. DDC Controller and ASC operation/sequence.
5. Operator control functions including scheduling, alarming, and trending.
6. Explanation of adjustment, calibration and replacement procedures.

C. Additional 8-hours of training shall be given after the 30 day shakedown period.

D. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor. If the Owner requires such training, it will be contracted at a later date. Provide description of available local and factory customer training. Provide costs associated with performing training at an off-site classroom facility and detail what is included in the manufacturer’s standard pricing such as transportation, meals, etc.

END OF SECTION

SECTION 23 74 33

DEDICATED OUTDOOR-AIR UNITS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes units with integral heating and cooling for rooftop installation. Integral Energy Recovery device shall be a rotary air-to-air total enthalpy wheel. Integral heat source shall be Indirect Gas-Fired furnace. Integral cooling source shall be packaged DX. Airflow arrangement shall be Outdoor Air with Recirculation.

1.02 QUALITY ASSURANCE

A. Packaged air-cooled condenser units shall be certified in accordance with ANSI/AHRI Standard 340/360 performance rating of commercial and industrial unitary air-conditioning and heat pump equipment.

B. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.

C. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.

D. Unit shall be certified in accordance with ANSI Z21.47b/CSA 2.3b and ANSI Z83.8/CSA 2.6, Safety Standard Gas-Fired Furnaces.

E. Unit Energy Efficiency Ratio (EER) shall be equal to or greater that prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.

1.03 SUBMITTALS

A. Comply with Section 01 3323, Submittals.

B. Product Data: For each type or model include the following:

1. Complete fan performance curves for both Supply Air and Exhaust Air, with system operating conditions indicated, as tested in an AMCA Certified Chamber.
2. Sound performance data for both Supply Air and Exhaust Air, as tested in an AMCA Certified chamber.
3. Motor ratings, electrical characteristics and motor and fan accessories.
4. Performance ratings for all chilled water or DX coils.
5. Dimensioned drawings for each type of installation, showing isometric and plan views, to include location of attached ductwork and service clearance requirements.
6. Estimated gross weight of each installed unit.
7. Installation, Operating and Maintenance manual (IOM) for each model.
8. Microprocessor Controller (DDC) specifications to include available options and operating protocols. Include complete data on all factory-supplied input devices.

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9. AHRI Certified coil performance ratings with system operating conditions indicated. Ratings shall be in accordance with Standard 410.
10. Energy wheel performance data for both summer and winter operation.

1.04 WARRANTY

A. Manufacturer shall provide a limited "parts only" warranty for a period of 12 months from the date of equipment startup or 18 months from the date of original equipment shipment from the factory, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer's written instructions for Installation, Operation, and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and filters.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Products shall be provided by the following manufacturers:

1. AAON, Greenheck
2. Substitute equipment may be considered for approval that includes at a minimum:
a. R-454B refrigerant
b. Variable capacity compressor with 10-100% capacity control
c. Direct drive supply fans
d. Double wall cabinet construction
e. Insulation with a minimum R-value of 13
f. Stainless steel drain pans

2.02 ROOFTOP UNITS

A. General Description

1. Packaged rooftop unit shall include compressors, evaporator coils, filters, supply fans, dampers, air-cooled condenser coils, condenser fans, reheat coil, gas heaters, exhaust fans, energy recovery wheels, and unit controls.
2. Unit shall be factory assembled and tested including leak testing of the DX coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. Run test report shall be supplied with the unit in the service compartment's literature pocket.
3. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
4. Unit components shall be labeled, including refrigeration system components and electrical and controls components.
5. Estimated sound power levels (dB) shall be shown on the unit ratings sheet.
6. Installation, Operation, and Maintenance manual shall be supplied within the unit.
7. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.
8. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

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B. Construction

1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
2. Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for a minimum flash ignition temperature of 610°F.
3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel.
4. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRIStandard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
5. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.
6. Access to filters, dampers, cooling coils, reheat coil, heaters, exhaust fans, energy recovery wheels, compressors and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.
7. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
8. Units with cooling coils shall include double sloped 304 stainless steel drain pans.
9. Unit shall be provided with base discharge and return air openings. All openings through the base pan of the unit shall have upturned flanges of at least 1/2 inch in height around the opening.
10. Unit shall include lifting lugs on the top of the unit.
11. Unit shall include factory installed, painted galvanized steel condenser coil guards on the face of the condenser coil.

C. Electrical

1. Unit shall have a 5kAIC SCCR.
2. Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.
3. Unit shall be provided with a factory installed and field wired 115V, 20 amp GFI outlet in the unit control panel.
4. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.

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D. Supply Fans

1. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.
2. Blowers and motors shall be dynamically balance and mounted on rubber isolators.
3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
4. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.

E. Exhaust Fans

1. Exhaust dampers shall be sized for 100% relief.
2. Fans and motors shall be dynamically balanced.
3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
4. Access to exhaust fans shall be through double wall, hinged access doors with quarter turn lockable handles.
5. Unit shall include belt driven, unhoused, backward curved, plenum exhaust fans.
6. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.

F. Cooling Coils

1. Evaporator Coils
a. Coils shall be designed for use with R-454B refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
b. Coils shall have interlaced circuitry and shall be standard capacity.
c. Coils shall have interlaced circuitry and shall be 6 row high capacity.
d. Coils shall be hydrogen or helium leak tested.
e. Coils shall be furnished with factory installed expansion valves.

G. Refrigeration System

1. Unit shall be factory charged with R-454B refrigerant.
2. Compressors shall be scroll type with thermal overload protection and carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory.
3. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam injected panels to prevent the transmission of noise outside the cabinet.
4. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.
5. Each refrigeration circuit shall be equipped with expansion valve type refrigerant flow control.
6. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides and a factory installed replaceable core liquid line filter driers.

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7. Unit shall include a variable capacity scroll compressor on the lead refrigeration circuit which shall be capable of modulation from 10-100% of its capacity.
8. Lead refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.

H. Condensers

1. Air-Cooled Condenser
a. Condenser fans shall be a vertical discharge, axial flow, direct drive fans.
b. Coils shall be designed for use with R-454B refrigerant. Coils shall be multi-pass and fabricated from aluminum microchannel tubes.
c. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.
d. Coils shall be hydrogen or helium leak tested.
e. Condenser fans shall be VFD driven variable speed for condenser head pressure control. Factory provided and factory programmed VFDs shall continuously modulate the fan air flow to maintain head pressure at acceptable levels. Cooling operation shall be allowed down to 35°F with adjustable compressor lockout.

I. Gas Heating

1. Stainless steel heat exchanger furnace shall carry a 10 year non-prorated warranty, from the date of original equipment shipment from the factory.
2. Gas furnace shall consist of stainless steel heat exchangers with multiple concavities, an induced draft blower and an electronic pressure switch to lockout the gas valve until the combustion chamber is purged and combustion airflow is established.
3. Furnace shall include a gas ignition system consisting of an electronic igniter to a pilot system, which will be continuous when the heater is operating, but will shut off the pilot when heating is not required.
4. Unit shall include a single gas connection and have gas supply piping entrances in the unit base for through-the-curb gas piping and in the outside cabinet wall for across the roof gas piping.
5. High Turndown Modulating Natural Gas Furnace shall be equipped with modulating gas valves, adjustable speed combustion blowers, stainless steel tubular heat exchangers, and electronic controller. Combustion blowers and gas valves shall be capable of modulation. Electronic controller includes a factory wired, field installed supply air temperature sensor. Sensor shall be field installed in the supply air ductwork. Supply air temperature setpoint shall be adjustable on the electronic controller within the controls compartment. Gas heater shall be capable of capacity turndown ratio as shown on the unit rating sheet. Heat trace shall be include on the condensate drain

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J. Filters

1. Unit shall include 4 inch thick, pleated panel filters with an ASHRAE MERV rating of 8, upstream of the cooling coil.
2. Unit shall include 1 inch aluminum mesh pre filters upstream of the outside air opening.
3. Unit shall include a clogged filter switch.
4. Unit shall include a Magnehelic gauge mounted in the controls compartment.

K. Outside Air/Economizer

1. Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Damper assembly shall be controlled by spring return enthalpy activated fully modulating actuator. Unit shall include outside air opening bird screen, outside air hood, and barometric relief dampers.

L. Energy Recovery

1. Unit shall contain a factory mounted and tested energy recovery wheel. The energy recovery wheel shall be mounted in a rigid frame containing the wheel drive motor, drive belt, wheel seals and bearings. Frame shall slide out for service and removal from the cabinet.
2. The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belt.
3. Wheel shall be wound continuously with one flat and one structured layer in an ideal parallel plate geometry providing laminar flow and minimum pressure drop-to-efficiency ratios. The layers shall be effectively captured in stainless steel wheel frames or aluminum and stainless steel segment frames that provide a rigid and self-supporting matrix.
4. Wheel shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Segments shall be removable without the use of tools to facilitate maintenance and cleaning. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel and the wheel shall be connected to the shaft by means of taper locks.
5. All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belts of stretch urethane shall be provided for wheel rim drive without the need for external tensioners or adjustment.

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6. The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in the cassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment. Cassettes shall be listed in the AHRI Certified Products.
7. Energy recovery wheel cassette shall carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory. The first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the factory, whichever is less, shall be covered under the standard AAON limited parts warranty. The remaining period of the warranty shall be covered by Airxchange. The 5 year warranty applies to all parts and components of the cassette, with the exception of the motor, which shall carry an 18 month warranty. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided the Airxchange written instructions for Installation, Operation, and Maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts. Refer to the Airxchange Energy Recovery Cassette Limited Warranty Certificate.
8. Unit shall include 2 inch thick, pleated panel outside air and exhaust air filters with an ASHRAE MERV rating of 8, upstream of the wheels.
9. Hinged service access doors shall allow access to the wheel.
10. Total energy recovery wheels shall be coated with silica gel desiccant permanently bonded by a process without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments. Coated segments shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.

M. Controls

1. Factory Installed and Factory Provided Controller
a. Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested. Controller shall be capable of stand alone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.
b. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.
c. Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.
d. Constant Volume Controller
1. Unit shall modulate cooling with constant airflow to meet space temperature cooling loads.
2. With modulating hot gas reheat, unit shall modulate cooling and hot gas reheat as efficiently as possible, to meet space humidity loads and prevent supply air temperature swings and overcooling of the space.

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e. Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with a touchscreen controller interface. Controller shall be capable of communicating and integrating with a BACnet MS/TP or Modbus RTU network. [AAON Touchscreen Controller]

2.03 CURBS

A. Curbs shall be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit. Curb gasket shall be furnished within the control compartment of the rooftop unit to be mounted on the curb immediately before mounting of the rooftop unit.

PART 3 EXECUTION

3.01 EXAMINATION

A. Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance. See unit IOM.

B. Examine roughing-in of plumbing, electrical and HVAC services to verify actual location and compliance with unit requirements. See unit IOM.

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

3.02 INSTALLATION

A. Installation shall be accomplished in accordance with these written specifications, project drawings, manufacturer's installation instructions as documented in manufacturer's IOM, Best Practices and all applicable building codes.

3.03 CONNECTIONS

A. In all cases, industry Best Practices shall be incorporated. Connections are to be made subject to the installation requirements shown above.

B. Piping installation requirements are specified in Division 23. Drawings indicate general arrangement of piping, fittings and specialties.

C. Duct installation and connection requirements are specified in Division 23 of this document.

D. Electrical installation requirements are specified in Division 26 of this document.

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3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation, to include electrical and piping connections. Report results to A / E in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed Start-Up Checklists as found in manufacturer's IOM.

3.05 START-UP SERVICE

A. Engage a factory authorized service representative to perform startup service. Clean entire unit, comb coil fins as necessary, install clean filters. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.

END OF SECTION

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The Engineer of Record for Classroom Addition, Junior High School, Stuttgart School District, Stuttgart, Arkansas Divisions 26, 27 and 28 of the specifications.

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Section 26 05 00

COMMON WORK RESULTS
FOR ELECTRICAL

PART ONE – GENERAL

1.01 SECTION INCLUDES

A. Basic Electrical Requirements specifically applicable to Division 26 Sections, in addition to Division One Requirements.

B. Work included: This specification includes the furnishing of all labor, materials, tools, equipment, drayage, rigging, fees, permits, etc., unless specifically furnished by others, necessary or reasonably required, for the complete installation and operation of all the work as herein specified or as shown on the Drawings. The entire work shall be delivered in a complete and perfect working order to the satisfaction of the Architect.

C. The scope of the work shall include the general listings as shown below in addition to which this contractor shall furnish and install all required conduit, wire, fittings, boxes, connectors, hangers, supports, sleeves, poles, concrete bases and other such equipment, items, and appurtenances as may be required for a complete and operative system or systems, including all parts auxiliary to the system or systems whether or not specifically set forth herein and/or shown on the drawings.

D. Extent of electrical connections for equipment is indicated by drawings and schedules. Electrical connections are hereby defined to include, but not necessarily limited to, connections for providing electrical power to equipment.

E. Types of electrical power connections specified in this section include the following:

1. Distribution system.
2. Branch circuits.
3. Grounding.
4. Disconnects.
5. Circuit Breakers.
6. Panelboards.
7. To motors.
8. From motor starters to motors.
9. To lighting fixtures and receptacles.
10. To converters, rectifiers, transformers, inverters, and similar current adjustment features of equipment.
11. To ground.
12. To owner furnished, contractor installed equipment.
13. To master units of communication, signal alarm, and public address systems.

F. Junction boxes and disconnect switches required for motors and other electrical units of equipment are specified in applicable Division 26 sections.

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G. Refer to sections of other Divisions for specific individual equipment power requirements.

1.02 Quality Assurance

A. Manufacturers: Firms regularly engaged in manufacturing of electrical connectors and terminals, of types and ratings required, and ancillary connection materials, including electrical insulating tape, and cable ties, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: Qualified with at least 5 years of successful installation experience on projects with electrical connection work similar to that required for project.

C. NEC Compliance: Comply with applicable portions of NEC as to type projects used and installation of electrical power connections (terminals and splices), for junction boxes, motor starters, and disconnect switches.

D. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to electrical connections for equipment.

E. ANSI Compliance: Comply with applicable ANSI standards pertaining to products and installation of electrical connections.

F. Labels: Provide electrical connection products and materials, which have been listed or labeled by a nationally recognized testing laboratory engaged in the testing, listing and labeling of electrical materials and equipment.

1.03 DRAWINGS:

A. The Electrical Drawings show the general arrangement of all piping, equipment and appurtenances and shall be followed as closely as actual building construction and the work of other trades will permit. The work shall conform to the requirements shown on all of the drawings. General and Structural Drawings shall take precedence over Electrical Drawings. Because of the small scale of the Electrical Drawings, it is not possible to indicate all offsets, fittings, and accessories, which may be required. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings, offsets, and accessories as may be required to meet such conditions.

B. The intent of the electrical drawings and specifications is that the subcontractor shall furnish all labor and materials, equipment and transportation necessary for the proper execution of the work unless specifically noted otherwise. The work of this subcontractor as related to the other trades is shown in its majority on the drawings, but this subcontractor shall thoroughly examine the drawings and specifications relating to other trades in order to include all necessary work in his bid. No additional payments shall be considered for failure to properly interpret the responsibility to other trades. The subcontractor shall do all the work shown on the drawings and described in the specifications and all incidental work considered necessary to complete the work ready for use, occupancy, and operation by the Owner. The Architect reserves the right to make any reasonable changes in the locations indicated without cost to the Owner.

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C. If there be conflicting variance between the drawings and specifications, the provisions of the most stringent shall control. In case of conflict between the General Conditions of the Contract or any modifications thereof and the electrical specification, the electrical specification shall control.

1.04 REFERENCES

A. The latest edition of specifications and standards of issues listed below but referred to thereafter by basic designation only, form a part of these specifications:

1. National Electrical Code.
2. National Fire Protection Association's Recommended Practices.
3. Local, City and State Codes and Ordinances.
4. National Electrical Safety Code.
5. Underwriter's Laboratories, Inc.
6. Illumination Engineering Society.
7. Institute of Electrical and Electronic Engineers.
8. Insulated Power Cable Engineers Association.
9. National Electrical Manufacturers Association.
10. Seismic Code Section of the International Building Code.
11. American Society for Testing Materials.
12. Occupational Safety and Health Act.
13. Service requirements of serving utility company.
14. Americans with Disabilities Act. (ADA).
15. ASHRAE/IESNA Standard 90.1.

B. 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.

C. Should any part of the drawings or specifications be found to be in conflict with applicable codes or ordinances, the contractor shall notify the Architect before submitting his bid. After entering into the contract, the Contractor shall complete all work necessary to meet the requirements of all codes or ordinances without additional expense to the Owner.

D. Non-compliance: Should the subcontractor 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 cost arising from correcting the deficiencies.

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1.05 SUBMITTALS

A. Submit under provisions of Section 01 33 23.

B. Contractor shall provide shop drawings and required field drawings as required or instructed by the Architect. Deviation from the drawings and specifications shall be called to the attention of the Architect in writing at the time of submission of shop drawings. The Engineer's approval of any drawings shall not release the subcontractor from responsibility for such deviations. The subcontractor shall check the work described by the catalog data with the engineer's contract documents for deviation and errors. All shop drawings submitted shall bear signed certification that the Contractor has carefully checked shop drawings and found them to be correct and that they comply with plans and specifications. The Architect will not review any shop drawings which are not accompanied by this certification.

C. Proposed Products List: Include Products specified in the following Sections:

1. Switchgear
2. Panelboards
3. Lighting Fixtures
4. Wiring Devices/Coverplates
5. Wire/Cable
6. Intercom
7. Fire Alarm
8. Premise Cabling
9. Access/Surveillance

D. Submit 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 operation 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.

1.06 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 Architect.

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C. All materials and workmanship shall comply with all applicable codes, specifications, local ordinances, industry standards and utility company regulations.

D. 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.

1.07 UTILITY FEES AND REQUIREMENTS

A. The Contractor shall obtain the consent of each serving utility company for the electrical and telecom service connections shown for the project. Each utility shall be requested by the Contractor to examine the contract documents and reply in writing their consent to service.

B. The Contractor shall be responsible for coordinating and providing the exact service equipment and installation methods with the serving Utility prior to bidding. Failure to do so will not constitute sufficient grounds for an authorized change order to the project.

C. Contractor shall furnish and install all conduit, wire, cabinets, weatherheads, etc., as required by local utility company for metering purposes. Contractor shall verify with utility the type, location, and general requirements for metering.

1.08 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions. The Architect/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. Locations and elevations of the various utilities, included within the scope of this work, have been obtained from utility maps and/or other substantially reliable sources and are offered separate from the contract documents as a general guide only, without guarantees as to accuracy. This Contractor shall examine the site and shall verify to his own satisfaction the location and elevation of all utilities and shall adequately inform himself of their relation to the work before entering into a contract.

C. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Architect/Engineer before proceeding.

D. Inspection:

1. The Contractor shall notify the Architect when the work reaches the following stages of construction, so that special inspection of the work may be accomplished prior to the covering up of these items:
   a. All underground or under slab items in place and tested, but not covered.
   b. Interior items prior to being concealed
   c. Tests
2. The Contractor shall give to the proper authorities all requisite notices relating to the work under his charge, shall afford all authorized inspectors every facility for inspection and all violations of the law shall be the responsibility of the Contractor.

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3. All materials and each part or detail of the electrical work shall be subject at all times to observation by the Engineer, and the Contractor shall be held strictly to the true intent of the electrical specifications in regard to quality of materials, workmanship, and the diligent execution of the contract. Such observation may include mill, plant, or shop. The engineer shall be allowed access to all parts of the work and shall be furnished with such assistance and information by the Contractor as is required to make a complete and detailed observation.

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. Upon completion of the work and prior to final payment, the Contractor shall furnish to the Architect, one set of "contractor revised" reproducibles, legibly and accurately marked to indicate all changes and additions.

C. 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 of extras after the contract is signed, by reason of unforeseen conditions.

1.10 SHOP DRAWINGS

A. The Contractor shall submit to the Architect for approval, a list of all equipment he proposes to furnish, together with descriptive literature, capacities, manufacturer's name, approximately delivery date and any other pertinent facts concerning the various items. The submittal shall consist of a tabulation of all items included, followed by catalog and data sheets, wiring diagrams, etc. Piecemeal submittals will be returned without consideration. Shop drawings are required even though the equipment is as specified. Refer to specification Section 01 33 23 – Shop Drawings, Product Data & Samples for submittal procedures.

B. The equipment listed herein or on the drawings will be furnished as specified unless scheduled "or equal". If "or equal" is indicated, the product of any reputable manufacturer regularly engaged in the commercial production of the specified equipment will not be excluded on the basis of minor differences, provided all essential requirements of this specification relative to materials, limitations of available space for equipment, capacity, and performance are met. The Contractor shall be responsible for any and all additional costs required by modifications to architectural, structural, mechanical or electrical facilities, devices, systems, etc. resulting from the approved substitution.

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C. Wherever the substituted equipment actually furnished under these specifications requires the use of larger connections, more connections, or a different connection arrangement than indicated on the drawings or specified under these specifications, the Contractor shall furnish a scaled drawing showing how he proposes to install substituted equipment. Drawings shall show clearances and be coordinated with other mechanical and electrical equipment in the space. Should a substitution require the Architect or Engineer to provide additional services to accommodate it, the Contractor shall be responsible for costs incurred by the Architect or Engineer. Should a substitution be approved for use in lieu of that specified and should the substitute material prove defective or otherwise unsatisfactory, in judgement of the engineer, for the service required within the guaranty period, the contractor shall replace the material or equipment as originally specified without additional cost to the Owner.

D. The subcontractor shall abide by the engineer's judgement when proposed substitute materials or items of equipment are judged to be unacceptable and shall furnish the specified material or item of equipment in such case. All proposals for substitution shall be submitted in writing by the General Contractor and not by the electrical subcontractor or material suppliers. The engineer will approve or disapprove proposed substitution in writing within a reasonable time and, if any request for a substitution is rejected, the Contractor shall automatically furnish material specified. No substitute materials shall be used unless approved in writing.

E. Electrical Distribution Equipment submittals must be typewritten and factory approved. Long hand submittals and field sketches will not be accepted. Submittals shall indicate proper numbering sequence of all circuit breakers. Submittals not reflecting the sequence will be returned without further consideration.

F. The Contractor shall submit shop drawings to the Architect in accordance with the schedule prepared by the General Contractor but not later than 30 calendar days after the date of the agreement. Failure to submit shop drawings within 30 days, shall disqualify the Contractor from substituting specified equipment.

G. If submittals are "not approved" or marked "revise and resubmit", the complete package must be corrected and returned for review. Partial submittals, including only the items not approved, are not acceptable.

H. The contractor shall not install any equipment or materials until the shop drawings for the equipment or materials have been approved.

1.11 INSTRUCTIONS OF OWNER'S REPRESENTATIVE: The Contractor shall instruct the representative of the Owner in the proper operation and maintenance of all elements of the mechanical and electrical systems. A competent representative of the Contractor shall spend sufficient time in such formal instruction to fully prepare the Owner to operate and maintain the Electrical Systems.

1.12 OPERATING AND MAINTENANCE MANUALS

A. After approval of materials and equipment for use in this project, a copy of an Operation and Maintenance Manual shall be submitted for approval.

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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. Performance curves and rating data
   e. 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
   f. Spare parts list (when parts are provided)
   g. Listing of part suppliers and their addresses
   h. Single line diagram of the "as-built" building electrical distribution system. This diagram shall indicate the locations of the check-metering access points as required by ASHRAE/IESNA.
   i. A transformer loss calculation estimate of each transformer installed on the project if the total capacity of all transformers utilized exceeds 300 KVA in accordance with ASHRAE/IESNA.
   j. Submit fire alarm system components inspection testing forms and system certification forms as required by NFPA 72.

C. Upon final approval, submit one (1) bound copy of the approved Operation and Maintenance Manual to the Architect and hold two (2) copies for instruction of Owner as hereinafter specified.

1.13 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 Architect, provide any service incidental to the proper performance of the electrical systems under guarantees outlined above for a period of one (1) year.

1.14 WARRANTY: The Contractor shall, after completion of the original test of the installation, and acceptance by the Architect, provide any service incidental to the proper performance of the plumbing, air conditioning, ventilating, heating and control systems under guarantees outlined above for a period of one (1) full year after acceptance by the Architect and Owner. Regardless of anything to the contrary in warranties by the equipment manufacturer involved, the Contractor's warranty shall run for one full year after final acceptance by the Architect.

1.15 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

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B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.16 ELECTRICAL LICENSE REQUIREMENT

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

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

1.17 ELECTRONIC DRAWING FILES: Electronic drawing files will be available to the Contractor, Sub-Contractors, and/or Vendors to prepare shop drawings, etc. An AutoCAD Release Form will be submitted for signature *prior to any drawing files released*.

PART TWO - PRODUCTS

2.01 GENERAL EQUIPMENT AND MATERIALS

A. All materials shall be new and shall bear the manufacturer's name, trade name and the UL label in every case where a standard has been established for the particular material. The equipment to be furnished under each section of the specification shall be essentially the standard product of a manufacturer regularly engaged in the production of the required type of equipment, and shall be the manufacturer's latest approved design.

B. When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer. Equipment and materials of the same general type shall be of the same make throughout the work to provide uniform appearance, operation and maintenance. Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.

C. In order to establish standards of quality, the engineer has, in the detailed specifications referred to certain products by name and catalog number. This procedure is not to be construed as eliminating from competition other products of equivalent or better quality by other manufacturers where fully suitable in design. Where multiple manufacturing sources are shown on the drawings or herein specified, the subcontractor shall limit his bid to one of those manufacturers.

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D. Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

E. Asbestos products or equipment or materials containing asbestos shall not be used.

F. Equipment and materials shall be delivered to the site and stored in the original containers, suitably sheltered from the elements. Items subject to moisture damage (such as controls, dry transformers, breakers, etc) shall be stored in dry, heated spaces.

G. Equipment shall be tightly covered and protected against dirt, water, and chemical or mechanical injury and theft. At the completion of the work, fixtures, equipment, and materials shall be cleaned and polished thoroughly. Damage or defects developing before acceptance of the work shall be made good at the Contractor's expense.

H. It shall be the responsibility of the Contractor to insure that items to be furnished fit the space available. The Contractor shall make necessary field measurements to ascertain space requirements, including those for connections, and shall furnish and install such sizes and shapes of equipment that the final installation shall suit the true intent and meaning of the Drawings and Specifications.

I. Manufacturer's directions shall be followed completely in the delivery, storage, protection, and installation of all equipment and materials. Should the Contractor perform any work that does not comply with the manufacturer's directions, he shall bear all costs arising in correcting the deficiencies.

2.02 MATERIALS AND COMPONENTS

A. General: For each electrical connection indicated on drawings, provide complete assembly of materials, including but not necessarily limited to pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories as needed to complete splices and termination of types indicated.

1. Raceway, Tubing and Fittings:

   General: Provide conduit, tubing and fittings of types, grades, sizes and weights (wall thickness) indicated for each type service / connections shown. Where types and grades are not indicated, provide proper selection to fulfill wiring requirements complying with the latest Electrical Codes, as well as, requirements listed under Division 26 "Raceway and Boxes for Electrical Systems" section.

B. Wire, Cable and Connectors:

1. General: Provide wires, cables and connectors complying with Division 26 "Electrical Power Conductors and Cables".
2. Wire: Unless otherwise indicated, provide wires/conductors for final electrical connections, which match wires/conductors of the wire supplying power to the equipment, device, appliance, etc.

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2.03 EQUIPMENT ACCESSORIES

A. The Contractor shall furnish and install all equipment, accessories, connections, and incidental items necessary to fully complete the work, ready for use, occupancy and operation by the Owner, whether or not specifically shown on the plans or herein specified.

B. Connections: All final connections to equipment shall be installed as required by the manufacturer and/or Vendor.

C. Equipment furnished under other Sections: This Contractor shall furnish all necessary material and labor for the connection to the mechanical and electrical systems of all fixtures and equipment requiring such connections, and which fixtures and equipment are furnished by the Owner or are specified under other section of these specifications. If any such fixtures or equipment are not delivered prior to final acceptance, the services shall be capped or plugged at walls or floors as directed, and shall be left ready for future connection.

D. Provide electrical insulating tape, heat-shrinkable insulating tubing and boots, wire nuts and cable ties as recommended for use by accessories manufacturers for type services indicated.

E. Connections Different From Those Shown: Where equipment requiring different arrangement or connections from those shown is approved, it shall be the responsibility of the Contractor to install the equipment to operate properly with the intent of the drawings and specifications. When directed, the Contractor shall submit drawings showing the proposed installation. If the proposed installation is approved, the Contractor shall make all incidental changes. The Contractor shall provide any additional equipment required for the proper operation of the system resulting from the selection of equipment, including all required changes in affected trades. The Contractor shall be responsible for the proper location of roughing in and connections by other trades. All changes shall be made at no increase in the contract amount or additional cost to the other trades.

2.04 LIGHT FIXTURES

Contractor shall furnish, install and adjust complete and ready to operate each and every light fixture shown and scheduled on the drawings.

A. This Contractor shall exercise extreme care in laying out his work so as to insure that ceiling outlets are located symmetrically within the area and with respect to air conditioning, heating, and ventilating outlets, tile patterns, finishes, etc. Any errors shall be corrected at no additional cost. This contractor shall check with the ceiling contractor for type of ceiling and order fixtures that are compatible with ceiling material as required to support fixtures. See reflected ceiling plan for exact location of fixtures.

B. The orientation of light fixtures in the same space shall match and be approved by Architect.

C. Contractor shall provide 0-10V low-voltage wiring to all fixtures throughout entire circuit whether shown or not.

D. Occupancy sensor and lighting control manufacturers specified shall provide layout shop drawings prior to beginning work.

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PART THREE - EXECUTION

3.01 COORDINATION OF WORK

A. The Contractor shall compare the Electrical Drawings and Specifications with the drawings and specifications for other trades and shall report any discrepancies between them to the Architect and obtain written instructions for changes necessary in the Electrical Work. The Electrical Work shall be installed in cooperation with other trades installing related work. Before installation, the Contractor shall make proper provision to avoid interferences. All changes required in the work of the Contractor caused by a failure to coordinate the work with other trades shall be made by the Contractor at his own expense.

B. Anchor bolts, sleeves, inserts and supports that may be required for the Electrical Work shall be furnished under the same section of the specifications as the respective items to be supported, and they shall be installed, except as otherwise specified, by the trade furnishing and installing the material in which they are to be located. Location of anchor bolts, sleeves, inserts and supports shall be directed by the trade requiring them, which trade shall also insure that they are properly installed. Any expense resulting from the improper location or installation of anchor bolts, sleeves, inserts and supports shall be paid for by the Contractor under the section of the specifications for the trade with the responsibility for directing their proper location.

C. Sleeves: All conduits passing through masonry construction shall be fitted with 20 gauge galvanized steel sleeve. Each sleeve shall extend through its respective floor or wall, and shall be cut flush with each surface, except floor sleeves which shall be extended to a minimum of 1 inch above the floor. Unless otherwise noted, the sleeve shall be two sizes larger than the overall outside diameter of the conduit. Sleeves thru non-fire rated structure may be PVC. Sleeves in walls below grade shall be a pre-engineered assembly equal to LINK-SEAL as manufactured by Thunderline Corporation; assembly shall be sized and installed in accordance with manufacturer's recommendations. All sleeves shall be fastened in place prior to pouring concrete and caulked with flexible caulking or LINK-SEAL device as applicable. Sleeves or conduits shall not be installed in spread footing. Core drilling will not be permitted without consent of the structural engineer. Sleeves in grade beams shall be installed near center.

D. Firestopping:

1. All fire walls, fire barriers, fire partitions, upper floors of multi-story buildings where pipe or ducts pass through, into, or out of, shall be protected by an approved penetration firestop system installed as tested in accordance with ASTM E 814, with a minimum positive pressure differential of 0.01 inch of water and shall have an F rating of not less that the required fire-resistance rating of the wall penetrated.
2. A UL approved firestop system shall be as specified by 3M Fire Protection Products, SpecSeal Firestop Products, or approved equal.
3. Firestopping material and method of installation shall be submitted to the Architect for approval.
4. Steel electrical boxes in fire walls, barriers or partitions shall be covered on the back with UL classified putty pads.
5. Cable tray penetrations thru fire walls, barriers and partitions shall be sealed with removable intumescent firestop pillows.

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E. Slots, chases, openings and recesses through floors, walls, ceilings and roofs as specified will be provided by the various trades in their respective materials, but the trade requiring them shall see that they are properly located, and shall do any cutting and patching caused by the neglect to do so. Slots, chases, openings and recesses in existing structures shall be cut by the trade requiring them and patched and repaired by that trade. No structural member shall be disturbed in any manner without written permission of the Architect.

F. Where electrical items penetrate the roofing, the Contractor shall coordinate location and size as required for factory vent flashing assembly to be furnished and installed by the Roofing Contractor in strict accordance with the Roof Manufacturer's recommendation. If single ply membrane roof is used, Contractor shall use factory pipe flashing assembly as recommended by Roofing Manufacturer. Coordinate locations with Roofing Contractor.

G. Locations of conduits and electrical equipment, etc. shall be adjusted to accommodate the work and to avoid interferences anticipated and encountered. The Contractor shall determine the exact route and location of each conduit and equipment gear prior to installation.

1. Right-of-Way: General and structural components have right of way. Equipment and piping whose elevations cannot be changed shall have the right of way over equipment and piping whose elevations can be changed. The Contractor shall coordinate the location of all electrical gear and piping with all trades prior to installation.
2. Offsets, transitions and changes in direction in pipes and ducts shall be made as required to maintain proper head room and pitch of sloping lines whether or not indicated on the drawings. The Contractor shall furnish and install all traps, air vents, sanitary vents, etc., as required to effect these offsets, transitions and changes in direction.

H. Installation and Arrangement: The Contractor shall install all Electrical Equipment to permit removal (without damage to other parts). Provide adequate access to all other parts requiring periodic replacement or maintenance. The Contractor shall arrange equipment to permit ready access to components and to clear the openings of swinging and overhead doors and of access panels.

I. Coordination Drawings: The Contractor shall furnish detailed coordination drawings for all congested areas including but not limited to Mechanical Rooms and Electrical Rooms. Coordination drawings shall indicate room dimensions, support column locations and space requirements for installation and access. Include the following:

1. Planned equipment layout.
2. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
3. Equipment and accessory locations, service connections, and support details.
4. Exterior wall and foundation penetrations and sleeve locations.
5. Sizes and location of required concrete pads and bases.
6. Floor plans, elevations, and details to indicate penetrations in floors, walls, and roofs and their relationship to other penetrations and installations.
7. Layout shall include all other trades impacting the Electrical work.

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J. Access: The Contractor shall provide all necessary access panels in walls, ceilings, equipment, etc., as required for inspection of interiors and for proper maintenance and or installation of equipment. Where changes from the plans are made by the Contractor in the installation of his work, he shall provide any and all access panels required as a result of these changes.

K. Drawings by Contractor: When directed by the Architect, the Contractor shall submit for approval by the Architect drawings clearly showing the Electrical Work and its relation to the work of other trades before commencing shop fabrication or erection in the field.

L. Cleanup: The contractor shall remove his tools, machinery, debris, etc., from the premises when his part of the work is finished. He shall leave the premises free of all obstructions and hindrances.

3.02 INSTALLATION OF ELECTRICAL CONNECTIONS

A. Install electrical connections as indicated; in accordance with connector manufacturer's written instructions and with recognized industry practices, and complying with requirements of NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.

B. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Wherever possible, mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.

C. Coordinate installation of all required electrical connections for equipment with equipment supplier.

D. Cover splices with electrical insulation equivalent to, or of higher rating, than insulation on conductors being spliced.

E. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated.

F. Trim cables and wires, as short as practicable and arrange routing to facilitate inspection, testing and maintenance.

G. Tighten wire-binding connector screws firmly.

H. Terminals for Designed Use: Each cable, conductor or wire shall terminate in a lug designed for that particular use: (i.e., one conductor per lug unless lug is designed to have additional conductors installed).

I. Check and re-tighten all splices, joints, terminations and connections originally installed by the manufacturer, where bolted, threaded or other mechanical means were used to secure joints and splices.

1. This shall include, but not be limited to: main services entrance equipment, distribution panels, branch circuit panels, motor control centers, transfer switches, etc.

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J. Provide flexible conduit for motor connections, and for other electrical equipment connections where subjected to movement and vibration. The Contractor shall isolate motor starters, conduits, fixture ballasts, transformers, equipment, etc., as required to insure an acceptable noise level free from objectionable vibration.

K. Provide liquid-tight flexible conduit for connection of motors and for other electrical equipment in all central plants, boiler rooms, and where subject to movement and vibration, and also where subjected to one or more of the following conditions:

Exterior location.
Moist or humid atmosphere where condensate can be expected to accumulate.
Corrosive atmosphere.
Subjected to water spray.
Subjected to dripping oil, grease, or water.

L. All circuits shall contain a dedicated neutral - no sharing.

M. All circuits on the emergency power system shall be kept separate from normal circuits.

3.03 600 VOLT INSULATION TEST

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. The test shall be scheduled in advance with the Architect/Engineer. A test report shall be submitted to the Architect/Engineer for approval. The minimum insulation resistance for all conductors shall be 1,000,000 ohms. Conductors testing below the minimum insulation resistance shall be replaced and tested again.

3.04 CONTINUITY TEST

The Contractor shall perform a continuity test on the entire electrical system prior to energizing the system to insure proper cable connections. Contractor to verify, test and demonstrate all low-voltage wiring connections, including AV, prior to energizing system. Contractor is responsible for any damage or labor that results.

3.05 CONNECTION TORQUE TESTS

All larger conductor bolted connections shall be torque tested using a torque wrench. Torque shall be to National Electrical Testing Association's (NETA) Standards.

3.06 REMOVAL OF RUBBISH

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.

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3.07 FIRE ALARM SYSTEM TEST

The fire alarm system shall be tested by the company responsible for the installation and shall submit a certification that the system operates properly.

3.08 GROUND RESISTANCE MEASUREMENTS

A. Ground resistance measurements of each ground rod shall be taken and certified by the Contractor to the Architect. 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 Architect. 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.

B. Contractor shall provide actual ground-fault injection testing for service disconnects with ground-fault tripping.

3.09 MECHANICAL OPERATION TESTS

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.

3.10 ROTATIONAL TESTS

The Contractor shall assist Mechanical Contractor in performing rotational tests on all motors provided under this contract. 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.

3.11 CUTTING AND PATCHING

A. Under each Section of the specifications, the Contractor shall be responsible for all required digging, cutting, etc., incident to his work under that Section, and shall make all satisfactory repairs, but in no case shall the Contractor cut into any major structural element, beam or column.

B. Pavements, sidewalks, roads and curbs shall be cut, patched, repaired and/or replaced as required to permit the installation of the work of the various trades and such cutting, patching, repairing and replacing shall be the responsibility of and paid for by the Contractor under the Section of the specifications for the trade requiring the work.

C. Each trade shall bear the expense of all cutting, patching, repairing or replacing of the work of other trades required because of his fault, error or tardiness or because of any damage done by him.

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D. Where holes in concrete floors are more than 1/2 inch diameter larger than conduit, the excess openings shall be filled or covered with damp-mix mortar or concrete to a thickness of a least 5 inches.

3.12 EXCAVATION AND TRENCHING FOR ELECTRICAL CONDUIT

A. The Contractor shall perform all excavation of every description and of whatever substances encountered to the depths indicated on the drawings or as otherwise specified. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. Such grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations, and any water accumulating therein shall be removed by pumping or by other methods. Unless otherwise indicated, excavation shall be by open cut except that short sections of a trench may be tunneled if the conduit or sleeves can be safely and properly installed and backfill can be properly tamped in such tunnel sections. Refer to Division 31 - Earthwork for additional requirements.

B. This specification and the drawings in no way imply as to the conditions of the soil to be encountered. When excavating may be required in execution of the work, this contractor agrees that he has informed himself regarding conditions affecting the work and labor and materials required, without recourse to any representation as to soil conditions that may appear, or seem to be implied, in any portion of the contract documents.

C. Trench Excavation: Trenches shall be of necessary width for proper laying of the conduit, and the banks shall be as nearly vertical as practical. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for the conduit on undisturbed soil at every point along its entire length. Except where rock is encountered, care shall be taken not to excavate below the depths indicated. Where rock excavations are required, the rock shall be excavated to a minimum overdepth of 4 inches below the trench depths indicated on the drawings, or specified. Overdepths in the rock excavation and unauthorized overdepths shall be backfilled with loose, granular, moist earth, thoroughly tamped. Whenever wet or otherwise unstable soil that is incapable of properly supporting the pipe is encountered in the bottom of the trench, such soil shall be removed to the depth required and the trench backfilled to the proper grade coarse sand, fine gravel or other suitable materials, as hereinafter specified.

D. Depth of Cover: Trenches for utilities shall be of a depth that will provide the following minimum depths of cover from existing grade or from indicated finish grade, whichever is lower, unless otherwise specifically shown.

Voltage	Depth (Minimum)
600 and below	30 inches
600 to 15,000	36 inches

E. Protection of Existing Utilities: Existing utility lines to be retained that are shown on the Drawings or the locations of which are made known to the Contractor prior to excavation, as well as all utility lines uncovered during excavation operations, shall be protected from damage during excavation and backfilling, and if damaged, shall be repaired by the Contractor at his expense.

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3.13 BACKFILLING OF TRENCHES

A. Trenches shall not be backfilled until all required pressure and other tests have been performed, witnessed by the Architect, and until the utilities systems as installed confirm to the requirements of the drawings and specifications.

B. Contractor shall perform all excavations of every description and of whatever substances encountered, to the depths indicated on the drawings and required for the installation of his portion of the utilities systems. Wherever possible, all exterior lines shall be installed with a minimum of 24" of cover, unless shown otherwise. All excavated materials not required for fill or backfill shall be removed and wasted as directed by the Architect. All excavations shall be made by open cut. The banks of trenches shall be kept as nearly vertical as practicable and where required shall be properly sheeted and braced. Rock shall be excavated to a minimum overdepth of 4" below the trench depths specified. The overdepth rock excavation shall be backfilled with loose, moist earth, thoroughly tamped. All grading in the vicinity of excavations shall be controlled to prevent surface ground water from flowing into the excavations. Any water accumulated in the excavations shall be removed by pumping, or by other approved method.

C. Normal Backfill: Where compacted backfill is not specified the trenches shall be carefully backfilled with the materials approved for backfilling (See appropriate section), deposited in 6” layers and thoroughly and carefully rammed until the pipe has a cover of not less than one foot. The remainder of the backfill material shall then be carefully placed in the trench in one foot layers and tamped. Settling the backfill with water will not be permitted. The surface shall be graded to a reasonable uniformity and the mounding over trenches left in a uniform and neat condition. Surface condition shall be equipment to match the existing condition prior to trenching (sod, asphalt, etc.).

D. Compacted backfill shall be used under slabs on grade, building structure, concrete paving and asphaltic concrete paving. The soils used in the fill shall be granular in nature and shall not contain roots, sod, rubbish or stones over 1-1/2” maximum dimension.

1. Required Density:

    a. All fills shall be compacted to a dry density equal to at least 90% of the maximum density determined in accordance with the Modified AASHO Method of Compaction. The maximum density and optimum moisture content shall be determined on the basis of laboratory tests conducted on the materials used in the fill.
    b. Modified AASHO Compaction Method provides that soil samples be compacted in 5 equal layers in a standard compaction cylinder having a volume of 1/30 cu. ft. using twenty-five (25) 18” blows of 10 pound rammer to compact each layer.

2. Control Tests: Adequacy of compaction shall be determined on the basis of in-place density determinations that are to be conducted while the fills are being placed. The results of these tests shall be the basis on which satisfactory completion of the work is judged. Should the fills fail to meet the specified densities, the Contractor shall remove and recompact the soils until the specified densities are achieved.
3. Equipment: The choice of compaction equipment shall be made by the Contractor; however, the equipment shall be adequate for achieving the specified densities. Use of hand-operated, power-driven compaction equipment may be necessary at locations inaccessible to roller-type equipment.

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3.14 CONSTRUCTION PHASING

A. The Contractor shall refer to the General Requirements of this specification and prepare all work schedules required to perform all work as shown on the Drawings and as herein specified.

B. All services such as, but not limited to, lighting, power and signaling shall be maintained to all areas of the building during this Contract. Temporary service connections will be required where necessary to maintain these services. The Contractor will make these connections as required to provide continuous service.

C. This contractor shall furnish and install temporary construction power wiring as required to provide sufficient power and lighting for all construction needs. Temporary electrical service shall be obtained in the name of the General Contractor and it will be the General Contractor's responsibility to pay all power company charges. The temporary service shall be obtained from the local utility company. All receptacles shall be grounding type. Provide temporary lighting as required or directed by the Architect for adequate illumination for construction purpose.

D. It will be the responsibility of the Contractor to carefully review the drawings, specifications and existing conditions with reference to these types of services so that the building may function normally during the construction process.

3.15 SAFETY

A. The electrical subcontractor is completely responsible for how all his work is performed; safety, in, on, or about the job site; methods of work performance; and timeliness in such performance. In the event he is unsatisfied with the performance and/or cooperation of other trades, he shall set forth such complaints in writing for the Architect's review. In no event shall this subcontractor expect to be specifically directed in the protection of personnel or material by the Owner, Architects, or Engineer.

3.16 ELECTRICAL WIRING METHODS / CONNECTIONS

A. The electrical wiring for the mechanical equipment furnished by others is separated into two main wiring divisions: (1) Power wiring by electrical contractor, and (2) control wiring below 120V by the mechanical contractor.

1. Power wiring shall be the energy source and include installation of circuit protective devices, motor starters or controllers, conduit, wiring and safety disconnects from the power supply, and termination at the motor or appropriate terminals on the equipment. This also includes all 120V control wiring.
2. Control wiring shall comprise all wiring not included in power wiring and below 120V. This wiring shall specifically include all automatic temperature control wiring, safety pilot interlocking wiring, push button starting, pilot light and signal wiring, etc., that is not included as part of pre-wired equipment but necessary for the proper operation and safety of the equipment. All conduit, boxes, etc., required for control wiring shall be provided and installed by the electrical contractor.

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B. The mechanical contractor shall furnish to the electrical contractor all magnetic motor starters and operators for installation and connection by the electrical contractor except for kitchen hood interlock system. (See wiring diagrams on drawings). Electrical contractor shall interlock 120V or above wiring between fans and operable louvers. Electrical contractor to furnish all manual motor starters.

C. Wherever equipment is shown requiring electrical connection as specified, all wiring shall be furnished and installed under this section of the specifications. Starting switches, protective devices, and other means for the operation and control of equipment shall be furnished under the various sections and installed under the ELECTRICAL SECTION unless specifically noted otherwise on the Drawings.

D. Additional disconnects required by the National Electrical Code shall be furnished, installed and connected under the ELECTRICAL SECTION. Motor terminal or equipment connection shall terminate in a junction box or disconnect adjacent to the equipment.

3.17 DEMOLITION

A. Remove all branch and feeder conduit and wire back to panelboards.

Where walls, ceilings, or floors are to remain remove all devices and wire where indicated. Provide blank cover plate at outlet box.

B. 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.

C. 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.

D. 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.

E. Demolition includes complete wrecking of structures and removal and disposal of demolished materials, as shown on drawings and herein specified.

F. Interior demolition includes complete wrecking of interior partitions, work above ceilings, finishes, and structures and removal and disposal of demolished materials, as shown on drawings and herein specified.

G. The Owner shall have the option of retaining any items removed. The Contractor shall deliver these items to the Owner’s designated storage area. Any items not retained by the Owner shall be disposed of off site by the Contractor.

3.17.1 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:

Transport materials removed from demolished structures and dispose of off site.

3.17.2 Job Conditions

A. Condition of Structures: The Owner assumes no responsibility for actual condition of structures to be demolished. 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. 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. 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 and Building Services: Maintain existing utilities and building services 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 and/or services serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction (Owner). Provide temporary services during interruptions to existing facilities, as acceptable to governing authorities (Owner).
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 service to that area.

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3.18 PAINTING

A. The Contractor shall remove all rust, oil and grease from exposed surfaces and clean all apparatus or materials specified to be painted under this section of the specifications. Contractor shall paint equipment, piping, etc., in accordance with Division 9. Equipment specified to have factory finishes shall be protected until completion of the Contract, with Contractor being responsible for maintaining finishes.

B. Apply paint to exposed piping according to the following, unless otherwise indicated:

4. Interior, Ferrous Piping: Use semi-gloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
5. Interior, Galvanized-Steel Piping: Use semi-gloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
6. Interior, Ferrous Supports: Use semi-gloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
7. Exterior, Ferrous Piping: Use semi-gloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
8. Exterior, Galvanized-Steel Piping: Use semi-gloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
9. Exterior, Ferrous Supports: Use semi-gloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.

C. Do not paint piping specialties with factory-applied finish.

D. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

F. Galvanized surfaces damaged during installation shall be repaired with a galvanized repair compound complying with Mil Spec DOD-P-21035B. Any equipment scratched, marred or damaged will be repainted to the original condition.

3.19 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.

END OF SECTION

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Section 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART ONE - GENERAL

1.01 GENERAL

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division One Specification sections, apply to work of this section.

B. This section is a Division 26 Common Work Results for Electrical section, and is part of each Division 26 section making reference to wires and cables specified herein.

1.02 DESCRIPTION OF WORK

A. Extent of electrical wire and electrical cable work is indicated by drawings and schedules.

B. Types of wire, cable and connectors in this section include the following:

1. Copper conductors
2. Fixture wires
3. Pigtail type connectors
4. Tap type connectors
5. Split-bolt connectors

C. Applications for wire, cable and connectors in the section required for project are as follows:

1. Power distribution circuitry
2. Lighting circuitry
3. Appliance and equipment circuitry
4. Motor-branch circuitry
5. Fire alarm circuitry

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacturer of electrical wire and cable products of types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: Qualified with at least 5 years of successful installation experience on projects with electrical wiring work similar to that required for project.

C. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wire, cable and connectors.

D. UL Compliance: Comply with UL standards pertaining to wire, cable and connectors.

E. UL Labels: Provide electrical wires, cables and connectors which have been UL-listed and labeled.

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F. NEMA/ICEA Compliance: Comply with applicable portions of NEMA/Insulated Cable Engineers Association standards pertaining to materials, construction and testing of wire and cable.

G. ANSI/ASTM: Comply with applicable portions of ANSI/ASTM standards pertaining to construction of wire and cable.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's data on wires and cables including dimensions, capacities, ratings, performance characteristics, gages and installation instructions.

PART TWO - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type of wire, cable and connector):

1. Wire and Cable:
   a. Advance Wire and Cable, Inc.
   b. Cerro Wire and Cable Co.
   c. Electrical Conductors, Inc.
   d. General Cable Corp.
   e. Hitemp Wires, Inc.
   f. Rome Cable Corp.
   g. Southwire Company
   h. Triangle PWC, Inc.
2. Connectors:
   a. AMP, Inc.
   b. Burndy Corp.
   c. Gould, Inc.
   d. Ideal Industries, Inc.
   e. O-Z/Gedney Co.
   f. Pyle National Co.
   g. Thomas and Betts Co.

2.02 WIRE, CABLE AND CONNECTORS

A. General: Except as otherwise indicated, provide wire, cable and connectors of manufacturer's standard materials, as indicated by published product information; designed and constructed as recommended by manufacturer, and as required for the installation.

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B. Wire:

1. Provide factor-fabricated wire of sizes, ratings, materials and types indicated for each service. Where not indicated, provide proper selection as determined by Owner to comply with project's installation requirements and NEC standards. Select from the following types, materials, conductor configurations, insulation and coverings:

UL Type: THHN
UL Type: THW
UL Type: THWN
UL Type: XHHW

Material: Copper

Conductors: Solid (AWG 12 & AWG 10 only).
Conductors: Concentric-lay-standard (standard flexibility).
Outer Covering: Cross-link polyethylene
Outer Covering: Thermoplastic

2. Conductors to be color coded as follows:

120/208 Volt Conductors:
Phase A - Black
Phase B - Red
Phase C - Blue
Neutral - White

Isolated Ground - Green with Orange Stripe
Equipment Ground - Green

277/480 Volt Conductors:
Phase A - Brown
Phase B - Orange
Phase C - Yellow
Neutral - Gray
Equipment Ground - Green

C. Cable:

1. Provide factory-fabricated cable of sizes, ratings, materials, and jacketing/sheathing as indicated for each type service. Where not indicated, provide proper selection as determined by Engineer to comply with installation requirements and NEC standards.

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D. Connectors:

1. General: Provide factory-fabricated, metal connectors of sizes, ratings, materials, types and classes as indicated for each service. Where not indicated, provide proper selection as determined by Engineer to comply with installation requirements and NEC standards. Select from the following types, classes, kinds and styles.

Type: Pressure
Type: Crimp
Type: Threaded

Class: Insulated
Class: Non-insulated

Kind: Copper

Style: Butt connection
Style: Elbow connection
Style: Combined "T" and straight connection.
Style: Insulation-piercing tap connection.
Style: Split-bolt parallel connection
Style: Tap connection.
Style: Pigtail connection

2. If conductors are larger than set screw terminal provisions in panelboards, switches, etc., contractor shall furnish Burndy Type YE-P compression adaptors or AYP connectors as required. Adaptor shall match aluminum or copper as required. Cutting strands of conductors will not be allowed.

PART THREE - 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 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 liquid tight flexible conduit.

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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 THHN/THWN insulation in raceway.

E. Use wiring methods indicated on Drawings.

3.04 INSTALLATION:

A. Install products in accordance with manufacturers instructions.

B. Use solid conductor for feeders and branch circuits 10 AWG and smaller.

C. Use stranded conductors for control circuits 24 volts and below. Minimum size shall be 16 AWG or as indicated on the drawings.

D. Use conductor not smaller than 12 AWG for power and lighting circuits (including all fixture whips) and 120 volt control circuits.

E. Conductors shall be continuous from outlet to outlet.

F. Use 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.

G. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet.

H. Pull all conductors into raceway at same time.

I. Use suitable wire pulling lubricant for building wire 4 AWG and larger.

J. Protect exposed cable from damage.

K. Support cables above accessible ceiling, unistrut, bridle rings, and cable ties to support cables. Do not rest cable on ceiling panels.

L. Use suitable cable fittings and connectors.

M. Neatly train and lace wiring inside boxes, equipment, and panelboards.

N. Clean conductor surfaces before installing lugs and connectors.

O. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

P. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape as follows:

1. Make a smooth assembly with 3-M Scotchfil insulating putty. Putty to fill all voids and be tapered to wire insulation to form a smooth transition.
2. Finish with two (2) one-half lapped layers of Scotch 33+ plastic tape.

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Q. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

R. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

S. Route circuits at own discretion; however, circuit numbers shall be according to Drawings.

T. On three phase systems, no more than 3 circuits are allowed in any one conduit without written permission from the Engineer.

U. On single phase systems, no more than 2 circuits are allowed in any one conduit without written permission from the Engineer.

V. Common neutrals are not allowed unless otherwise noted. Each circuit shall have a dedicated neutral. Neutral conductors shall be of same size as phase conductors unless specifically noted otherwise.

W. All parallel conductors shall be of the same length, of the same conductor material, circular - mil area, same insulation type and terminated in the same manner. No parallel conductors smaller than #1/0 are acceptable.

X. This subcontractor is warned to adhere strictly to the circuitry shown on the plans to achieve optimum system balance. Failure to properly circuit according to plans shall result in rewiring as directed at no additional cost to the Owner.

Y. Insulation resistance tests shall be made in accordance with the National Electrical Code in the presence of the Architect or his representative, and the results filed with the Architect and Engineer before final acceptance.

Z. Run conductors of same circuit in same conduit.

AA. Run conductors of different voltage system in separate conduits.

BB. All wire installed on the load side of branch GFI circuit breakers and isolation power panels shall be type “XHHW” or “XLP”. Use of pulling compound on these conductors is prohibited.

3.05 INTERFACE WITH OTHER PRODUCTS:

A. Identify wire and cable under provisions of Section 26 05 53.

B. Identify each conductor with its circuit number of other designation indicated on Drawings in each junction box and in each panelboard.

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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 measurements with manufacturer's recommended values.

D. Verify continuity of each branch circuit conductor.

3.07 PROHIBITED USES:

A. Types AC and MC cables.

B. Types NM, NMC, and NMS cables.

END OF SECTION

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Section 26 05 26

GROUNDING AND BONDING
FOR ELECTRICAL SYSTEMS

PART ONE - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division One Specification section apply to work of this section.

B. Division 26 – Common Work Results for Electrical sections apply to work specified in this section.

1.02 DESCRIPTION OF WORK:

A. Extent of grounding and ground-fault protection work is indicated by drawings and schedules.

B. Types of grounding and ground-fault protection in this section include the following:

1. Grounding:
   a. Metal building frames.
   b. Separately derived systems.
   c. Enclosures.
   d. Systems.
   e. Equipment.
2. Ground-Fault Protection:
   a. Ground-fault circuit interrupters.

C. Requirements of this section apply to electrical grounding and ground-fault protection work specified elsewhere in these specifications.

1.03 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacturer of grounding and ground-fault protection units of types and ratings required whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: Qualified with at least 5 years of successful installation experience on projects with grounding and ground fault installation work similar to that required for this project.

C. NEC Compliance: Comply with NEC as applicable to electrical grounding and ground-fault protection systems.

D. ANSI/IEEE Compliance: Comply with C114.1 (IEEE Std 142) and IEEE Stds Nos. 241 and 242 pertaining to grounding and ground-fault protection of power systems.

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E. ANSI/UL Compliance: Comply with requirements of ANSI/UL and UL standards pertaining to grounding and ground-fault protection equipment and devices. Provide products which have been UL-listed and labeled.

F. NEMA Compliance: Comply with NEMA Stds Pub Nos. PB 1.2 and AB 1, pertaining to construction and installation of ground-fault protection devices and molded-case circuit breakers.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's data on grounding and ground-fault protection equipment and devices.

B. Maintenance Data: Submit maintenance instruction and spare parts lists. Include this data in maintenance manuals.

PART TWO - PRODUCTS

2.01 GROUNDING:

A. Materials and Equipment:

1. Except as otherwise indicated, provide each electrical grounding system indicated, with assembly of materials including, but not necessarily limited to, cable/wires, connectors, terminals (solderless lugs), bonding jumper braid, and other items and accessories needed for complete installation. Where materials or components are not otherwise indicated, comply with NEC, NEMA and established industry standards for application indicated.
2. Provide conduit, duct and fittings complying with Section 26 05 33 - Raceways and Boxes for Electrical Systems, in accordance with the following listing:
   a. Rigid steel conduit.
   b. Electrical metallic tubing.
   c. Flexible metal conduit, Type 2.
   d. Liquid-tight flexible metal conduit.
   e. Rigid metal conduit fittings.
   f. EMT fittings, Type 1.
   g. Flexible metal conduit fittings.
   h. Liquid-tight flexible metal conduit fittings.

B. Electrical Grounding Conductors:

1. Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NEC. All grounding conductors shall be copper.

C. Bonding Plates, Connectors, Terminals and Clamps:

1. Provide electrical bonding plates, connectors, terminals and clamps as recommended by bonding plate, connector, terminal and clamp manufacturer's for indicated applications.

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2.02 GROUND FAULT PROTECTION DEVICES:

A. General: Except as otherwise indicated, provide ground-fault protection devices and components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation. Where types, sizes, or ratings are not indicated, comply with NEC, UL and established industry standards for applications indicated.

B. Circuit Interrupters / Circuit-Breakers: Provide 1" wide module bolt-on panelboard circuit breakers, with integral ground-fault circuit interrupters, UL-rated Class A, Group 1; with ampacity rating, pole construction, voltage and asymmetric interruption capacity as shown on the drawings. Provide with solid-state ground-fault sensing and signaling, with 5 milliamperes ground-fault sensitivity, ± 1 milliampere. Equip with PUSH-TO-TEST capability. Provide modules which fit panelboards in which they are located.

C. Manufacturer: Subject to compliance with requirements, provide ground-fault circuit interrupters of one of the following:

1. Cutler-Hammer
2. Square D Company

D. Contractor shall include ground-fault performance current injection testing in accordance with manufacturer and NEC. A written record of this test shall be given to Owner.

PART THREE - EXECUTION

3.01 INSTALLATION OF GROUNDING AND GROUND-FAULT PROTECTION SYSTEMS:

A. Install electrical grounding systems and ground-fault protection devices as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to ensure grounding and ground-fault protection devices comply with requirements. Comply with requirements of NEC, NESC, and NEMA standards for installation of grounding and ground-fault protection systems and devices.

B. Coordinate with other electrical work as necessary to interface installation of grounding system and ground-fault protection devices with other work.

C. Install clamp-on connectors only on thoroughly cleaned metal contact surface, to ensure electrical conductivity and circuit integrity.

D. All wire used on the load side of branch GFCI protective devices shall be Type XHHW, XLP, or equivalent. Wiring pulling compound shall not be used on this wiring to facilitate installation.

E. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

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F. Size and type of green equipment ground conductors and method of securing them to obtain electrical continuity and effective grounding as per National Electrical Code, Article 250. Conduit shall not be used for the primary grounding means, but shall be electrically continuous for use as a supplemental grounding system.

G. Neutrals of lighting systems shall be grounded independently and in accordance with the National Electrical Code.

H. All metal raceway system, including cabinets, conduit and boxes, shall be grounded to a water pipe with UL approved grounding clamp in accordance with the National Electrical Code.

I. An equipment ground conductor shall be installed in all conduits.

J. Use Burndy Bar Connector or Cadwell to attach to water line. Contractor to verify that the resistance to ground is less than 25 ohms. Ground wire to panel shall be in PVC. All connection shall be visibly inspected and approved by Engineer.

K. Provide ground fault injection testing on-site as required by NEC.

3.02 TESTING:

A. Upon completion of installation of ground-fault protection devices and after electrical circuitry has been energized, demonstrate capability and compliance with requirements using current injection testing. Where possible, correct malfunctioning units at site, then re-test to demonstrate compliance; otherwise, remove and replace with new units, and proceed with testing.

B. Upon completion of installation of electrical grounding system, test ground resistance with ground resistance tester. Where tests show resistance-to-ground is over 3 ohms, take appropriate action to reduce resistance to 3 ohms or less by driving additional ground rods and/or by chemically treating soil encircling ground rods with sodium chloride, calcium chloride, copper sulfate, or magnesium. Then re-test to demonstrate compliance.

END OF SECTION

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Section 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART ONE - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division One Specification sections, apply to work of this section.

B. This section is a Division 26 Common Work Results for Electrical section and is part of each Division 26 section making reference to supports, anchors, sleeves, and seals specified herein.

1.02 DESCRIPTION OF WORK

A. Extent of supports, anchors, sleeves and seals is indicated by drawings and schedules and/or specified in other Division 26 sections.

B. Types of supports, anchors, sleeves and seals specified in this section include the following:

1. C-clamps.
2. I-beam clamps.
3. One-hole conduit straps.
4. Two-hole conduit straps.
5. Round steel rods.
6. Lead expansion anchors.
7. Toggle bolts.
8. Wall and floor seals.
9. Conduit and box fasteners

C. Supports, anchors, sleeves and seals furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 26 sections.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in Manufacturer of supporting devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: Qualified with at least 5 years of successful installation experience on projects with electrical installation work similar to that required for this project.

C. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical supporting devices.

D. ANSI/NEMA Compliance: Comply with applicable requirements of ANSI/NEMA Std Pub. No. FB1, “Fittings and Supports for Conduit and Cable Assemblies”

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E. NECA Compliance: Comply with National Electrical Contractors Association's "Standard of Installation" pertaining to anchors, fasteners, hangers, supports, and equipment mounting.

F. UL Compliance: Provide electrical components which are UL-listed and labeled.

G. FS Compliance: Comply with Federal Specification FF-S-760 pertaining to retaining strap for conduit, pipe and cable.

1.04 SUBMITTALS

A. Product Data: Submit catalog cuts, specifications, installation instructions, for each type of support, anchor, sleeve and seal. Submit hanger and support schedule showing manufacturer's figure number, size, location, and features for each required hanger and support.

PART TWO - PRODUCTS

2.01 MANUFACTURED SUPPORTING DEVICES

A. General: Provide supporting devices complying with manufacturer's standard materials, design and construction in accordance with published product information, and as required for a complete installation, and as herein specified. Where more than one type of device meets the following requirements, selection is Installer's option.

B. Supports: Provide supporting devices of types, sizes and materials indicated; and having the following construction features:

1. C-Clamps: Black malleable iron; 1/2" rod size; approx. 70 pounds per 100 units.
2. I-Beam Clamps: Black steel, 1-1/4" x 3/16" stock; 3/8" cross bolt; flange width 2"; approx. 52 pounds per 100 units.
3. One-Hole Conduit Straps: For supporting 3/4" rigid metal conduit; galvanized steel; approx. 7 pounds per 100 units.
4. Two-Hole Conduit Straps: For supporting 3/4" rigid metal conduit, galvanized steel; 3/4" strap width; and 2-1/8" between center of screw holes.
5. Hexagon Nuts: For 1/2" rod size; galvanized steel; approx. 4 pounds per 100 units.
6. Round Steel Rod: Black steel; 1/2" dia.; approx. 67 pounds per 100 feet.
7. Offset Conduit Clamps: For supporting 2" rigid metal conduit; black steel; approx. 200 pounds per 100 units.
8. Conduit and Box Fasteners: Fasteners specifically manufactured for the support of conduit and electrical boxes, UL labeled.

C. Anchors: Provide anchors of types, sizes and materials indicated; and having the following construction features:

1. Lead Expansion Anchors: 1/2"; approx. 38 pounds per 100 units.
2. Toggle Bolts: Springhead; 3/16" x 4"; approx. 5 pounds per 100 units.
3. Manufacturer: Subject to compliance with requirements, provide anchors of the following:
   a. Abbeon Cal Inc.
   b. Ackerman Johnson Fastening Systems, Inc.
   c. Elcen Metal Products Co.

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d. Ideal Industries, Inc.
e. Josyln Mfg. and Supply Co.
f. McGraw Edison Co.
g. Rawlplug Co., Inc.
h. Star Expansion Co.
i. U.S. Expansion Bolt Co.
j. Caddy-Erico Product, Inc.
k. Hitt-Thomas Industries, Inc.

D. Sleeves and Seals: Provide sleeves and seals, of types, sizes and materials indicated; and having the following construction features:

1. Wall and Floor Seals: Provide factory-assembled watertight wall and floor seals, of types and sizes indicated; suitable for sealing around conduit, pipe, or tubing passing through concrete floors and walls. Construct with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.

E. Conduit Cable Supports: Provide cable supports with insulating wedging plug for non-armored type electrical cables in risers; construct for 2" rigid metal conduit; 3-wires, type wire as indicated; construct body of malleable iron casting with hot dip galvanized finish.

F. U-Channel Strut Systems:

1. Provide U-channel strut system for supporting electrical equipment, 16- gage hot dip galvanized steel, of types and sizes indicated; construct with 9/16" dia. holes, 8" o.c. on top surface, with standard green finish, and with the following fittings which mate and match with U-channel:

a. Fixture hangers.
b. Channel hangers.
c. End caps.
d. Beam clamps.
e. Wiring stud.
f. Thinwall conduit clamps
g. Rigid conduit clamps.
h. Conduit hangers.
i. U-bolts.

2. Manufacturer: Subject to compliance with requirements, provide channel systems of one of the following:

a. B-Line Systems, Inc.
b. Elcen Metal Products Co.
c. Greenfield Mfg. Co., Inc.
d. Midland-Ross Corp.
e. Power-Strut Div; Van Huffel Tube Corp.
f. Unistrut Div; GTE Products Corp.

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2.02 FABRICATED SUPPORTING DEVICES

A. Pipe Sleeves: Provide pipe sleeves of one of the following:

1. Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
2. Sleeve Seals: Provide sleeve seals for sleeves located in foundation walls below grade or in exterior walls. All sleeves shall be made watertight.

PART THREE - EXECUTION

3.01 INSTALLATION OF SUPPORTING DEVICES

A. Install hangers, anchors, sleeves and seals as indicated, in accordance with manufacturer's written instructions, and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA, NEC and ANSI/NEMA for installation of supporting devices.

1. The use of support wires or tie wires is not acceptable as support for boxes conduit, or equipment.
2. Boxes in ceiling spaces shall be rigidly supported from a structural member of the building directly or by using a metal brace. The metal brace shall be a minimum of 1/4" all thread rod.

B. Coordinate with other electrical work, including raceway and wiring box and wiring work, as necessary to interface installation of supporting devices with other work.

C. Install hangers, supports, clamps and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports within maximum spacings indicated.

D. All void spaces within or around sleeves shall be filled with approved fire sealant.

END OF SECTION

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Section 26 05 33

RACEWAY AND BOXES FOR
ELECTRICAL SYSTEMS

PART ONE - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division One Specification sections, apply to work of this section.

B. This section is a Division 26 Common Work Results for Electrical section, and is part of each Division 26 section making reference to electrical raceways specified herein.

1.02 DESCRIPTION OF WORK

A. Extent of raceways is indicated by drawings and schedules.

B. Types of raceways in this section include the following:

1. Electrical metallic tubing.
2. Flexible metal conduit.
3. Liquid-tight flexible metal conduit.
4. Rigid metal conduit.
5. Non-metallic conduit.
6. Surface Metal Raceway

C. Types of electrical boxes and fittings in this section include the following:

1. Outlet boxes.
2. Junction boxes.
3. Pull boxes.
4. Floor boxes.
5. Conduit bodies.
6. Bushings.
7. Locknuts.
8. Knockout closures

1.03 SUBMITTALS

A. Product Data: Provide dimensions, knockout sizes and locations, materials, fabrication details, finishes, and accessories.

B. 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.

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1.04 QUALITY ASSURANCE

A. Installer: A firm or individual with not less than five years of successful experience in installation of raceways similar to those required for this project.

B. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to raceways.

C. UL Compliance with Labeling: Comply with applicable portions of UL safety standards pertaining to electrical raceway systems and boxes; and provide products and components, which have been UL-listed and labeled.

D. NEC Compliance: Comply with NEC requirements as applicable to construction and installation of raceway systems.

E. ANSI / NEMA Standards Compliance: Comply with ANSI C 134.1 (NEMA Standards Pub No. OS 1) as applicable to sheet-steel outlet boxes, device boxes, covers and box supports.

PART TWO - PRODUCTS

2.01 METAL CONDUIT AND TUBING

A. General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thickness') for each service indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill Wiring requirements, and comply with applicable portions of NEC for raceways.

B. Rigid Steel Conduit: FS WW-C-0581 and ANSI C80.1.

1. Minimum size shall be 3/4 inch.

C. Rigid Metal Conduit Fittings: FS W-F-408.

1. Use Type 1 fittings for raintight connections.
2. Use Type 2 fittings for concrete tight connections.
3. Use Type 3 fittings for other miscellaneous connections.

D. Electrical Metallic Tubing (EMT): FS WW-C-563 and ANSI C80.3.

1. Minimum size shall be 3/4 inch.

E. EMT Fittings: FS W-F-408.

1. Use Type 1 fittings for raintight connections.
2. Use Type 2 fittings for concrete tight connections.
3. Use Type 3 fittings for other miscellaneous connections.

F. Flexible Metal Conduit: FS WW-C-566, of the following type:

1. Minimum size shall be 1/2 inch.
2. Type 2: Zinc-coated steel.

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G. Flexible Metal Conduit Fittings: FS W-F-406, Type 1, Class 1, and Style A.

H. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight flexible metal conduit; construct of single strip, flexible and continuous, interlocked, and double-wrapped steel; galvanize inside and outside; coat with liquid-tight jacket of flexible polyvinyl chloride (PVC).

1. Minimum size shall be 3/4 inch.

I. Liquid-Tight Flexible Metal Conduit Fittings: FS W-F-406, Type 1, Class 3, Style G.

J. Non Metallic Conduit: Schedule 80 PVC

1. Minimum size shall be 1 inch.
2. NEMA TC 2 Pipe
3. NEMA TC 3 Fittings
4. Manufacturers:
   a. Carlon
   b. Engineer Approved

2.02 SURFACE METAL RACEWAY

A. Manufacturers:

1. Walker/Wiremold
2. Square D
3. Mono-Systems, Inc.

B. Description: One piece surface steel raceway suitable for surface mounting in dry locations. Provide raceway with interlocking base and cover construction. Finish shall be pre-painted scratch-resistant suitable for over-painting.

C. Knockouts: Manufacturer's standard.

D. Size: Provide Wiremold V2000 and V500 or as indicated on the Drawings. Finish to be approved by architect.

E. Supports: Provide support clips at intervals as recommended by the manufacturer. Adhesive applied raceways are not allowed.

F. Fittings: Provide surface raceway fittings as required for devices specified on the Drawings. Provide dividers for combination power and systems raceways.

G. Provide device outlets as indicated on the Drawings.

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2.03 FABRICATED MATERIALS

A. Interior Outlet Boxes: Provide galvanized flat rolled sheet steel interior outlet wiring boxes, of types, shapes and sizes, including box depths, to suit each respective location and installation; construct with stamped knockouts in back and sides, and with threaded screw holes with corrosion-resistant screws for securing box covers and wiring devices. Gangable boxes are not acceptable.

1. Interior Outlet Box Accessories: Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used and fulfilling requirements of individual wiring situations.
   a. Outlet Box Mounting Supports: "Caddy" Quick Mount Box Supports H-3 or approved straps or bars.
   b. Outlet Box Extension Rings: Raco 700 series, square cut.
2. Manufacturer: Subject to compliance with requirements, provide interior outlet boxes of one of the following:
   a. Adalet-PLM Div, Scott and Fetzer Co.
   b. Appleton Electric Co.
   c. Bell Electric/Square D Co.
   d. Eagle Electric Mfg. Co., Inc.
   e. Pass and Seymour, Inc.
   f. RACO, Inc.
   g. Steel City/Midland-Ross Corp.

B. Weatherproof Outlet Boxes: Provide corrosion-resistant cast-metal weatherproof outlet wiring boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit. Hubs cast-metal face plates with spring-hinged waterproof caps suitably configured for each application, including face plate gaskets and corrosion-resistant fasteners.

1. Manufacturers: Subject to compliance with requirements, provide weatherproof outlet boxes of one of the following:
   a. American Metal Forming Co.
   b. Arrow-Hart Div., Crouse-Hinds Co.
   c. Bell Electric/Square D. Co.
   d. Gould, Inc.
   e. Harvey Hubbell, Inc.
   f. O-Z/Gedney Co.
   g. Pyle-National Co.

C. Junction and Pull Boxes: Provide galvanized code-gage sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes to suit each respective location and installation; with welded seam and equipped with nuts, bolts, screws, and washers.

1. Manufacturer: Subject to compliance with requirements, provide junction and pull boxes of one of the following:
   a. Adalet-PLM Div., Scott and Fetzer Co.
   b. Appleton Electric Co.
   c. Arrow-Hart Div., Crouse-Hinds Co.
   d. Bell Electric/Square D Co.

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e. GTE Corporation
f. Keystone Columbia, Inc.
g. O-Z/Gednew Co.
h. Spring City Elect Mfg. Co.

D. Floor Boxes: Provide cast-iron waterproof adjustable floor boxes as indicated in concrete slabs on grade, with thread-conduit-entrance hubs, and vertical adjusting rings, gaskets, metal floor plates and flush duplex flap covers. Stamped steel floor boxes may be used on all floors above grade. Metal floor plate shall be compatible with type of floor finish.

1. Floor Box Accessories: Provide devices and accessories as indicated on the issued contract drawings.
2. Manufacturer: Subject to compliance with requirements, provide floor boxes of one of the following:
   a. American Metal Forming Corp.
   b. Bell Electric / Square D Co.
   c. Crouse-Hinds Co.
   d. Harvey-Hubbell, Inc.
   e. Pyle-National Co.
   f. Spring City Electrical Mfg. Co.
   g. Steel City / Midland-Ross Corp.
   h. Walker Mfg. Co.

E. Conduit Bodies: Provide galvanized cast-metal conduit bodies, of types, shapes and sizes, to suit respective locations and installation, construct with threaded-conduit-entrance ends, removable covers, and corrosion-resistant screws. Conduit bodies shall be compatible with conduit materials.

1. Manufacturer: Subject to compliance with requirements, provide conduit bodies of one of the following:
   a. Allen-Stevens Conduit Fittings Corp.
   b. Appleton Electric Co.
   c. Atlas Technologies, Inc.
   d. Crouse-Hinds Co.
   e. Gould, Inc.
   f. Killark Electric Mfr. Co.
   g. O-Z/Gedney Co.
   h. Pyle-National Co.
   i. Spring City Electrical Mfg. Co.

F. Bushings, Knockout Closures and Locknuts: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and connectors of one of the following:

1. Allen-Stephens Conduit Fittings Corp.
2. Appleton Electric Co.
3. Atlas Technologies, Inc.
4. Burndy Corp.
5. Crouse-Hinds Co.
6. Gould, Inc.
7. O-Z/Gedney Co.
8. RACO, Inc.

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9. Steel City / Midland-Ross Corp.
10. Thomas and Betts Co., Inc.

PART THREE - EXECUTION

3.01 INSTALLATION OF ELECTRICAL RACEWAYS

A. Install electrical raceways where indicated; in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA "Standard of Installation", and complying with recognized industry practices.

1. The use of ceiling support wires or tie wires is not acceptable as support or fastening for raceways or conduit.

B. Coordinate with other work including metal and concrete deck work, as necessary to interface installation of electrical raceways and components.

C. Level and square raceway runs, and install at proper elevations and/or heights. Conduit shall be run parallel and perpendicular to the building construction.

1. All conduit shall be installed above other trades (ductwork, piping, etc.) and supported to the structure.
2. In corridors, the conduit should be installed to one or each side (either high on the wall or at structure) for accessibility.

D. Complete installation of electrical raceways before starting installation of cables/wires within raceways.

E. Install flexible conduit for motor connections, final connections to light fixtures, and for other electrical equipment connections where subject to movement or vibration.

F. Install liquid-tight flexible conduit for connection of motors and for other electrical equipment in all central plants, boiler rooms, and where subject to movement and vibration (six foot maximum length), and also where subjected to one or more of the following conditions:

1. Exterior location.
2. Moist or humid atmosphere where condensate can be expected to accumulate.
3. Corrosive atmosphere.
4. Subjected to water spray.
5. Subjected to dripping oil, grease, or water.
6. Wherever possible, install horizontal raceway runs above water and steam piping.

G. All interior concealed conduit shall be EMT with die cast compression fittings. Use flexible metal conduit at final fixture and equipment connections only.

1. Use of rigid nonmetallic and flexible nonmetallic conduit in any interior applications is unacceptable.
2. Final connections to lay-in light fixtures shall be made with a 6 foot maximum length of flexible conduit from a junction box to the fixture. Flexible conduit connections from fixture to fixture will not be acceptable.

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3. Install approximately twelve inches (12”) maximum of flexible conduit at final connection of equipment. At exterior damp/wet locations, use PVC jacketed flexible metal conduit.

H. For interior exposed locations such as Storage, Mechanical, and similar rooms the following shall apply:

1. Lighting and power circuits: conduit is permitted to be electrical metallic tubing (EMT).
2. Communications (telephone, computer, EMCS, and similar) systems conduit is permitted to be EMT.

I. For interior exposed conduit locations such as Electrical Rooms and Communications Closets the following apply:

1. Lighting and power circuits shall be EMT.
2. Communications systems conduit shall be EMT.

J. All concealed or exposed panel feeders and three phase motor branch circuits shall be EMT. All feeders on emergency power systems, including underground, shall be rigid steel (GRSC).

K. Insulated bushings must be provided for all conductors number four (#4) and larger when entering or leaving a conduit. All rigid steel conduit without insulated bushings shall have malleable iron bushings.

L. Couplings, whether threadless or not, shall be run up tight to assure electrical continuity. Conduit threads must be devoid of non-conductive coatings, and connectors must be watertight where buried in concrete or fill.

M. Exterior exposed conduit locations shall be galvanized rigid steel GRSC.

N. All conduit installed below grade shall be Schedule 40 PVC with rigid steel elbows.

O. Arrange supports to prevent misalignment during wiring installation.

P. 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, fitting, etc. Do not space supports further than 10 feet apart.

Q. Group related conduits; support using conduit rack. Construct rack using steel channel.

R. Electrical raceways shall be concealed where possible. All conduit runs shall be grouped where possible, properly supported by approved conduit or pipe hangers and run parallel or perpendicular to building lines. Where surface mounted panelboards are utilized, contractor shall mount all conduits above and below panel to Unitstrut Channels with P2900 Series Universal clamps or equal. Conduit shall be arranged in a neat and orderly manner. Failure to comply with the above will result in replacement without additional cost to the Owner.

S. Fasten conduit supports to building structure and surfaces under provisions of Section 26 05 29.

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T. Arrange conduit to maintain headroom and present neat appearance.

U. Install insulated bushings on each end of power conduit 1-1/4 inch and larger and on all auxiliary systems conduit.

V. Maintain 12-inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F. Wherever possible, install horizontal raceway runs above water and steam piping.

W. Cut conduit square using saw or pipecutter; de-burr cut ends.

X. Bends shall be made with an approved bender, and no conduit shall be installed with crimps or indenters. Where applicable, factory formed long radius ells are recommended.

Y. Bring conduit to shoulder of fittings; fasten securely.

Z. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

AA. Install no more than equivalent of three 90-degree bends between boxes. Use factory elbows for all 90 degree bends for conduits 1-1/4" or larger.

BB. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

CC. Provide suitable fittings to accommodate expansion and deflection where conduit crosses expansion joints.

DD. Provide suitable pull string in each empty conduit except sleeves and nipples.

EE. Use suitable caps to protect installed conduit against entrance of dirt and moisture during construction.

FF. Ground and bond conduit under provisions of Section 26 05 26.

GG. Identify conduit under provisions of Section 26 05 33.

HH. Provide suitable pullboxes in all conduit runs as required by the National Electrical Code and as required to facilitate wire installation.

II. Install Products in accordance with manufacturer's instructions.

JJ. Use manufacturer's clips and straps to fasten raceway channel to surfaces. Mount plumb and level.

KK. Use suitable insulating bushings at connections to building raceway systems.

LL. Provide four 3/4" empty conduit from each flush mounted branch panel board to the attic or joist space.

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MM. Flexible metal conduit shall not be smaller than 1/2" except as allowed in Article 350-3 of N.E.C. Contractor shall not use lengths longer than 6' and shall be supported as per 350-4 N.E.C. Flexible metal conduit shall not be used to go from light fixture to light fixture. Contractor shall securely anchor outlet box above each group of fixtures and then install flexible conduit to each fixture.

NN. Conduit 1" and smaller below slab shall be installed 6" below compacted fill. Conduit larger than 1" shall be 18" below compacted fill.

OO. Electrical contractor is responsible for installation of all conduit including power and all mechanical control systems.

PP. Install 3/4" EMT from all T-stat locations to 6" above ceiling. Verify location with Mechanical Contractor.

QQ. Feeders and branch circuits installed outside of building slab shall be a minimum of 24" below finished grade.

3.02 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS

A. General: Install electrical boxes and fittings where indicated or required, complying with manufacturer's written instructions, applicable requirements of NEC and NECA "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

B. Coordinate installation of electrical boxes and fittings with wire/cable and raceway installation work.

C. Provide weatherproof outlets for interior and exterior locations exposed to weather or moisture. Weatherproof covers shall be manufactured and installed so that the device is weatherproof during use (equal to RACO).

D. Provide knockout closures to cap unused knockout holes where blanks have been removed.

E. Install boxes and conduit bodies in those locations to ensure ready accessibility of electrical wiring.

1. Provide each outlet box with the appropriate extension ring to suit wall thickness.
2. Install boxes in a manner that preserves the Fire Resistance Ratings or shielding of partitions and other elements.

F. Avoid using round boxes where conduit must enter box through side of box, which would result in difficult and insecure connections when fastened with locknut or bushing on rounded surface.

G. Outlet, pull, and junction boxes shall be of sufficient sizes to properly nest the conductors passing in and out. Size and gauge shall not be smaller than that required by the National Electrical Code. All non-weatherproof outlet boxes shall be galvanized steel. All free-standing weatherproof outlet boxes shall be cast aluminum, hub or hubless, equal to Killark FS Series. Pull and Junction Boxes shall be as noted on plans.

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H. Fasten boxes rigidly to substrates or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.

1. Securely mount each outlet box to metal studs with Outlet Box Mounting Supports. If a bar or strap is used, secure to at least two metal studs.
2. The use of ceiling support wires or tie wires is not acceptable as support or mounting for electrical boxes. All electrical boxes shall be independently supported to structure.

I. Provide equipment grounding connections for all installed boxes. This connection shall be made to the back of the box with an approved green grounding screw. All grounding connections shall be made via pig tails.

J. No more than four gangs (4 openings for a single yoke) shall be permitted. Where additional requirements dictate more than four, another box with appropriate gangs shall be installed.

K. Insulated throats or plastic bushings shall be installed at all conduit terminations.

L. Secure fittings to the raceways by tightening set screws to the manufacturer's recommended torque.

M. Boxes shall not be installed back to back in the same wall. If unavoidable, then the boxes shall have void between boxes completely filled with sound attenuation mineral fiber blanket. No through-the-wall boxes or nipples between boxes are to be used. If back to back boxes are connected, make the connection with flexible metal conduit. There shall be no rigid connections.

N. All junction and outlet boxes used shall have the circuits contained within clearly marked on the cover.

O. All fire alarm junction boxes shall be painted red. All fire alarm junction boxes over 4-inches square shall be equipped with terminal strips (labeled) for splice connections.

P. All communications junction boxes shall be clearly labeled with system enclosed (e.g. "Intercom").

3.03 COORDINATION WITH OTHER TRADES

A. All conduit shall be installed as high as possible being supported directly to bottom of structure to avoid conflicts with ductwork and piping. In corridors, conduit shall be mounted to the sides of the corridor either on the wall up high or to the structure. The electrical contractor shall coordinate installation with the mechanical contractor.

3.04 ADJUSTING AND CLEANING

A. During installation of raceways, inspect interiors of raceways; remove burrs, dirt, and construction debris.

B. Upon completion of installation of raceways and before conductor installation, inspect interior of raceways and swab out dirt and construction debris.

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C. Adjust flush-mounting outlets to make front flush with finished wall material.

D. Install knockout closure in all unused box openings.

3.05 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve all partition ratings to include, but not be limited to, fire, sound, and HVAC (plenum).

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket.

C. 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.

D. All threaded conduit shall be secured to boxes, cabinets, panels, etc. by means of a threaded bushing on the inside and locknutted on the box exterior and interior.

E. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

F. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes with Architect and vendor drawings prior to rough-in.

G. Position outlet boxes to locate luminaires as shown on reflected architectural ceiling plan.

3.06 PROHIBITED USES

A. EMT set-screw fittings.

B. Spray (aerosol) PVC cement.

C. All thread nipples in other than dry locations.

D. Wooden plugs inserted in concrete or masonry units as bases for fastening conduits, tubing, boxes, cabinets, or other equipment.

E. Installation of conduit or tubing, which has been crushed or deformed.

F. Torches for bending PVC conduit.

G. LB Fittings. <u>All bends</u> for conduits 1-1/4” or larger shall be factory made 90 degree elbows.

H. Wire nuts shall not be used for splicing control wiring.

END OF SECTION

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Section 26 05 53

IDENTIFICATION FOR
ELECTRICAL SYSTEMS

PART ONE - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division One Specification sections, apply to work of this section.

B. This section is a Division 26 Common Work Results for Electrical section, and is part of each Division 26 section making reference to electrical identification specified herein.

1.02 DESCRIPTION OF WORK

A. Extent of electrical identification is indicated by drawings and schedule.

B. Types of electrical identification specified in this section include the following:

1. Cable conductor identification (not including low voltage)
2. Danger signs
3. Equipment / system identification signs

C. Refer to electrical general provisions sections for equipment system nameplates and performance data.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacturer of electrical identification products of types required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: A firm with not less than 5 years of successful experience in installation of raceways similar to those required for this product.

C. NEC Compliance: Comply with NEC as applicable to installation of identifying labels and markers for wiring and equipment.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer’s product specifications and installation instructions for each identification material and device required. Include data substantiating that materials comply with requirements.

B. Sample: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.

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PART TWO - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufactures offering identification products which may be incorporated in the work include, but are not limited to, the following:

1. Almetek Industries, Inc.
2. Brady Co.
3. Cole-Flex Corp.
4. Griffolyn Company
5. Ideal Industries, Inc.
6. LEM Products, Inc.
7. National Band and Tag Co.
8. Radar Engineers Div.; EPIC Corp.
9. Seton Name Plate Co.
10. Tesa Corp.

2.02 ELECTRICAL IDENTIFICATION MATERIALS

A. Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.

B. Engraved Plastic-Laminate Signs:

1. Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in sizes and thickness' indicated, engraved with engraver's standard letter style of sizes and wording indicated, black and white core (letter color) except as otherwise indicated, punched for mechanical fastening.
   a. Thickness: 1/16", for units up to 20 sq. in. or 8" length; 1/8" for larger units.
   b. Fasteners: Self-tapping stainless steel screws.

2.03 LETTERING AND GRAPHICS

A. Coordinate names, abbreviations, and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or as required for proper identification and operation/maintenance of electrical systems and equipment. Specific wording shall be approved by the Engineer.

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PART THREE - EXECUTION

3.01 APPLICATION AND INSTALLATION

A. General Installation Requirements:

1. Coordination: Where identification is to be applied to surfaces which requires finish, install identification after completion of painting.
2. Regulations: Comply with governing regulations and requirements or authorities having jurisdiction for identification of electrical work.

B. Operational Identification and Warnings:

1. Wherever reasonably required to ensure safe and efficient operation and maintenance of electrical systems, and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, install self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls, devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposes.

C. Danger Signs:

1. In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations indicated and at locations subsequently identified by Installer of electrical work as constituting similar dangers for persons in or about project.

a. High Voltage: Install danger signs wherever it is possible, under any circumstances, for persons to come into contact with electrical power of voltages higher than 110 - 120 volts.
b. Critical Switches / Controls: Install danger signs on switches and similar controls, regardless of whether concealed or locked up, where untimely or inadvertent operation (by anyone) could result in significant danger to persons, or damage to or loss of property.

D. Equipment / System Identification:

1. Install engraved plastic-laminate sign on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication / signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide double line of text, 1/4” high lettering on 1 - 1/2” high sign, white lettering in black field for items fed from normal power circuits. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide signs for each unit of the following categories of electrical work:

a. Panel boards, electrical cabinets and enclosures
b. Electrical switchgear
c. Motor control centers

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d. Power transfer equipment
e. Transformers
f. Starters
g. Disconnects
h. Junction boxes larger then 8” x 8”
i. Circuit breaker enclosures
j. Power generating units

2. The following are sample:

Panel	Panel XXX	XXX AMPS
xxx/xxx Volts	X Phase	X Wire

Equipment	(Equipment Name)
Panel XXX	Circuit XX

Disconnect	(Equipment Name)
Panel XXX	Circuit XX

3. Nameplate shall include panel or equipment designation. Include amperage, voltage, phase and wire for the panels, and "Panel fed from" for the equipment. At equipment disconnect secure nameplate (with unit designation and “Fed From Panel”) to the equipment.
4. Nameplates shall be installed to panels, cabinets, switches, etc. with rivets or sheet metal screws. Plates attached to drywall or block on interior may be adhesive back. Embossed stick back will not be allowed.
5. Signs for equipment on emergency power shall be red with white letters, and signs for equipment on normal power shall be black with white letters.
6. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners.
7. Signs located at the following items shall have text which will provide manufacturing date and serial number:
   a. Service entrance equipment
   b. Transformers (greater than 45 KVA)
   c. Switchgear and switchboards
   d. Standby generators
   e. Transfer switches
   f. Motor control centers

   Samples:

PANEL A 225A, 120/208V, 3P, 4W

CU-1 FED FROM PANEL E

8. Provide available fault current stickers/labels as required by NFPA.

END OF SECTION

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Section 26 09 23

OCCUPANCY SENSORS

PART ONE - GENERAL

1.01 WORK INCLUDED

A. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.

B. Contractor/Supplier shall examine all general specification provisions and drawings for related electrical work required as work under Division 26.

C. Contractor shall coordinate all work described in this section with all other applicable plans and specifications, including but not limited to wiring, conduit, fixtures, HVAC systems and building management systems.

1.02 EQUIPMENT QUALIFICATION

A. Products supplied shall be from a single manufacturer that has been continuously involved in manufacturing of occupancy sensors for a minimum of five (5) years. Mixing of manufacturers shall not be allowed.

B. All components shall be U.L. listed, offer a five (5) year warranty and meet all state and local applicable code requirements.

C. Wall switch products must be capable of withstanding the effects of inrush current. Submittals shall clearly indicate the method used.

1.03 SYSTEM DESCRIPTION

A. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.

B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

C. Contractor shall warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with specifications. The supplier’s obligation shall include repair or replacement, and testing without charge to the owner, all or any parts of equipment which are found to be damaged, defective or non-conforming and returned to the supplier. The warranty shall commence upon the owner's acceptance of the project. Warranty on labor shall be for a minimum period of one (1) year.

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1.04 SUBMITTALS

A. Manufacturer shall substantiate conformance to this specification by supplying the necessary documents, performance data and wiring diagrams. Any deviations to this specification must be clearly stated by letter and submitted.

B. Submit a lighting plan clearly marked by manufacturer showing proper product, location and orientation of each sensor.

C. Submit any interconnection diagrams per major subsystem showing proper wiring.

D. Submit standard catalog literature which includes performance specifications indicating compliance to the specification.

E. Catalog sheets must clearly state any load restrictions when used with electronic ballasts.

1.05 SYSTEM OPERATION

A. It shall be the contractor's responsibility to make all proper adjustments to assure owner's satisfaction with the occupancy system, or;

B. Factory Startup: It shall be the manufacturer's responsibility to verify all proper adjustments and train owner's personnel to ensure owner's satisfaction with the occupancy system. This service is provided at an additional cost.

PART TWO - SPECIFIC REQUIREMENTS

2.01 ACCEPTABLE MANUFACTURERS

A. Watt Stopper, Cooper Greengate, or System Sensor.

B. The listing of any manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the electrical contractor to ensure that any price quotations received and submittals made are for sensors which meet or exceed the specifications included herein.

2.02 PRODUCTS

A. All products shall be Watt Stopper product numbers:

1. Ceiling sensors: WT-605, WT-600, WT-1105, WT-1100, WT-2205, WT-2200, WT-2250, WT-2255, WP-605, WP-1105, WP-2255, WP-2205, W-500A, W-1000A, W-2000A, W-2000H, UT-300, UT-305, UT-355, WPIR, DT-200, DT-205, DT-300, DT-305, DT-355, CX-100, CX-105, CI-200, CI-205, CI-300, CI-305, CI-355, CI-12, CI-24
2. Wall switch sensors: PW-100, PW-100-24, PW-200, WS-200, WD-170, WD-180, WD-270, WD-280, WN-100-120, WN-100-277, UW-100, UW-100-24, UW-200, DW-100, DW-100-24, DW-200.
3. Power and Auxiliary Packs: BZ-50, BZ-100, BZ-150, LC-100, C120E-P, C277E-P, S120/27-P, AT-120, AT-277
4. Digital Time Switches: TS-400, TS-400-24
5. Automatic Control Switch: AS-100

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B. Wall switch sensors shall be capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet.

C. Wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts; 0 to 1200 watts at 277 volts and shall have 180˚ coverage capability.

D. Wall switch products shall utilize Zero Crossing Circuitry which increases relay life, protects from the effects of inrush current, and increases sensor's longevity.

E. Wall switch sensors shall have no leakage current to load, in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.

F. Where specified, wall switch sensors shall provide a field selectable option to convert sensor operation from automatic-ON to manual-ON.

G. Where specified, vandal resistant wall switch sensors shall utilize a hard lens with a minimum 1.0mm thickness. Products utilizing a soft lens will not be considered.

H. Passive infrared sensors shall utilize Pulse Count Processing and Detection Signature Processing to respond only to those signals caused by human motion.

I. Passive infrared sensors shall provide high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise on the line).

J. Passive infrared sensors shall have a multiple segmented Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up.

K. Where specified, passive infrared ultrasonic and dual technology sensors shall offer daylighting footcandle adjustment control and be able to accommodate dual level lighting.

L. Dual technology sensors shall be wall mounted, corner mounted or ceiling mounted in such a way as to minimize coverage in unwanted areas.

M. Dual technology sensors shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.

N Ultrasonic sensors shall utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.

O. Ultrasonic operating frequency shall be crystal controlled at 25 kHz within ± 0.005% tolerance, 32 kHz within ± 0.002% tolerance, or 40 kHz ± 0.002% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.

P. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.

Q. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.

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R. When specified, sensors shall utilize SmartSet™ technology for automatically adjustable time delay and sensitivity settings.

S. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.

T. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.

U. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

V. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.

W. All sensors shall have UL rated, 94V-0 plastic enclosures.

2.03 CIRCUIT CONTROL HARDWARE - CU

A. Control Units - For ease of mounting, installation and future service, control unit(s) shall be able to externally mount through a 1/2" knock-out on a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Control unit shall provide power to a minimum of two (2) sensors.

B. Relay Contacts shall have ratings of:
13A - 120 VAC Tungsten
20A - 120 VAC Ballast
20A - 277 VAC Ballast

C. Control wiring between sensors and controls units shall be Class II , 18-24 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.

D. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

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PART THREE - EXECUTION

3.01 INSTALLATION

A. It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.

B. It is the contractor’s responsibility to arrange a pre-installation meeting with manufacturer's factory authorized representative, at owner's facility, to verify placement of sensors and installation criteria.

C. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

END OF SECTION

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Section 26 24 16

PANELBOARDS

PART ONE - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provision of Contract, including General and Supplementary Conditions and Division One Specification sections, apply to work of this section.

B. This section is a Division - 26 Electrical and is a part of each Division – 26 section making reference to panelboards specified herein.

1.02 DESCRIPTION OF WORK:

A. Extent of panelboard and enclosure work, including cabinets and cutout boxes is indicated by drawings and schedules.

B. Types of panelboards and enclosures in this section include the following:

1. Power-Distribution panelboards
2. Lighting and appliance panelboards

C. Refer to other Division 26 sections for cable/wire, connectors and electrical raceway work required in conjunction with panelboards and enclosures; not work of this section.

1.03 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacture of panelboards and enclosures, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: A firm with at least 5 years of successful installation experience on projects with electrical installation work similar to that required for project.

C. Special Use-Markings: Provide panelboards, constructed for special use, with UL marks indicating that special type usage.

D. UL Compliance: Comply with applicable UL safety standards pertaining to panelboards and accessories, and enclosures; provide units which have been UL-listed and labeled.

E. NEC Compliance: Comply with NEC as applicable to installation of panelboards, cabinets, and cutout boxes. Comply with NEC articles pertaining to installation of wiring and equipment in hazardous locations.

F. NEMA Compliance: Comply with NEMA Std. Pub. No. 250, “Enclosures for Electrical Equipment (1000 volt maximum)”, Pub. No. 1 “Panelboards”, and installation portion of Pub. No. PB 1.1, “Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less”.

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G. Federal Specification Compliance: Comply with FS W-P-115, "Power Distribution Panel", pertaining to panelboards and accessories.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's data including specifications, installation instructions and general recommendations, for each type of panelboard required. Include data substantiation that units comply with requirements.

B. Shop Drawings: Submit dimensioned custom drawings of panelboards and enclosures showing accurately scaled layouts of enclosures and required individual panelboard devices, including but not necessarily limited to, circuit breakers, fusible switches, fuses ground-fault circuit interrupters, and accessories. Manufacturer's standard catalog sheets are not acceptable.

C. Maintenance Data: Submit maintenance instructions and spare parts lists. Include this data in maintenance manuals.

PART TWO - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type of panelboard and enclosure):

1. Cutler-Hammer
2. Square D Company

2.02 PANELBOARDS:

A. General: Except as otherwise indicated, provide panelboards, enclosures and ancillary components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials, design and construction in accordance with published product information; equip with number of unit panelboard devices as required for complete installation. Where more than one type of component meets indicated requirements, selection is Installer's option. Where types, sizes, or ratings are not indicated, comply with NEC, UL and established industry standards for applications indicated.

B. Power Distribution Panelboards: Provide dead-front safety type power distribution panelboards as indicated, with panel-board switching and protective devices in quantities, ratings, types and with arrangement shown; with anti-turn solderless pressure type main lug connectors approved for copper conductors. Sub-feed breakers are not allowed unless otherwise noted on the Drawings. Construct unit for connecting feeder at top of panel. Equip with copper bus bars, and full-sized neutral bus; provide suitable lugs on neutral bus for out-going feeders requiring neutral connections. Provide molded-case main circuit breaker or main lugs only (as shown on the drawings) and branch circuit breaker types for each circuit, with toggle handles that indicate when tripped. Where multiple-pole breakers are indicated, provide with internal common trip so overload on one pole will trip all poles simultaneously. Provide a bare un-insulated grounding bar bolted to enclosures. Provide panelboards fabricated by the same manufacturer as enclosures, and which mate properly with enclosures. Where specified provide isolated ground bus bar.

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C. Lighting and Appliance Panelboards: Provide dead-front safety type lighting and appliance panelboards as indicated, with switching and protective devices in quantities, ratings, types and arrangement shown; with anti-burn solderless pressure type lug connectors approved for copper conductor; construct unit for connecting feeders at top or bottom of panel as required; equip with copper bus bars, full-sized neutral bar, with bolt-in molded case circuit breakers; provide suitable lugs on neutral bus for each outgoing feeder required; provide bare un-insulated grounding bar bolted to enclosure; and provide panelboards fabricated by same manufacturer as enclosures; and which mate properly with enclosures. Where specified provide isolated ground bus bar. The branch circuit breaker sub-assembly shall be in continuous contact and bolted to the panel enclosure back-box; sub-assemblies mounted on "Z" brackets are not allowed. The circuit breaker sub-assembly shall utilize thermo-plastic mounting straps to properly align breakers.

D. Panelboard Enclosures: Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types as indicated, code-gauge, minimum 16-gauge thickness. Construct with multiple knockouts and wiring gutters. Provide fronts with adjustable indicating trim clamps, and doors with flush locks and keys, all panelboard enclosures keyed alike, with concealed door hinges and door swings as indicated. equip with interior circuit-directory frame, and card with clear plastic covering. Provide baked gray enamel finish over a rust inhibitor. Design enclosure for surface or recessed mounting as indicated on the drawings. Provide enclosures fabricated by same manufacturer as panelboards, and which match properly with panelboards to be enclosed.

E. Panelboard Accessories: Provide panelboard accessories and devices including, but not necessarily limited to circuit breakers, ground-fault protection units, etc., as recommended by panelboard manufacturer for ratings and applications indicated.

PART THREE - EXECUTION

3.01 INSTALLATION OF PANELBOARDS:

A. General: Install panelboards and enclosures where indicated, in accordance with manufacturer's written instructions applicable requirements of NEC and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

B. Coordinate installation of panelboards and enclosures with cable and raceway installation work.

C. Anchor enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically secure.

D. Provide electrical connections within enclosures.

E. Circuit breakers shall be quick-make, quick-break, thermal magnetic trip indicating, and have common trip on all multipole breakers. Handle ties will not be accepted. All panelboards and circuit breakers shall be fully rated to AIC rating as noted on drawings. (No series rating allowed.)

F. All sub-feed breakers shall be connected to line side of main circuit breaker.

G. All circuit breakers shall be in proper sequence according to panel schedule. Factory rearranged sequence will not be accepted.

H. Each panelboard shall be labeled with a bakelite name tag indicating voltages, phase, and wire, and panelboard identification. See Identification Section. Each circuit shall be identified by numbers furnished by factory as 1 thru 42 or 1 thru 84 in 2 section panelboards. Any change or alteration in numbering shall be corrected by contractor at his expense.

I. Fill out (typewritten) panelboard's circuit directory card upon completion of installation work.

J. Provide identification as required by Section 26 05 53 and as required by the National Electrical Code.

K. Provide a minimum of six (6) spare circuit breakers (or more if indicated on the Drawings) in each panelboard and install a minimum of six (6) spare 3/4" conduits from each flush mounted panelboard/load center to above an accessible ceiling.

L. External handle tie type circuits breakers are not acceptable.

M. Main Circuit Breakers "MCB" shall be Separate Vertically Factory Mounted on bus bars and not "back-fed" branch style. Service Entrance Main Breakers shall also have barriers to comply with UL 67 and NEC 230.

END OF SECTION

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Section 26 27 26

WIRING DEVICES

PART ONE - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division One Specification sections, apply to work of this section.

B. This section is a Division 26 – Electrical and is part of each Division 26 section making reference to wiring devices specified herein.

1.02 DESCRIPTION OF WORK

A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry but not utilize electrical energy.

B. Types of electrical wiring devices in this section include the following:

1. Receptacles.
2. Switches.
3. Wall plates
4. Dimmer controls.
5. Attachment plug.
6. Plug connectors.
7. Floor and counter-top service outlets.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in Manufacturer of wiring devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: Qualified with at least 5 years of successful installation experience on projects with electrical installation work similar to that required for this project.

C. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring devices.

D. Compliance and Labeling: Provide electrical wiring devices which have been listed and labeled by a nationally recognized testing facility engaged in and equipped to test electrical equipment and materials.

E. NEMA Compliance: Comply with NEMA standards for general and specific-purpose wiring devices.

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1.04 SUBMITTALS

A. Product Data: Submit manufacturer's data on electrical wiring devices.

PART TWO - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following (for each type of wiring device):

1. Eaton
2. Hubbell Inc.
3. Leviton

2.02 FABRICATED WIRING DEVICES

A. General: Provide factory-fabricated wiring devices, in types, colors, and electrical ratings for applications indicated and complying with NEMA Stds Pub No. WD 1. Where types and grades are not indicated, provide proper selection as determined by Architect/Engineer to fulfill wiring requirements, and complying with NEC and NEMA standards for wiring devices. All devices shall have side wired screw terminals.

B. Receptacles:

1. Commercial Specification Grade Duplex: Provide duplex commercial specification grade type receptacles, 2-pole, 3-wire grounding, with green hexagonal equipment ground screw, ground terminals and poles internally connected to mounting yoke, 20-amperes, 125-volts, with metal plaster ears, nylon face, NEMA configuration 5-20R unless otherwise indicated. Hubbell 5362.
2. Ground-Fault Interrupter: Provide commercial specification grade, duplex receptacle, 2-pole, 3-wire, grounding type UL-rated Class A, Group 1, 20-amperes rating, 120-volts, 60 Hz; with solid-state ground-fault sensing and signaling; with 5 milliamperes ground-fault trip level; equip with 20 ampere plug configuration, NEMA 5-20R. Hubbell GF 5362.
3. Commercial Specification Grade Duplex Isolated Ground: Provide duplex commercial specification grade type receptacles, 2-pole, 3-wire grounding, isolated ground connection with green hexagonal equipment ground screw, ground terminals and poles internally connected to mounting yoke, 20-amperes, 125-volts, with metal plaster ears, nylon face, NEMA configuration 5-20R unless otherwise indicated. Provide Hubbell IG5362.
4. Receptacle, duplex, Leviton 5362*
   Receptacle, duplex, WP, Leviton G5362-WT* with TAYMAC MX4280S cover
   Receptacle, ground fault interrupter, Leviton 7899-SG*
   Receptacle, 2 pole, 3 wire, 20A, 250V, Leviton 5461
   Receptacle, 3 pole, 4 wire, 30A, 250V, Leviton 278
   Receptacle, 3 pole, 4 wire, 50A, 250V, Leviton 279
   Receptacle, Isolated ground, Leviton 5362-IG* w/ engraved "Isolated Ground"
   Receptacle, surge suppressor, Leviton 5380-* or 5380IG
   Receptacle, commercial grade, tamper-resistant, 5362-SG*
   Receptacle, commercial grade, GFCI, tamper Resistant, G5362-WT*

Receptacle, hospital grade, tamper-resistant, 8300-SG*
Receptacle, hospital grade, GFCI, tamper resistant, GFWT2-HG*
Receptacle, USB Combo, USB20AC5*
Receptacle, clock outlet, Leviton 5361-CH

C. Plugs and Connectors:

1. Plugs: Provide grounding, armored cap plugs with cord clamp, and 0.4" cord hole; match NEMA configuration ampacity, voltage and wire quantity with power sources.

D. Switches:

1. Single Pole: Provide commercial specification grade flush single-pole quiet toggle switches, 20-ampere, 277-volts AC, with mounting yoke insulated from mechanism, equip with plaster ears, and switch handle. Hubbell HBL 1221.
2. 3-way Snap: Provide commercial specification grade flush 3-way quiet switch, 20-amperes, 277 volts, with mounting yoke insulated from mechanism, equip with plaster ears, and switch handles. Hubbell HBL 1223.
3. Four-Way: Provide commercial grade flush four-way quiet toggle switches, 20-amperes, 277-volt AC, with mounting yoke insulated from mechanism, equip with plaster ears, and switch handle. Hubbell HBL 1224.

Switch, single pole (S), Leviton CS120-2*
Switch, double pole (S2), Leviton CS220-2*
Switch, three way (S3), Leviton CS320-2*
Switch, four way, (S4) Leviton CS420-2*
Switch, single pole, pilot light (Sp), Leviton 1221-PLR
Switch, interchangeable (SIC), Arrow Hart QST91* or QST93*

E. Dimmers:

1. Single Pole Dimmers: Provide branch lighting solid-state AC dimmer controls for fixtures; wattage as indicated, 120-volts, 60 hertz, with continuously linear slide dimmer, nylon face plate, single-pole, soft-touch ON-OFF switch. Lutron Nova N-2000, Lutron NLV-1500 (low voltage application) or approved equal. Provide 0-10V dimmers equal to Lutron for 0-10V LED circuits.

2.03 WIRING DEVICE ACCESSORIES

A. Wall Plates: Provide switch and duplex outlet wall plates for wiring devices, of types, sizes, and with ganging and cutouts as indicated. Where more than one device occurs, provide single piece-plates with appropriate cutout. Construct with metal screws for securing plates to devices; screw heads colored to match finish of plates; all plates shall be thermo-plastic. All non-weatherproof coverplates shall be Leviton nylon plates, color as noted by Architect. Provide horizontal or vertical gang plates where more than one device is concurrent at the same elevation or location. For interchangeable door mullion switches use narrow cover plates as manufactured by Arrow-Hart T-1650. Furnish blank plates for outlets without a device. All non-weatherproof coverplates throughout project shall be of the same material, color, finish and design and shall match any existing device coverplates as directed by architect.

B. Floor and Countertop Service Outlets: Provide service receptacle outlets and fittings of types and ratings indicated on the Drawings. All floor boxes installed in slab on grade shall be cast iron and floor boxes installed in slab above grade shall be stamped steel as manufactured by Legrand.

PART THREE - EXECUTION

3.01 INSTALLATION OF WIRING DEVICES

A. Install wiring devices as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate with other work, including painting, electrical box and wiring work, as necessary to interface installation of wiring devices with other work.

C. Install wiring devices only in electrical boxes which are clean; free from excess building materials, dirt, and debris.

D. Tighten connectors terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torque's specified in UL standard 486A. Use properly scaled torque indicating hand tool.

E. Delay installation of wiring devices until wiring work is completed.

F. Delay installation of wall plates until after wall finish completed. This Contractor shall remove and re-install plates for painting contractor.

G. Mounting Heights: (to centerline):

Receptacles	18" above finish floor unless otherwise noted
Switches	48" above finish floor to top of box unless otherwise noted

H. All outlets shown to be mounted above counter shall be mounted accessible. Exact location above counter and mounting configuration shall be coordinated with Architect and Architectural millwork details.

I. Install switches with off position down, and install all devices plumb and square.

J. Where receptacles occur where built-in cabinets or table tops exist, they shall be installed above working surfaces as directed. All receptacles to have grounding slots below parallel slots.

K. Switches for use on 277 volt system, grouped in outlet boxes shall have a permanently installed shield as directed by N.E.C.

L. Connect wiring devices by wrapping conductor around side mounted screw terminal. Back-wired connections will not be acceptable.

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M. Use jumbo size plates for devices in masonry walls.

N. All floor outlets to be installed from an approved shop drawing. Locations shown for bidding purposes only. Floor boxes shall be equal to Legrand RFB6-OG unless indicated otherwise on plans. Provide Metallic carpet/tile flange as directed by architect. Nonmetallic covers are not acceptable.

O. All receptacles installed within 6' of any sink, hose bibb or other water source shall be of the GFI type as specified above. Any receptacle installed on the exterior of the building or outdoors shall be the GFI type.

P. Use of feed-thru GFI protection is not allowed.

3.02 PROTECTION OF WALL PLATES AND RECEPTACLES

A. Upon installation of wall plates and receptacles, advise contractor regarding proper and cautious use of convenience outlets. At time of Substantial Completion, replace those items which have been damaged, including those burned and scored by faulty plugs.

3.03 GROUNDING

A. Provide electrically continuous, tight grounding connections for wiring devices, unless otherwise indicated. Device grounding connection shall be made via a pig tail from the ground screw within the device backbox. Install in strict accordance with NEC Article 300-13 (b).

3.04 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 05 33 to obtain mounting heights specified and indicated on Drawings.

B. Install wall switch 48 inches above finished floor.

C. Install convenience receptacle 18 inches above finished floor except surface mounted devices shall be mounted on top on baseboard.

D. Install convenience receptacle 6 inches above counter unless noted otherwise.

E. Install telephone and computer outlets 18 inches above finished floor except surface mounted devices shall be mounted on top of baseboard.

F. Install fire alarm audio/visual and visual devices 6'-8" above finish floor.

G. Install fire alarm pull station 4'-0" above finish floor.

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.

3.06 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

END OF SECTION

Section 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART ONE - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division One Specification sections, apply to work of this section.

B. This section is a Division – 26 Electrical and is a part of each Division 26 section making reference to motor and circuit disconnect switches specified herein.

1.02 DESCRIPTION OF WORK

A. Extent of Enclosed Switches And Circuit Breakers work is indicated by drawings and schedules.

B. Types of motor and circuit disconnect switches in this section include the following:

1. Equipment disconnects
2. Appliance disconnects
3. Motor-circuit disconnects
4. Overcurrent Protective Devices

1.03 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacturer of motor and circuit disconnect switches of types, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: Qualified with at least 5 years of successful installation experience on projects with electrical installation work similar to that required for project.

C. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical motor and circuit disconnect switches. Comply with applicable requirements of NEMA Std Pub Nos. AB 1 and SG 3 pertaining to molded-case and power type circuit breakers.

D. UL Compliance and Labeling: Provide motor and circuit disconnect switches which have been UL-listed and labeled. Provide overcurrent and grounding devices which have been listed and labeled by a nationally recognized testing facility engaged in and equipped to test electrical equipment and materials.

E. NEMA Compliance: Comply with applicable requirements of NEMA Standards Pub. No. KS 1.

F. ANSI Compliance: Comply with applicable requirements of ANSI C97.1 pertaining to low-voltage cartridge fuses.

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1.04 SUBMITTALS

A. Product Data: Submit manufacturer's data including specifications, installation instructions and general recommendations, for each type of motor and circuit disconnect switch required. Submit manufacturer's data on overcurrent protective devices, including catalog cuts, time-current trip characteristic curves, and mounting requirements.

B. Shop Drawings: Submit dimensioned drawings of electrical motor and circuit disconnect switches which have ratings of 100 amperes and larger, showing accurately scaled switches, their layouts and proximity to associated equipment.

C. Maintenance Data: Submit maintenance instructions and spare parts lists. Include this data in maintenance manuals.

D. Maintenance Stock, Fuses: For types and ratings required, furnish additional fuses amounting to one (1) set for every 10 installed units, but not less than five (5) sets of each type.

PART TWO - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following (for each type of switch):

1. Switches/Circuit Breakers*:
   a. Cutler-Hammer
   b. Square D Company

*Circuit breakers installed in existing equipment shall match existing equipment type, manufacturer, rating, etc.

2. Fuses**:
   a. CEFCO - Commercial Enclosed Fuse Co., Inc.
   b. Chase-Shawmut
   c. Bussmann Mfg. Co.

**Fuses installed in existing equipment shall match existing equipment type, manufacturer, rating, etc.

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2.02 FABRICATED SWITCHES

A. Disconnect Switches: Provide surface mounted (Heavy Duty Horse Power Rated) type switches with sheet steel indoor NEMA-1 or outdoor NEMA-3R enclosures as required, rated 240 volts for 208 and 240 volt circuits and 600 volts for 440, 480 and 600 volt circuits; ampere rating, ground lug, number of poles and solid neutral connection as indicated; fused or non-fused as indicated; incorporating spring assist, quick make, quick break mechanism constructed so that the switch blades are visible in the "OFF" position with the door open. Equip with operating handle, mechanically interlock with the door to prevent access in the "ON" position and which position is easily recognizable and is capable of being padlocked in the "OFF" position. Current carrying parts shall be of 98% conductive copper; switch contacts shall be of silver-tungsten; fuse clips shall be reinforced positive pressure type designed to accept Class R rejection type fuses. Safety switches shall conform to governing industry NEMA Standards, heavy duty. They shall be listed by Underwriters Laboratories, Inc., where applicable. All safety switches shall be metallic with front operated with factory enamel finishes. All switches shall be either NEMA TYPE 1 or 3R, depending on moisture conditions or direct exposure to exterior conditions. Furnish complete with equipment ground kits.

B. Fuses shall be UL, Class RKI dual element, time delay Class R rejection type, current limiting with 200,000 amperes interrupting capacity. Ampere rating shall be noted on the drawings or 125 percent of the load name plate rating. All fuses shall be of the same manufacturer to maintain selectivity.

2.03 CIRCUIT BREAKERS

A. General: Except as otherwise indicated, provide circuit breakers and ancillary components, of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information, and as required for a complete installation. All circuit breakers serving elevator power, elevator controls, and elevator cab lighting shall be shunt trip type circuit breakers.

B. Molded-Case Circuit Breakers: Provide factory-assembled, molded-case circuit breakers with a maximum rating of 400 amperes, 250 or 600-volts, 60 HZ, 1 to 3 poles with symmetrical interrupting ratings as indicated on the drawings. Provide breakers with permanent thermal and instantaneous magnetic trips in each pole, and with fault-current limiting protection, ampere ratings as indicated. Construct with over-center, trip-free, toggle type operating mechanisms with quick-make, quick-break action and positive handle indication. Provide push-to-trip button on cover for mechanically tripping circuit breakers. Construct breakers for mounting and operating in any physical position and in an ambient temperature of 40 degrees C. Provide with mechanical screw type removable connector lugs, AL/CU rated.

C. Electronic Trip Circuit Breakers With Standard Function Trip System:

1. Shall be Square D Standard Function type: LX, MX, NX, PX, or current limiting Standard Function type LXI or approved equal.
2. Circuit breaker trip system shall be a microprocessor-based true rms sensing design with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on the associated schedules and drawings.

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3. The integral trip system shall be independent of any external power source and shall contain no less than industrial grade electronic components.
4. The ampere rating of the circuit breaker shall be determined by the combination of an interchangeable rating plug, the sensor size and the long-time pickup adjustment on the circuit breaker. The sensor size, rating plug and adjustment positions shall be clearly marked on the face of the circuit breaker. Circuit breakers shall be UL Listed to carry 80% of their ampere rating continuously.
5. The following time/current response adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent of all other adjustments.
    a. Long Time Pickup Instantaneous Pickup
    b. Long Time Delay
    c. Short Time Pickup
    d. Short Time Delay
    e. Ground Fault Pickup – If indicated on the Drawings
    f. Ground Fault Delay - If indicated on the Drawings
6. A means to seal the trip unit adjustments in accordance with NEC Section 240-6(b) shall be provided.
7. Local visual trip indication for overload, short circuit and ground fault trip occurrences shall be provided.
8. An ammeter to individually display all phase currents flowing through the circuit breaker shall be provided. [Indication of inherent ground fault current flowing in the system shall be provided on circuit breakers with integral ground fault protection]. All current values shall be displayed in true rms with 2% accuracy.
9. Long Time Pickup indication to signal when loading approaches or exceeds the adjusted ampere rating of the circuit breaker shall be provided.
10. The trip system shall include a Long Time memory circuit to sum the time increments of intermittent overcurrent conditions above the pickup point. Means shall be provided to reset Long Time memory circuit during primary injection testing.
11. Circuit breakers (except LX, LXI) shall be equipped with back-up thermal and magnetic trip system.
12. Circuit breaker trip system shall be equipped with an externally accessible test port for use with a Universal Test Set. Disassembly of the circuit breaker shall not be required for testing. Test set shall be capable of verifying the operation of all trip functions with or without tripping the circuit breaker.

2.04 FUSES

A. General: Except as otherwise indicated, provide fuses of types, sizes and ratings and electrical characteristics indicated, which comply with manufacturer's standard design, materials, and construction in accordance with published product information, and with industry standards and configurations.

B. Fuses of 600A capacity and below serving circuit breaker panels shall be Bussman KTN or KTS Limitron fast acting fuse. Fuses of greater capacity shall be Bussman dual element FRN and FRS Fustrons.

C. Class L Fuses: Provide NEMA Class L fuses in current ratings indicated, for service entrances, main and feeder circuits, busways and motor control centers.

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D. Class J (K-5) Fuses: Provide NEMA Class J (K-5), dual-element types, with time delay of 10 seconds at 500% of rating, for use with switches.

PART THREE - EXECUTION

3.01 INSTALLATION OF MOTOR AND CIRCUIT DISCONNECT SWITCHES

A. Install motor and circuit disconnect switches where indicated complying with manufacturer's written instructions, applicable requirement of NEC, NEMA, and NECA's "Standard of Installation" and in accordance with recognized industry to ensure that products fulfill requirements.

B. Coordinate motor and circuit disconnect switch installation work with electrical raceway and cable work, as necessary for proper interface.

C. Install disconnect switches used with motor-driven appliances, and motors and controller within sight of controller position unless otherwise indicated.

D. Provide identifications required by Section 26 05 53.

3.02 INSTALLATION OF OVERCURRENT PROTECTIVE DEVICES

A. Install overcurrent protective devices as indicated, in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC and NEMA standards for installation of overcurrent protective devices.

B. Coordinate with other work, including electrical wiring work, as necessary to interface installation of overcurrent protective devices with other work.

E. Fasten circuit breakers without mechanical stresses, twisting or misalignment being exerted by clamps, supports, or cables.

F. Set field-adjustable circuit breakers for trip settings as indicated, subsequent to installation of devices.

G. All breakers with trip settings greater than 400 ampere shall be electronic trip type breakers unless otherwise noted on the Drawings.

H. Main Circuit Breakers "MCB" shall be Separate Vertically Factory Mounted on bus bars and not "back-fed" branch style. Service Entrance Main Breakers shall also have barriers to comply with UL 67 and NEC 230.

3.03 ADJUST AND CLEAN

A. Inspect circuit-breaker operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.

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3.04 FIELD QUALITY CONTROL

A. Prior to energization of overcurrent protective devices, test devices for continuity of circuitry and for short-circuits. Correct malfunctioning units, and then demonstrate compliance with requirements.

END OF SECTION

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Section 26 29 13

ENCLOSED CONTROLLERS

PART ONE - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division One Specifications sections, apply to work of this section.

B. This section is a Division 26 Electrical and is part of each Division 26 section making reference to motor starters and/or enclosed controllers specified herein.

1.02 DESCRIPTION OF WORK

A. Extent of motor starter work is indicated by drawings and schedules.

B. Types of motor starter work are indicated by drawings and schedules and include (but are not limited to) the following:

1. Manual with overload protection.
2. Full voltage, non-reversing combination starters/disconnect switches

1.03 QUALITY ASSURANCE

A. Manufacturer: Firms regularly engaged in manufacturer of motor starters, of types, ratings and characteristics required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: Qualified with at least 5 years of successful installation experience on projects with electrical installation work similar to that required for the project.

C. NEC Compliance: Comply with NEC as applicable to wiring methods, construction and installation of motor starters.

D. UL Compliance and Labeling: Comply with applicable requirements of UL 508, “Electric Control Equipment”, pertaining to electrical motor starters. Provide units which have been UL-listed and labeled.

E. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to motor controllers/starters and enclosures.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer’s data on motor starters.

B. Shop Drawings: Submit dimensioned drawings on motor starters showing accurately scaled equipment layouts and spatial relationship to associated motors, and connections to electrical power feeders and panels. All accessory components shall be clearly outlined and identified.

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C. Maintenance Data: Submit maintenance instructions for motor and drive replacements and spare parts listed. Include this data in maintenance manuals.

PART TWO - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following (for each type and rating of motor starter):

1. Cutler Hammer
2. Square D Co.

2.02 MOTOR STARTERS

A. General: except as otherwise indicated, provide motor starters and auxiliary components; of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installations. Where more than one type of equipment meets indicated requirements, selection is Engineer's option. Provide phase loss and low voltage protection relay in the control circuits of all motors 7-1/2 HP and larger. Size 0 Starters shall be supplied as a minimum. Size 0 starters shall be provided in an oversized enclosure for control wiring. Combination units shall be provided with integral non-fused disconnect or circuit breaker as indicated on the Drawings. Starters installed in existing motor control centers shall match existing equipment type, rating, etc.

B. AC Fractional HP Manual Starters: Provide manual single-phase fractional HP motor starters of types, ratings and electrical characteristics indicated; equip with thermal overload relay for protection of 120 V AC motors of 1/2 HP and less. Provide starters with quick-make, quick-break trip free toggle mechanisms; mount starter in NEMA Type I general purpose enclosure.

C. AC Full Voltages: Provide full voltage alternating current magnetic starters, consisting of contactors and overload relays mounted in common enclosures; of type, size, ratings and NEMA sizes indicated. Overload relays to be block type with manual reset. Control voltage to be supplied via 120 volt control transformer with fused primary and fused secondary and with a minimum of two sets of auxiliary contacts, (two-NO and two-NC) or as required for controls specified. Provide other control components as listed below and as directed by applicable Sections in Division 26.

1. Green power off pilot light.
2. Red power on pilot light.
3. H-O-A selector switch.

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PART THREE - EXECUTION

3.01 INSTALLATION OF MOTOR STARTERS

A. Install motor starters as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

B. Install fuses in fusible disconnects, if any.

C. Install heaters, sized to provide protection in accordance with the manufacturer's recommendations and the NEC in overload relays.

D. Coordinate auxiliary control requirements with mechanical contractor and application Section of Division 23.

E. Provide identification as required by Section 26 05 53.

3.02 ADJUST AND CLEAN

A. Inspect operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finish.

3.03 FIELD QUALITY CONTROL

A. Subsequent to wire/cable hook-up, energize motor starters and demonstrate functioning of equipment in accordance with requirements.

END OF SECTION

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Section 26 51 00

INTERIOR LIGHTING

PART ONE – GENERAL

1.1 SCOPE

A. The work under this section includes interior luminaires and accessories, exit signs, and building-mounted exterior lighting. Included are the following topics:

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

Section 26 27 26 – Wiring Devices

1.3 REFERENCE STANDARDS

A. LM-79-08 (or latest) – IES Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products.

B. LM-80-08 (or latest) – IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.

C. TM-21-11 (or latest) – IES Technical Memorandum on Projecting Long Term Lumen Maintenance of LED Light Sources.

D. NEMA SSL 1-2010 (or latest) – Electronic Drivers for LED Devices, Arrays, or Systems.

1.4 SUBMITTALS

A. Include outline drawings, lamp and ballast data, support points, weights, accessory information and performance data for each luminaire type.

B. For each luminaire type, submit luminaire information including catalog cuts with highlighted catalog numbers and required accessories:

1. Luminaire:
   a. Manufacturer and catalog number,
   b. Type (identification) as indicated on the plans and schedule,
   c. Delivered lumens,
   d. Input watts,
   e. Efficacy,
   f. Color rendering index.
2. Driver:
   a. Manufacturer and catalog number,
   b. Type (Non-Dimming, Step-dimming, Continuous dimming, etc.),
   c. Power Factor, Crest Factor, THD, etc.

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1.5 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.6 DEFINITIONS

A. Driver: The power supply used to power LED luminaires, modules, or arrays.

B. L70, $L_{70,}$ or $L_{70\%}$: The reported life of an LED component or system to reach 70% lumen maintenance, or 70% of the LED's original light output. This test is being developed by the IES and is currently described by TM-21-11.

C. LED's: Broadly defined as complete luminaire with light emitting diode (LED) packages, modules, light bars or arrays, complete with driver.

D. LED luminaire failure: Negligible light output from more than 10 percent of the LED's constitutes luminaire failure.

PART TWO - PRODUCTS

2.1 INTERIOR LUMINAIRES AND ACCESSORIES

A. See the Luminaire Schedule on the drawings for type of luminaires and catalog numbers. Catalog numbers are shown on the drawings for quality and performance requirements only. Luminaires manufactured by others are equally acceptable provided they meet or exceed the performance of the indicated luminaires, and meet the intent of the design.

B. Luminaire shall be listed by a NRTL (Nationally Recognized Testing Laboratory: e.g. UL, ETL, etc.).

C. Provide luminaires with quick-connect disconnecting means, similar to Thomas & Betts Sta-Kon.

2.2 LED LUMINAIRES

A. LED Luminaires shall meet all DesignLights Consortium® (DesignLights.org) Product Qualification Criteria. This does not require that the luminaire be listed on the DesignLights Consortium's® Qualified Products List, but they must meet the Product Qualification Criteria. The technical requirements that the luminaire shall meet for each Application Category are:

1. Minimum Light Output.
2. Zonal Lumen Requirements.
3. Minimum Luminaire Efficacy.
4. Minimum CRI.
5. L70 Lumen Maintenance.
6. Minimum Luminaire Warranty of 5 years (not pro-rated) to include LED driver and all LED components.

Additional requirements:

1. Color Temperature of 3000K-4100K for interior luminaires as listed in the Luminaire Schedule on the plans. The color temperature of exterior LED luminaires should not exceed 4100K (nominal).
2. Color Consistency: LED manufacturer shall use a maximum 3-step MacAdam Ellipse binning process to achieve consistent luminaire-to-luminaire color for interior luminaires. Exterior luminaires shall use a maximum 5-step MacAdam Ellipse binning process.
3. Glare Control: Exterior luminaires shall meet DesignLights Consortium's® criteria for Zonal Lumen Distribution requirements or Backlight-Uplight-Glare (BUG) standards for exterior luminaires.
4. Luminaire shall be mercury-free, lead-free, and RoHS compliant.
5. Luminaire shall comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.
6. Light output of the LED system shall be measured using the absolute photometry method following IES LM-79 and IES LM-80 requirements and guidelines.
7. Luminaire shall maintain 70% lumen output (L70) for a minimum of 50,000 hours.
8. Lumen output shall not depreciate more than 20% after 10,000 hours of use.
9. Luminaire and driver shall be furnished from a single manufacturer to ensure compatibility.
10. Luminaire Color Rendering Index (CRI) shall be a minimum of 80 for interior luminaires, and a minimum of 70 for exterior luminaires.
11. LED luminaire shall be thermally designed as to not exceed the maximum junction temperature of the LED for the ambient temperature of the location the luminaire is to be installed. Rated case temperature shall be suitable for operation in the ambient temperatures typically found for the intended installation. Exterior luminaires to operate in ambient temperatures of -20°F to 122°F (-29°C to 50°C).
12. Luminaire shall operate normally for input voltage fluctuations of plus or minus 10 percent.
13. Luminaire shall have a maximum Total Harmonic Distortion (THD) of ≤20% at full input power and across specified voltage range.
14. All connections to luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
15. All luminaires shall be provided with knockouts for conduit connections.
16. The LED luminaire shall carry a limited 5-year warranty minimum for LED light engine(s)/board array, and driver(s).
17. Provide all of the following data on submittals:
    a. Delivered lumens
    b. Input watts
    c. Efficacy
    d. Color rendering index.

LED Luminaires used for Emergency Egress Lighting:

1. The failure of one LED shall not affect the operation of the remaining LEDs.

Emergency LED Luminaire Compatibility with Inverters:

1. 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.

2.3 LED DRIVERS

A. General:

1. Provide driver type (non-dimmed, step-dimmed, continuous-dimming, etc.) as indicated on the luminaire schedule on the drawings.
2. Minimum Warranty of 5 years (not pro-rated) to include LED driver and all LED components.
3. Driver shall have a rated life of 50,000 hours, minimum.
4. Driver and LEDs shall be furnished from a single manufacturer to ensure compatibility.
5. Driver shall have a minimum power factor (pf) of 0.9 and a maximum crest factor (cf) of 1.5 at full input power and across specified voltage range.
6. Driver shall operate normally for input voltage fluctuations of plus or minus 10 percent.
7. Driver shall have a maximum Total Harmonic Distortion (THD) of ≤20% at full input power and across specified voltage range.
8. Wiring connections to LED drivers shall utilize polarized quick-disconnects for field maintenance.
9. Provide all of the following data on submittals:
   a. Input watts
   b. Power Factor (pf)
   c. Crest Factor (cf) at full input power
   d. Total Harmonic Distortion (THD).

B. Dimming Drivers:

1. LED driver shall be compatible with dimming controls where dimming is indicated on the plans. Dimmable drivers shall use Dimming Constant Current (DCC), Constant Voltage, or Pulse Width Modulation (PWM) operation.
2. Step-Dimming Drivers: Easily switched from 0% to 50% to 100% output power. Both switch-leg inputs shall control 50% of the luminaire's light output equally.
3. Continuous Dimming Drivers: LED luminaires shall dim to (10%, 1%, or 0.1%) as specified in the Luminaire 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. Continuous Dimming Drivers shall use 0-10V control.

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PART THREE - EXECUTION

3.1 INSTALLATION

A. Verify ceiling types with Architectural plans or with existing ceilings. Verify specified luminaires are compatible with specified ceiling type(s) prior to ordering luminaires.

B. Install in accordance with manufacturer's instructions.

C. Install suspended luminaires using aircraft cable, or pendants supported from swivel hangers. Heavy duty chain supports may be used where indicated on the luminaire schedule. Provide aircraft cable, pendants, or chain lengths required to suspend luminaire at indicated height. All aircraft cables or pendant supported luminaires shall have an independent support to structure at all cable or pendant support locations. When chain is used, tie-wrap the luminaire wiring method to the chain.

D. Support luminaires larger than 2 x 4 foot size independent of ceiling framing.

E. Provide independent support for all luminaires over 50 lbs.

F. Locate ceiling luminaires as indicated on reflected ceiling plan.

G. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

H. The Contractor shall install luminaire supports as required. Luminaire installations with luminaires supported only by insecure boxes will be rejected. It shall be the Contractor's responsibility to support all luminaires adequately, providing extra steel work for the support of luminaires if required. Any components necessary for mounting luminaires shall be provided by the Contractor. No plastic, composition or wood type anchors shall be used.

I. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure.

J. Install recessed luminaires to permit removal from below.

K. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

L. Install code required hardware to secure recessed grid-supported luminaires in place.

M. Install wall mounted luminaires and exit signs at height as scheduled. Use pendants supported from swivel hangers in exposed ceiling/structure locations where necessary to mount exit signs at the specified height.

N. Install accessories furnished with each luminaire.

O. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

P. Bond luminaires and metal accessories to branch circuit equipment grounding conductor.

Q. Install specified lamps in each luminaire and exit sign.

R. High-Bay or Low-Bay Luminaires: Use power hook hangers rated 500 pounds (225 kg) minimum and provide safety chain between ballast and structure. Also provide safety chain between reflector and ballast.

S. Dimmed luminaire circuits shall have separate neutrals.

T. Dimmed LED luminaires shall have a positive OFF, which requires turning off the circuit to the luminaire so that the luminaires don't "glow" at the lowest dimmed setting. This shall be accomplished using a switch, relay, or some other means acceptable to DFD.

3.2 ADJUSTING AND CLEANING

A. Align luminaires and clean lenses and diffusers at completion of Work. Clean paint splatters, dirt, and debris from installed luminaires.

B. Aim and adjust luminaires as indicated on Drawings or as directed by the A/E.

C. Touch up luminaire finish at completion of work.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Interface with air handling accessories furnished and installed under Division 23.

B. Provide controls as indicated on the plans. Refer to section 26 27 26 - Wiring Devices. Controls shall be compatible with the luminaires/ballasts/drivers being installed.

3.4 ZERO-TO-10V DIMMING CONTROL WIRING INSTALLATION

A. Zero-to-10V dimming control conductors are classified by the NEC as Class 2 conductors and shall be kept separate from line-voltage conductors per NEC 725.136(A). Matching the insulation rating of Conductors of Different Systems does not apply to Class 2 conductors per NEC 300.3(C)(1), Informational Note No.1.

B. Wall box dimmers will typically have two conduits: One conduit for line-voltage power, and one conduit or conduit stub for the 0-10V control wiring.

C. At each luminaire, separate openings (either manufactured knock-outs or punched openings) shall be used for the line-voltage power and the 0-10V wiring. The EC shall use a cable connector at the opening for the 0-10V wiring. Zero-to-10V conductors entering and within a luminaire enclosure shall maintain a minimum separation of 6 mm (0.25 in.) per NEC 725.136(D).

D. Exposed 0-10V cables shall be installed in separate conduits from line-voltage conductors.

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E. The 0-10V cables may be routed in free air where concealed above accessible ceilings. Cables routed in free air shall observe the following installation requirements:

1. The 0-10V cables may be tie-wrapped to the outside of the luminaire power raceway where allowed by NEC 300.11(B)(2). Tie-wraps shall be UL listed for UV resistance. Care should be taken in the use of cable ties to secure and anchor the cabling. Ties shall not be over tightened as to compress the cable jacket. No sharp burrs shall remain where excess length of the cable tie has been cut.

F. Cabling shall be neatly run at right angles and be kept clear of other trades work.

G. Cabling shall be secured within twelve (12) inches of direction change or termination.

H. Cabling shall be supported at a maximum of 5-foot intervals utilizing “J-Hook” or “Bridle Ring” supports anchored to ceiling concrete, piping supports or structural steel beams. If cable sag at mid-span exceeds 12-inches, another support shall be provided. Cable supports shall be installed to maintain cable bend to larger than the minimum bend radius.

I. Cabling shall not be attached to or supported by existing cabling, plumbing or steam piping, ductwork, suspended ceiling supports or electrical or communications conduit. Do not place cable directly on the ceiling grid or attach cable in any manner to the ceiling grid wires.

J. All cables shall be free of tension at both ends. Nylon strain relief connectors shall be provided at each device and junction box where cables enter. In cases where the cable must bear some stress, Kellum type grips may be used to spread the strain over a longer length of cable.

K. Cable manufacturer’s minimum bend radius shall be observed in all instances.

L. Use suitable cable fittings and connectors.

3.5 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.6 LUMINAIRE CONNECTIONS

A. METAL-CLAD (MC) CABLE

Metal-Clad (MC) type cable that combines power and Class 2 circuits into a single cable may be used for the luminaire wiring where 0-10V dimming control wiring is required. Examples of such products are Encore Wire® MC-LED™ or Southwire® MC-PCS Duo™. Manufacturer's names and catalog numbers are used for quality and performance only. MC Cables manufactured by others shall be equally acceptable provided they meet or exceed in performance and quality as specified.

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B. Recessed, including Master-Satellite connections:

1. Use a luminaire fixture whip from a J-box for recessed lay-in luminaires. Luminaire fixture whips shall be aluminum or steel AC Cable (Armored Cable) or Flexible Metal Conduit (FMC). Metal Clad (MC) cable that combines power and Class 2 circuits (for 0-10V dimming control) into a single cable may be used as a whip for luminaires that are dimmed.
2. Cable/Conduit whips shall be 3/8" (10 mm) minimum diameter, six feet (1.8 m) maximum length.
3. Flexible whips or pre-wired systems between master and satellite luminaires may be supported by the ceiling grid wires.
4. The flexible connectors shall be steel, galvanized, clamp type with locknut, snap-in type with locknut, or snap-in connector type, including those used on the master-satellite units.

C. Chain or Cable Hung (unfinished spaces):

1. Use manufacturer's SO cord or a luminaire fixture whip from a J-box. Luminaire fixture whips shall be aluminum or steel AC Cable (Armored Cable) or Flexible Metal Conduit (FMC). Metal Clad (MC) cable that combines power and Class 2 circuits (for 0-10V dimming control) into a single cable may be used as a whip for luminaires that are dimmed.
2. Conduit whips shall be 3/8" (10 mm) minimum diameter. Conduit whip or SO cord shall be cut to length (six feet (1.8 m) maximum) and shall allow movement of the chain/cable/luminaire, but shall not be long enough to "loop" and shall present a neat and workmanlike appearance.
3. Luminaire field wired flexible cord installations shall be connected per NEC 410.62.
4. The flexible connectors shall be steel, galvanized, clamp type with locknut, snap-in type with locknut, or snap-in connector type, including those used on the master-satellite units.
5. Conduit whip slack shall be tie-wrapped to the chain supports. Tie-wraps shall be UL listed for UV resistance.

D. Cable Hung (finished spaces):

1. Use manufacturer's SO cord from luminaire to a J-box.
2. SO cord shall be cut to length (six feet (1.8 m) maximum) and shall allow movement of the cable/luminaire, but shall not be long enough to "loop" and shall present a neat and workmanlike appearance.
3. SO cord slack may be tie-wrapped to the cable supports. Tie-wraps shall be UL listed for UV resistance.
4. Luminaire field wired flexible cord installations shall be connected per NEC 410.62.

E. Surface Mounted (unfinished spaces):

1. Provide direct conduit and box connection.

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F. Surface Mounted (finished spaces):

1. Provide direct conduit and box connection. Use surface metal raceway where indicated on drawings. Conceal box and conduit where appropriate. Flexible metal conduit shall not be used where the conduit is exposed.

END OF SECTION

Section 26 56 00

EXTERIOR LIGHTING

PART ONE - GENERAL

1.1 SCOPE

A. The work under this section includes removal and relocating exterior luminaires and accessories, poles, and foundations.

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

B. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables

1.3 REFERENCE STANDARDS

A. International Building Code IBC 1807.3 Embedded Posts and Poles

B. LM-79-08 (or latest) – IES Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products.

C. LM-80-08 (or latest) – IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.

D. TM-21-11 (or latest) – IES Technical Memorandum on Projecting Long Term Lumen Maintenance of LED Light Sources.

E. NEMA SSL 1-2010 (or latest) – Electronic Drivers for LED Devices, Arrays, or Systems.

1.4 DEFINITIONS

A. Driver: The power supply used to power LED luminaires, modules, or arrays.

B. L70, $L_{70,}$ or $L_{70\%}$: The reported life of an LED component or system to reach 70% lumen maintenance, or 70% of the LEDs original light output. This test is being developed by the IES and is currently described by TM-21-11.

C. LEDs: Broadly defined as complete luminaire with light emitting diode (LED) packages, modules, light bars or arrays, complete with driver.

D. LED luminaire failure: Negligible light output from more than 10 percent of the LEDs constitutes luminaire failure.

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1.5 SUBMITTALS

A. Shop Drawings: Indicate dimensions and components for each luminaire, pole and base.

B. Product Data: For each luminaire type, submit luminaire information including catalog cuts with highlighted catalog numbers, and required accessories:

1. Luminaire:
   a. Manufacturer and catalog number,
   b. Type (identification) as indicated on the plans and schedule,
   c. Delivered lumens,
   d. Input watts,
   e. Efficacy,
   f. Color rendering index,
   g. Performance data, and
   h. Effective Projected Area (EPA).
2. Driver:
   a. Manufacturer and catalog number,
   b. Type (Non-Dimming, Step-dimming, Continuous dimming, etc.),
   c. Power Factor, Crest Factor, THD, etc.
3. Pole (if applicable):
   a. Diameter
   b. Height
   c. Pole thickness
   d. Weight

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under "Regulatory Requirements".

D. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

E. Light Layout: Provide a computer-generated factory point-by-point foot-candle layout of the project for each area involved.

F. Post Installation Report: Provide to the Engineer and DFD the results of the measured foot-candle level for each area involved. Use a measuring device pre-approved by DFD.

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of each luminaire, pole, and underground circuit.

B. Provide record drawings of the final, as installed and measured, point-by-point foot-candle layout for each area involved.

1.7 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

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1.8 COORDINATION

A. Use bolt templates and pole mounting accessories to install anchor bolts in pole base.

PART TWO- PRODUCTS

2.1 LUMINAIRES

A. See the Luminaire Schedule on the drawings for type of luminaires and catalog numbers. Catalog numbers are shown on the drawings for quality and performance requirements only. Luminaires manufactured by others are equally acceptable provided they meet or exceed the performance of the indicated luminaires, and meet the intent of the design.

B. Luminaire shall be certified by a Nationally Recognized Testing Laboratory (UL, ETL, or IEC).

C. Provide luminaires with quick-connect disconnecting means, similar to Thomas & Betts Sta-Kon.

2.2 LED LUMINAIRES

A. LED Luminaires shall meet all DesignLights Consortium® (DesignLights.org) Product Qualification Criteria. This does not require that the luminaire be listed on the DesignLights Consortium's® Qualified Products List, but they must meet the Product Qualification Criteria. The technical requirements that the luminaire shall meet for each Application Category are:
   1. Minimum Light Output.
   2. Zonal Lumen Requirements.
   3. Minimum Luminaire Efficacy.
   4. Minimum CRI.
   5. L70 Lumen Maintenance.
   6. Minimum Luminaire Warranty of 5 years (not pro-rated) to include LED driver and all LED components.

   Additional requirements:

   1. Color Temperature of 3000K-4100K for interior luminaires as listed in the Luminaire Schedule on the plans. The color temperature of exterior LED luminaires should not exceed 4100K (nominal).
   2. Color Consistency: LED manufacturer shall use a maximum 3-step MacAdam Ellipse binning process to achieve consistent luminaire-to-luminaire color for interior luminaires. Exterior luminaires shall use a maximum 5-step MacAdam Ellipse binning process.
   3. Glare Control: Exterior luminaires shall meet DesignLights Consortium's® criteria for Zonal Lumen Distribution requirements or Backlight-Uplight-Glare (BUG) standards for exterior luminaires.
   4. Luminaire shall be mercury-free, lead-free, and RoHS compliant.
   5. Luminaire shall comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.
   6. Light output of the LED system shall be measured using the absolute photometry method following IES LM-79 and IES LM-80 requirements and guidelines.

7. Luminaire shall maintain 70% lumen output (L70) for a minimum of 50,000 hours.
8. Lumen output shall not depreciate more than 20% after 10,000 hours of use.
9. Luminaire and driver shall be furnished from a single manufacturer to ensure compatibility.
10. Luminaire Color Rendering Index (CRI) shall be a minimum of 80 for interior luminaires, and a minimum of 70 for exterior luminaires.
11. LED luminaire shall be thermally designed as to not exceed the maximum junction temperature of the LED for the ambient temperature of the location the luminaire is to be installed. Rated case temperature shall be suitable for operation in the ambient temperatures typically found for the intended installation. Exterior luminaires to operate in ambient temperatures of -20°F to 122°F (-29°C to 50°C).
12. Luminaire shall operate normally for input voltage fluctuations of plus or minus 10 percent.
13. Luminaire shall have a maximum Total Harmonic Distortion (THD) of ≤20% at full input power and across specified voltage range.
14. All connections to luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
15. All luminaires shall be provided with knockouts for conduit connections.
16. The LED luminaire shall carry a limited 5-year warranty minimum for LED light engine(s)/board array, and driver(s).
17. Provide all of the following data on submittals:
    a. Delivered lumens
    b. Input watts
    c. Efficacy
    d. Color rendering index.

LED Luminaires used for Emergency Egress Lighting:

1. The failure of one LED shall not affect the operation of the remaining LEDs.

Emergency LED Luminaire Compatibility with Inverters:

1. 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.

2.3 LED DRIVERS

A. General:

1. Provide driver type (non-dimmed, step-dimmed, continuous-dimming, etc.) as indicated on the luminaire schedule on the drawings.
2. Minimum Warranty of 5 years (not pro-rated) to include LED driver and all LED components.
3. Driver shall have a rated life of 50,000 hours, minimum.
4. Driver and LEDs shall be furnished from a single manufacturer to ensure compatibility.
5. Driver shall have a minimum power factor (pf) of 0.9 and a maximum crest factor (cf) of 1.5 at full input power and across specified voltage range.
6. Driver shall operate normally for input voltage fluctuations of plus or minus 10 percent.

7. Driver shall have a maximum Total Harmonic Distortion (THD) of ≤20% at full input power and across specified voltage range.
8. Wiring connections to LED drivers shall utilize polarized quick-disconnects for field maintenance.
9. Fuse Protections: All luminaires shall have built-in fuse protection. All power supply outputs shall be either fuse protected or be Polymeric Positive Temperature Coefficient (PTC)-protected as per Class 2 UL listing.
10. Provide all of the following data on submittals:
    a. Input watts
    b. Power Factor (pf)
    c. Crest Factor (cf) at full input power
    d. Total Harmonic Distortion (THD).

2.4 WIRING CONNECTORS

A. Wiring Connectors shall meet the requirements of Section 26 05 19 Low-Voltage Electrical Power Conductors and Cables.

B. Twist-On Wire Connectors: Solderless twist-on spring connectors (wire-nuts) with insulating covers for copper wire splices and taps. All wire connectors used in site lighting applications shall be silicone gel-filled twist connectors or connectors designed for damp and wet locations. Gel-filled twist-on connectors may be used for copper conductor sizes 6 AWG and smaller for site lighting applications. The manufacturer's wire fill capacity must be followed.

2.5 POLES

A. Furnish products as specified in schedule on Drawings.

B. Handhole: With removable weatherproof cover.

C. Anchor Bolts: As recommended by pole manufacturer. Provide template, flat washers, lock washers, and hex nuts for each pole.

2.6 FOUNDATIONS

A. Provide all concrete foundations for poles, bollards, and ground-mounted flood and accent lighting.

B. Construct from reinforced concrete in sizes to meet the minimum structural requirements of IBC 1807 for Posts and Poles and/or as designed by a licensed Structural Engineer in State of Installation.

C. Place the anchor bolts in pole bases so that the luminaire will be oriented perpendicular to the curb/street/sidewalk/parking lot or as indicated on the plan.

D. Provide a concrete-encased electrode (UFER) grounding system for grounding the foundation, luminaire, and pole:

1. Provide twenty-five (25) feet of #4 bare stranded copper grounding electrode conductor.

2. Extend three (3) feet of the grounding electrode conductor out the top of the foundation for connection to the luminaire/pole.
3. Clamp the grounding electrode conductor to the top of the rebar cage. Use a clamp rated for such use such as an Erico EK16 or similar.
4. Spiral a minimum of ten (10) feet of the grounding electrode conductor around the outside of the rebar cage.
5. Loop the remaining conductor around the rebar cage at the bottom of the foundation in direct contact with earth.

E. The exposed surface area of the foundation shall have the forms removed and the concrete rubbed out to a smooth finish.

F. Pole Base J-Boxes:

1. For pole bases above grade with multiple conduits to other poles/locations, the contractor may provide a non-metallic j-box with a curved cover mounted in the side of the exposed part of the base to accommodate the multiple conduits. Boxes shall be NEMA 3R Carlon Nonmetallic Curved Lid J-Boxes or equal. Mount j-box centered at 20” above grade. Use only in poles 18” in diameter and larger. Locate boxes 90-degrees or 180-degrees from traffic. Install boxes per manufacturer’s recommendations.

PART THREE - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturers' instructions.

B. Minimum underground conduit size is 1 inch.

C. Underground and exterior wire shall be type XHHW-2 or USE-2.

D. Project anchor bolts 2 inches (50 mm) minimum above base.

E. Install all anchor bolts and handhole fasteners with anti-seize compound.

F. Install poles plumb. Provide shims or double nuts to adjust plumb.

G. Use belt slings or non-chafing ropes to raise and set pre-finished luminaire poles.

H. Bond each luminaire, each metal accessory, the ground rod and the pole to the branch circuit equipment ground conductor with a separate ground wire sized per NEC or as shown on the drawings.

I. Luminaire circuits shall have separate neutrals.

J. Dimmed luminaires shall have a positive OFF, which requires turning off the circuit to the luminaire so that the luminaires don’t “glow” at the lowest dimmed setting. This shall be accomplished using a switch, relay, or some other means acceptable to DFD.

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3.2 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

3.3 ADJUSTING

A. Aim and adjust luminaires as indicated on Drawings or as directed by the A/E.

B. All new lamps shall be operational at the Substantial Completion of the project.

C. Adjust motion sensors to provide proper coverage for bi-level switching operation.

3.4 CLEANING

A. Clean photometric control surfaces.

B. Clean finishes and touch up damage.

END OF SECTION

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Section 27 05 00

COMMON WORK RESULTS
FOR COMMUNICATIONS

PART ONE - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division One specification sections, apply to work of this section.

B. Division 26 - Common Work Results for Electrical sections apply to work specified in this section.

1.02 DESCRIPTION OF WORK

A. Extent of telephone/computer systems conduit system work is indicated by drawings and schedules, and is hereby defined to include conduit from each outlet to above an accessible corridor ceiling space and interior outlet boxes. Sleeves from each termination board or patch panel room to above an accessible corridor ceiling shall be provided for cable entry.

B. The work of this section includes electrical raceways, boxes and fittings as specified in applicable Division 26 Common Work Results for Electrical Sections.

C. Extent of site system work is indicated by drawings and schedules, and is hereby defined to include two - 2" minimum service conduits from the exterior to the interior terminal board as shown.

PART TWO - PRODUCTS

2.01 MATERIALS

A. Refer to applicable Division 26 sections for telephone/computer system conduit.

PART THREE - EXECUTION

3.01 INSTALLATION OF TELEPHONE/COMPUTER SYSTEMS CONDUIT

A. Coordinate with other electrical work, including raceways, electrical boxes and fittings, as necessary to interface installation of this work with other work.

B. All conduit shall be left sealed against moisture collection, and a number sixteen (#16) gauge galvanized pull wire left between each box or outlet for the installer. Provide a minimum of 1" EMT to all systems boxes to include, but no limited to: telecom, data, voice, video, audio, security, surveillance and fiber. (Fire alarm and intercom shall be 3/4" EMT minimum.)

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C. Provide suitable pullwire in each conduit and an insulated bushing on each conduit termination.

D. Cable to be bundled with plastic ties and secured to building structure. Do not lay on ceiling grid.

E. Backboxes for telephone/computer outlets shall be mounted at 18 inches above finished floor unless noted otherwise.

F. All above counter outlets shall be mounted accessible. Exact locations and mounting configuration shall be coordinated with Architect and Architectural millwork elevations.

G. All premise cabling shall be punched down at rack-mounted patch panels. Direct connections to switches not allowed.

END OF SECTION

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Section 27 10 00

STRUCTURED CABLING

PART ONE – GENERAL

1.1 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 shall apply to work specified in this section.

C. Division 27 - Section 27 05 00 - Common Work Results for Communications shall apply to work specified in this section.

1.2 DESCRIPTION OF WORK

A. This work includes the installation of:

1. Computer structured building cabling, Category 6.
2. Computer modular outlets: Where shown on the plans provide combination types and configurations as detailed.
3. Telecom "punch-down" blocks.
4. Computer patch panels.
5. Structured building cabling, Category 6 for any other uses.

B. The Owner shall purchase and install the telephone switch, computer system and associated equipment. Owner's telephone vendor shall perform the cross-connect.

1.3 SUBMITTALS

A. General:

1. Material and documentation shall be submitted for review and approval as follows:
   a. Installation and operation instructions
   b. Manufacturer's descriptive literature
   c. Applicable riser diagrams
   d. Floor plans as described below
2. Incomplete or partial submittals will not be reviewed nor approved until all requested items are provided to the Engineer. Completeness of the submittal is the sole responsibility of the Contractor.
3. Sufficient information, clearly marked, shall be presented in order for the reviewer to determine compliance with contract documents. Unmarked submittals shall be returned un-reviewed.
4. A complete submittal shall contain:
   a. Product Descriptions,
   b. Floor Plans and Comm. Closet layouts,
   c. O & M Manual (excluding project test reports)

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B. Product Descriptions:

1. Provide manufacturer's standard catalog sheets for the voice/data system devices proposed. This shall include (but not limited to) cabling (copper and fiber optic), modular jacks, device plates, patch panels, equipment racks, surge protection devices, sample labels, and sample test report.
2. Each item proposed shall be clearly marked with complete part numbers.

C. Floor Plans:

1. Provide large scale drawings (24" x 36" or 32" x 42"). Drawings shall be produced with a "CAD" program. Photocopied floor plans from the contract document set are unacceptable. 8½" x 11" drawings are also unacceptable. CAD file background drawings are available from the Architect/Engineer; refer to Section 26 05 00 – Basic Electrical Requirements.
2. Floor plans shall show as a minimum: 1/8 scale walls, rooms with names and numbers, voice/data outlet locations, symbol legend, wire and cable types and counts.
3. Provide large scale (e.g. ¼" = 1'-0") of communication closet layouts showing all equipment locations and dimensioned from walls.
4. Provide a site plan showing exterior building connections where applicable.

D. O & M Manuals:

1. Manuals shall be bound into "book" form and marked "O & M VOICE/DATA System Manual".
2. Manuals shall contain system operating information along with component technical sheets.
3. Manuals shall contain system component interconnection wiring diagrams marked as applicable for this project. General wiring diagrams are unacceptable.
4. Manuals shall provide clear and concise information on such items (but not limited to):
   a. Product data sheets
   b. Basic Troubleshooting
   c. Cabling test reports
   d. Contact Information for Warranty, Repair, Maintenance work

1.4 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of premise cabling products of types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: Qualified with at least 5 years of successful installation experience on projects with voice and data cabling work similar to that required for this project. Installers shall have proof of factory certification for products specified for this project.

C. NEC Compliance: Comply with NEC as applicable to construction and installation of products and work specified herein.

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1.5 ACCEPTABLE MANUFACTURERS

A. Companies who have formed alliances and have engaged in manufacture of Category 6 cabling products of types and ratings as specified herein and whose products have been in satisfactory use in similar service for not less than 3 years.

1. Group 1: Berk-Tek under the trade name *LANmark*.
2. Group 2: Commscope Products under the trade name *NETCONNECT*.
3. Group 3: Siemon under the trade name *SYSTEM 6*.

PART TWO – PRODUCTS

2.1 CABLING

A. Computer building wiring shall be 4 pair Category 6 UTP #23 AWG plenum 550MHZ rated, NEC type CMP. Outer jacket shall be blue in color. Accepted Category 6 manufacturer shall be as listed in Section 1.05.

2.2 MODULAR JACKS

A. Provide data modular jacks style RJ-45, 8P8C, 568B wired, with 110 style punch down terminations for computer use. Color selection by Owner. Accepted Category 6 manufacturer shall be as listed in Section 1.05.

B. Provide thermoplastic faceplates with two, three, or four modular ports and configuration of modular jacks as specified on the plans. Where required provide blank closures. Color to match other wiring device faceplates.

2.3 COMPUTER SUPPORT EQUIPMENT

A. Patch Panels: Provide rack mounted Category 6 patch panels wired for 568B as required for termination of computer cables. Configure panels in 24 and 48 ports; provide 25% spare capacity in each rack. Each rack shall have a maximum of 240 ports. Accepted Category 6 manufacturer shall be as listed in Section 1.05.

2.4 TELECOM/IC SUPPORT EQUIPMENT

A. Premise telecom/IC wiring shall be terminated on 110 type punch down blocks mounted to terminal boards. Provide Siemon F-66 or equivalent.

2.5 SURGE SUPPRESSION

A. All copper cabling entering/leaving building shall be protected by Ditek Surge Suppression modules (Vm/Rm Series).

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PART THREE – EXECUTION

3.1 GENERAL

A. All system components and appurtenances shall be installed in accordance with the manufacturer's instructions as specified and indicated. All installation work must be done in accordance with the safety requirements set forth in the general requirements of ANSI C2 and NFPA 70.

B. Interior cabling shall be installed and terminated at all station locations as indicated on the Drawings and herein specified. Cabling shall take the form of a "Structural Building Wiring Plan" where station cables are wired directly from a distribution point to the appropriate outlet location. Station cables shall not be installed in the same raceway with AC power cables. Station cables not installed in raceways shall be properly secured above the ceiling on system cable supports as shown on the Drawings. Cables shall not be installed on top of the tiles of lay-in ceiling grid system.

C. Labeling and marking shall be as follows:

1. Provide permanent markers on each cable at each termination point for easy identification. Numbering for jack identification shall be as described below unless the Owner has a predetermined identification scheme.
2. Jack numbering shall match the corresponding patch panel in the communications closet. Labels are to be machine made; hand written labels are unacceptable.
3. Data jacks shall be numbered with the flowing scheme: nn-01-D01, where nn is the building number, 01 is the floor number, “D” indicates data, and 01 is the 1st cable in the sequence for that floor.

D. All cables shall be terminated in approved modular jacks or termination enclosures. No cables shall be left "free" unless so stated on the Drawings.

3.2 INSTALLATION OF STRUCTURED COMPUTER CABLING

A. The computer wiring standard shall be T568B.

B. The Contractor shall install the computer system connecting all outlets and cabling to patch panels for a complete premise wiring system. This system shall be tested as specified herein.

3.3 TESTING - GENERAL

A. After installation the Contractor shall test the structured cabling systems as outlined below. Tests performed will have the results recorded in a pdf file format and submitted to the Architect for review. Test reports shall be attached a signed affidavit by the contractor certifying the reports. Outlets/cables failing these test procedures shall be corrected (or replaced) and retested at no additional cost to the Owner. After testing all cables will have a PASS rating.

B. The Contractor shall provide the necessary testing equipment for testing all cabling under this project. Installers testing cabling shall have a minimum of three years experience in industry testing procedures; installers shall also have factory certification in testing. Copies of this certification shall be available to Owner for examination upon request. Copies of all test reports shall be included with close-out documents.

C. The Owner reserves the right to witness any or all testing. The Contractor shall advise the Owner in written when testing is scheduled at least one week in advance of actual testing.

3.4 TESTING - STRUCTURED COMPUTER CABLING

A. Each computer cable shall be tested from each outlet (jack) to the patch panel for the following parameters:

1. Basic data:
   a. Cable manufacturer and part number, NVP
   b. ester manufacturer, model, serial number and hardware/software versions.
   c. Project name and circuit ID number
   d. Autotest specification used
   e. Overall PASS/FAIL indication
   f. Date of test
2. Wire Map:
   a. Continuity
   b. Shorts between conductors
   c. Crossed pairs
   d. Reversed pairs
   e. Split/open pairs
3. TIA/EIA 568-B.2 testing criteria for Permanent Link shall be followed as described below and shall meet the minimum values specified in the table below.
   a. Cable length in meters
   b. Propagation delay
   c. Delay skew
   d. Attenuation
   e. Near End Cross Talk (NEXT); both ends
   f. Power sum NEXT (PS NEXT); both ends
   g. ELFEXT; both ends
   h. Power Sum ELFEXT (PS ELFEXT); both ends
   i. Return Loss; both ends
   j. ACR
   k. Power Sum ACR

Permanent Link Performance –based upon TIA/EIA 568-B.2 (Draft 9b)								
Frequency MHz	Attenuation, db	Return Loss, db	NEXT, db	PS NEXT, db	ELFEXT, db	PS ELFEXT, db	ACR, db	PS ACR, db
1.0	1.9	19.1	65.0	62.0	64.2	61.2	62.0	59.0
4.0	3.5	21.0	64.1	61.8	52.1	49.1	60.6	58.3
8.0	5.0	21.0	59.4	57.0	46.1	43.1	54.4	52.1
10	5.6	21.0	57.8	55.5	44.2	41.2	52.3	49.9
16	7.0	20.0	54.6	52.2	40.1	37.1	47.6	45.2
20	7.9	19.5	53.1	50.7	38.2	35.2	45.2	42.8
25	8.9	19.0	51.5	49.1	36.2	33.2	42.6	40.2
31.25	10.0	18.5	50.0	47.5	34.3	31.3	40.0	37.6
62.5	14.4	16.0	45.1	42.7	28.3	25.3	30.8	28.3
100	18.6	14.0	41.8	39.3	24.2	21.2	23.3	20.7
200	27.4	11.0	36.9	34.3	18.2	15.2	9.6	7.0
250	31.1	10.0	35.3	32.7	16.2	13.2	4.2	1.6
Propagation Delay: 498 ns					Delay Skew: 44 ns			

B. UTP testers shall be approved for Level III as a field test device. Testers shall be factory calibrated by the manufacturer. The contractor shall provide a copy of the calibration certificate upon request by the Engineer or Owner.

3.5 WARRANTY

A. The Contractor shall warrant his installation against product defects and workmanship. All cabling components shall meet or exceed the requirements of TIA/EIA-568B, for a minimum period of 10 years.

END OF SECTION

Section 27 51 23

INTERCOMMUNICATIONS
AND PROGRAM SYSTEMS

PART ONE – GENERAL

1.1 SYSTEM DESCRIPTION

A. This section of the specifications includes the furnishing, installation, an extension of the existing multi-path intercom system. It shall include, but not be limited to, control devices, stations, power supplies, and wiring as shown on the drawings and specified.

1.2 MANUFACTURERS

A. Acceptable manufacturers are:

1. Valcom, Inc. (Multi-Path)

PART TWO – PRODUCTS

2.1 FUNCTIONAL REQUIREMENTS

A. Expand existing system to include one-way or talk-back paging with an unlimited number of one-way speakers per zone. A zone is defined as a call-in switch and/or speaker output.

2.2 EQUIPMENT SPECIFICATIONS

A. Equipment shall be rack-mountable in a standard 19” telecommunications rack/cabinet. The system shall be expandable in 24-zone increments or fewer.

2.3 SOFTWARE

2.3.1 Programming

A. The intercom/paging system shall be software programmable on any PC of the districts choice. The software settings shall control the practical function of the system. The system shall have a Windows® based PC administration programming tool which allows the administrative personnel to easily manage Audio Sources, Class Change schedules, paging groups, zone changes, time updates, holiday schedules and day/night mode operation from their desktop PC.

2.4 CABLING AND TERMINATIONS

2.4.1 Cabling

A. The Intercom/Paging system shall utilize TIA/EIA 568B.2-1 compliant Category 6, CMP cabling or pre-approved equal. Cable manufacturer shall meet the requirements set for in the Data and Voice Infrastructure Section 27 10 00. Cable shall be gray in color.

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2.4.2 Installation

A. All cable installations shall adhere to TIA/EIA 568, 569, and 606 standards. The 66-Blocks (110 blocks) shall be laser labeled. No hand written labels shall be accepted by the Owner.

B. The system shall be grounded in accordance with manufacturer recommendations and must meet or exceed TIA/EIA 607 standards for grounding and bonding in commercial buildings.

2.5 SPEAKER ASSEMBLIES AND CALL BUTTONS

2.5.1 Talkback Speakers

A. The Talkback speaker assembly shall be a 2'x2' lay-in ceiling tile speaker with a white perforated grille, a speaker and integral back-box. The volume setting is located in/on the speaker enclosure.

B. The speaker shall be 8" in diameter and have a 5oz. Ceramic magnet. The 8" speaker cone material shall be paper. The speaker impedance shall be 45 ohms. The diameter of the voice coil shall be ¾" diameter. The speaker shall be capable of handling 5watts of continuous power. Sound pressure level at one meter on axis with a one watt input shall be 95dB. The frequency shall be 70Hz to 17kHz.

C. The baffle shall be constructed with a single piece of perforated steel with a white baked on acrylic enamel finish. The back-box shall meet A.S.T.M E84 flame and smoke test and have a three hour burn rating (UL181).

2.5.2 One-Way Speakers

A. The One-Way speaker assemblies shall consist of a white 2'x2' perforated grille, a speaker and integral back-box. The volume control is accessible through the perforated grille.

B. The speaker shall be 8" in diameter and have a 5oz. Ceramic magnet. The 8" speaker cone material shall be paper. The speaker impedance shall be 45ohms. The diameter of the voice coil shall be ¾" diameter. Operating temperature shall be +32 to +122 ° F.

C. The One-Way shall include an amplifier assembly and volume control. Distortion shall be less than 1.5% at rated output of 1 watt RMS. Signal to noise ratio shall be -70dB. The amplifier shall operate on a -24Vdc nominal, positive ground Power Supply. Operating current shall be 50mA at -24Vdc.

D. The baffle shall be constructed with a single piece of perforated steel with a white baked on acrylic enamel finish. The back-box meets or exceeds A.S.T.M. E84 flame and smoke test and has a three hour burn rating (UL181).

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2.5.3 Outdoor Horns

A. All Outdoor Horns shall be 5-watt, high efficiency horns. Horns shall be registered as FCC approved devices. All outdoor horns shall be weather-resistant with a high frequency diffuser. It shall be equipped with an amplifier, externally accessible volume control. It shall include a detachable base for wall or single, double or octagon electrical box mounting and omni-directional ball joint mounting bracket to allow precise positioning in the vertical and horizontal planes with a single adjustment. An I-Beam Mounting Clamp shall also be provided. Note: Match existing type on building.

B. The frequency response shall be 275Hz to 14kHz. Dispersion shall be 120° horizontal and 90° vertical. Sound pressure level shall be 116dB measured at 4 feet on axis with an input to the amplifier module being -10dBm at 1kHz. Distortion shall be less than 2.05 at rated output of 5 watts RMS. Output load shall be 8 ohms. Input impedance shall be 600 ohms nominal. The amplifier shall operate on a -24Vdc nominal, positive ground power supply. Operating current shall be 300mA at -24Vdc.

C. The horn shall be constructed of high impact ABS Plastic. The mounting base shall be constructed on LEXAN an ultra high impact material which is stronger and tougher than die casting. The finish shall be beige with a brown accent. The I-Beam mounting clamp shall be constructed of zinc chromate plated steel.

2.5.4 Push To Talk Call Buttons

A. The unit shall be compatible with single gang electrical boxes. Dimensions shall be 4.5”W x 2.75”H x 2.125”D.

B. The call switch shall be a momentary rocker style switch to match existing. The call station shall be line powered. A screwdriver set volume control shall be provided to allow audio level adjustment of externally connected 45ohm speakers.

2.5.5 Power Supply

A. The wall or rack mountable switching power supply shall be 24 VDC power supply capable of providing 6 amperes of current. The design of this regulated power supply shall use switching technology, shall provide auto recovery short circuit protection and shall feature three (3) individual class “B” outputs each capable of providing 1/3 of the supply’s rated current. Additionally, the supply’s design shall incorporate EMI filtering, a minimum of 88.5% efficiency, a 3 second power up delay, a working input frequency range of 47 to 63Hz and an LED status indicator. The supply shall also feature +/- 2% voltage regulation and over voltage protection.

B. The supply shall be capable of operating within a temperature range of 0° to 50° C and a humidity range of 10% to 90% non-condensing. Maximum dimensions of the supply shall not exceed 10.3”H x 5.92”W x 2.5”D.

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PART THREE - EXECUTION

3.1 DOCUMENTATION REQUIREMENTS

A. The contractor shall provide to the district at no additional charge a complete set of as-built diagrams in AutoCAD pdf. The AutoCAD as-built shall have at a minimum the following information: Speaker and equipment layout including closet locations, zone identification including arch-number as provided by the School District, and trunk cable pathways. All termination fields shall be labeled in accordance with TIA/EIA 606(a) standards. No hand-written labels shall be accepted.

3.2 CONTRACTOR REQUIREMENTS

A. The selected contractor or sub-contractor shall have satisfactorily installed systems of this type and size within at least one year of this bid.

B. The contractor shall have at least two (2) manufacturer training and certified installation/programming technicians employed as full-time technicians at the time of their BID response. Show satisfactory evidence of certification and training by the manufacturer or manufacturer's authorized representative.

END OF SECTION

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Section 28 46 00

FIRE DETECTION AND ALARM SYSTEM

PART ONE - GENERAL

1.1 RELATED SECTIONS

A. Section 26 05 00 – Common Work Results for Electrical

1.2 DESCRIPTION:

A. This section of the specification includes the expansion, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.

B. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

C. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof).

D. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

E. The installing company shall employ NICET (minimum Level III Fire Alarm Technology) technicians on site to guide the final checkout and to ensure the systems integrity.

1.3 VOICE PANEL DESCRIPTION:

A. Existing voice panel is Notifier NFC-50/100.

B. The voice evacuation panel shall comply with NFPA 72 requirements.

C. Expand existing system/amps as required for new addition.

1.4 SCOPE:

A. A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance to the project specifications and drawings.

B. Expand the voice evacuation control panel shall be installed in accordance with the project specifications and drawings.

C. Basic Performance:

1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).
2. Initiation Device Circuits (IDC) shall be wired Class A (NFPA Style D) as part of an addressable device connected by the SLC Circuit.
3. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z) as part of an addressable device connected by the SLC Circuit.
4. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
5. NAC speaker circuits shall be arranged such that there is a minimum of one speaker circuit per floor of the building or smoke zone which ever is greater.
6. NAC speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system.

D. BASIC SYSTEM FUNCTIONAL OPERATION

When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

1. The system alarm LED on the system display shall flash.
2. A local piezo electric signal in the control panel shall sound.
3. A backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
4. All system output programs assigned via control-by-event interlock programming to be activated by the particular point in alarm shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.

1.5 SUBMITTALS

A. General:

1. Two copies of all submittals shall be submitted to the Architect/Engineer for review.
2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent compatible UL-listed equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.
3. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

B. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.

3. Show annunciator layout, configurations, and terminations.

C. Manuals:

1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.
2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.
3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

D. Software Modifications

1. Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site.

E. Certifications:

Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of the installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

1.6 GUARANTY:

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

1.7 APPLICABLE STANDARDS AND SPECIFICATIONS:

The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.

A. National Fire Protection Association (NFPA) - USA:

No. 13	Sprinkler Systems
No. 15	Water Spray Systems
No. 72	National Fire Alarm Code
No. 101L	ife Safety Code

B. Underwriters Laboratories Inc. (UL) - USA:

No. 268	Smoke Detectors for Fire Protective Signaling Systems
No. 864	Control Units for Fire Protective Signaling Systems
No. 268A	Smoke Detectors for Duct Applications
No. 521	Heat Detectors for Fire Protective Signaling Systems
No. 464	Audible Signaling Appliances
No. 38	Manually Actuated Signaling Boxes
No. 346	Waterflow Indicators for Fire Protective Signaling Systems
No. 1076	Control Units for Burglar Alarm Proprietary Protective Signaling Systems
No. 1971	Visual Notification Appliances

C. Local and State Building Codes.

D. All requirements of the Authority Having Jurisdiction (AHJ).

1.10 APPROVALS:

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:

UL Underwriters Laboratories Inc

B. The fire alarm control panel shall meet UL Standard 864 (Control Units) and UL Standard 1076 (Proprietary Burglar Alarm Systems).

C. The system shall be listed by the national agencies as suitable for extinguishing release applications. The system shall support release of high and low pressure CO2.

PART TWO - PRODUCTS

2.1 EQUIPMENT AND MATERIAL, GENERAL:

A. All equipment and components shall be new, and match existing model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signaling system, meeting the National Fire Alarm Code.

B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.2 CONDUIT AND WIRE:

A. Conduit:

1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
2. Where required, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-55.
4. Wiring for 24 volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
5. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
6. Conduit shall be 3/4-inch (19.1 mm) minimum.

B. Wire:

1. All fire alarm system wiring shall be new.
2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.
3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).
5. Wiring used for the multiplex communication circuit (SLC) shall be twisted and unshielded and support a minimum wiring distance of 12,500 feet. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit.
6. All field wiring shall be electrically supervised for open circuit and ground fault.
7. The fire alarm control panel shall be capable of t-tapping Class B (NFPA Style 4) Signaling Line Circuits (SLCs). Systems that do not allow or have restrictions in, for example, the amount of t-taps, length of t-taps etc., are not acceptable.

C. Terminal Boxes, Junction Boxes and Cabinets:

All boxes and cabinets shall be UL listed for their use and purpose.

D. Initiating circuits shall be arranged to serve like categories (manual, smoke, waterflow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

E. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod.

2.3 MAIN FIRE ALARM CONTROL PANEL OR NETWORK NODE:

A. The existing FACP in aNotifier NFW2-100 system.

B. Signaling Line Circuits (SLC)

1. Each FACP network node shall support one SLC. Each SLC interface shall provide power to and communicate with up to 159 intelligent detectors (ionization, photoelectric or thermal) and 159 intelligent modules (monitor or control) for a loop capacity of 318 devices. SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class B) wiring.

C. Voice Evacuation Control Panel

1. Existing Evac Panel is Notifier NFC-50/100.
2. Minimum requirements:
   a. Integral 25 Watt, 25 Vrms audio amplifier with optional converter for 70.7-volt systems. The system shall be capable of expansion to 50 watts total via the insertion of an additional 25-watt audio amplifier module into the same cabinet.
   b. Speaker circuit that can be wired both Class A or B.
   c. Built in alert tone generators with steady, slow whoop, high/low and chime tone field programmable.
3. Speakers:
   a. All speakers shall operate on 25 or 70 VRMS with field selectable output taps from 0.5 to 2.0 Watts.
   b. Speakers in corridors and public spaces shall produce a nominal sound output of 84 dBA at 10 feet (3m).
   c. Frequency response shall be a minimum of 400 HZ to 4000 HZ.
   d. The back of each speaker shall be sealed to protect the speaker cone from damage and dust.

D. Power Supply:

1. A high tech off-line switching power supply shall be available for the fire alarm control panel or network node and provide 6.0 amps of available power for the control panel and peripheral devices.
2. Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.
3. Positive-Temperature-Coefficient (PTC) thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs. The power supply shall provide an integral battery charger for use with batteries up to 55 AH or may be used with an external battery and charger system. Battery arrangement may be configured in the field.

4. The power supply shall continuously monitor all field wires for earth ground conditions, and shall have the following LED indicators:

   Ground Fault LED
   AC Power Fail LED
   NAC on LED (4)

5. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.
6. The main power supply shall provide a battery charger using dual-rate charging techniques for fast battery recharge and be capable of charging batteries up to 200 AH.
7. All circuits shall be power-limited, per UL864 requirements.

E. Auxiliary Field Power Supply - Addressable

1. The auxiliary addressable power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24VDC power. The power supply shall also include and charge backup batteries.
2. The addressable power supply for the fire alarm system shall provide up a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 5 amps of 24 volt DC general power. The power supply shall have an additional .5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 7.0 - 25.0 amp hour batteries.
3. The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as two Class "A" and two Class "B" or four Class "B" only circuits. All circuits shall be power-limited per UL 864 requirements.
4. The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.
5. The addressable power supply shall operate on 120 or 240 VAC, 50/60 Hz.
6. The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signaling Line Circuit (SLC) or other multiplexed means Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACP to the addressable power supply shall be a single unshielded twisted pair wire. Data on the SLC shall be transmitted between 24 VDC, 5 VDC and 0 VDC at approximately 3.33k baud.
7. The addressable power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.
8. The addressable power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss, reporting of the incident to the FACP will be delayed. A delay time of eight or sixteen hours shall be Dip-switch selected.

9. The addressable power supply shall have an option for Canadian Trouble Reporting and this option shall be Dip-switch selectable.
10. The addressable power supply mounts in either the FACP backbox or it's own dedicated surface mounted backbox with cover.
11. Each of the power supply's four output circuits shall be DIP-switch selected for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.
12. The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "A" or by the use of and end-of-line resistor. When the power supply's output circuit is selected as General 24VDC power, the circuit shall be individually supervised when an end-of-line relay is used.
13. When selected for Notification Appliance Circuits, the output circuits shall be individually DIP-switch selectable for Steady, March Time, Dual Stage or Temporal.
14. When selected as a Notification Appliance Circuit, the output circuits of the addressable power supply shall have the option to be coded by the use of a universal zone coder.
15. The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.
16. An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

F. Field Charging Power Supply (FCPS)

The FCPS is a device designed for use as either a remote 24 volt power supply or used to power Notification Appliances.

1. The FCPS shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24 volt power. It shall include an integral charger designed to charge 7.0 amp hour batteries and to support 60 hour standby.
2. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (two Style Y or Z and two style Y) shall be available for connection to the Notification devices.
3. The FCPS shall include an attractive surface mount backbox.
4. The Field Charging Power Supply shall include the ability to delay the AC fail delay per NFPA requirements.
5. The FCPS include power limited circuitry, per 1995 UL standards.

G. Specific System Operations

1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.

2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 5 to 30 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
3. Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.
4. Point Read: The system shall be able to display or print the following point status diagnostic functions:
    a. Device status
    b. Device type
    c. Custom device label
    d. View analog detector values
    e. Device zone assignments
    f. All program parameters
5. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.
6. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 800 events. Up to 200 events shall be dedicated to alarm and the remaining events are general purpose. Systems that do not have dedicated alarm storage, where events are overridden by non-alarm type events, are not suitable substitutes. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.
7. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display, and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
8. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
9. Software Zones: The FACP shall provide 100 software zones, 10 additional special function zones, 10 releasing zones, and 20 logic zones.
10. The fire alarm control panel shall include a walk test feature. It shall include the ability to test initiating device circuits and notification appliance circuits from the field without returning to the panel to reset the system. Operation shall be as follows:
    a. Alarming an initiating device shall activate programmed outputs, which are selected to participate in walk test, for 3 seconds.

b. Introducing a trouble into the initiating device shall activate the programmed outputs for 8 seconds.
c. All devices tested in walk test shall be recorded in the history buffer.

11. Waterflow Operation

An alarm from a waterflow detection device shall activate the appropriate alarm message on the main panel display, turn on all programmed notification appliance circuits and shall not be affected by the signal silence switch.

12. Supervisory Operation

An alarm from a supervisory device shall cause the appropriate indication on the system display, light a common supervisory LED, but will not cause the system to enter the trouble mode.

13. Signal Silence Operation

The FACP shall have the ability to program each output circuit (notification, relay, speaker etc) to deactivate upon depression of the signal silence switch.

14. Non-Alarm Input Operation

Any addressable initiating device in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.

15. Combo Zone

A special type code shall be available to allow waterflow and supervisory devices to share a common addressable module. Waterflow devices shall be wired in parallel, supervisory devices in series.

2.4 SYSTEM COMPONENTS:

A. Programmable Electronic Sounders:

1. Electronic sounders shall operate on 24 VDC nominal.
2. Electronic sounders shall be field programmable without the use of special tools, at a sound level of at least 90 dBA measured at 10 feet from the device.
3. Shall be flush or surface mounted as shown on plans.

B. Speakers:

1. All speakers shall operate on 25 VRMS or with field selectable output taps from 0.5 to 2.0 Watts.
2. Speakers in corridors and public spaces shall produce a nominal sound output of 84 dBA at 10 feet (3m).
3. Frequency response shall be a minimum of 400 HZ to 4000 HZ.
4. The back of each speaker shall be sealed to protect the speaker cone from damage and dust.

C. Strobe lights shall meet the requirements of the ADA, UL Standard 1971, be fully synchronized, and shall meet the following criteria:

1. The maximum pulse duration shall be 2/10 of one second.
2. Strobe intensity shall meet the requirements of UL 1971.
3. The flash rate shall meet the requirements of UL 1971.
4. Strobes shall have the capability of field adjusting the intensity (cd).

D. Manual Fire Alarm Stations

1. Manual fire alarm stations shall be non-code, non-breakglass type, equipped with key lock so that they may be tested without operating the handle.
2. Stations must be designed such that after an actual activation, they cannot be restored to normal except by key reset.
3. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of 100 feet (30.5 m) front or side.
4. Manual stations shall be constructed of high impact Lexan, with operating instructions provided on the cover. The word FIRE shall appear on the manual station in letters one half inch (12.7 mm) in size or larger.

E. Duct Smoke Detectors

Duct smoke detectors shall be a 24 VDC type with visual alarm and power indicators, and a reset switch. Each detector shall be installed upon the composite supply/return air ducts(s), with properly sized air sampling tubes.

F. Waterflow Indicator:

1. Waterflow Switches shall be an integral, mechanical, non-coded, non-accumulative retard type.
2. Waterflow Switches shall have an alarm transmission delay time which is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds.
3. All waterflow switches shall come from a single manufacturer and series.
4. Waterflow switches shall be provided and connected under this section but installed by the mechanical contractor.
5. Where possible, locate waterflow switches a minimum of one (1) foot from a fitting which changes the direction of the flow and a minimum of three (3) feet from a valve.

G. Sprinkler and Standpipe Valve Supervisory Switches:

1. Each sprinkler system water supply control valve riser, zone control valve, and standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
2. PIV (post indicator valve) or main gate valves shall be equipped with a supervisory switch.
3. The switch shall be mounted so as not to interfere with the normal operation of the valve and adjusted to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.

4. The supervisory switch shall be contained in a weatherproof aluminum housing, which shall provide a 3/4 inch (19 mm) conduit entrance and incorporate the necessary facilities for attachment to the valves.
5. The switch housing shall be finished in red baked enamel.
6. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.
7. Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor.
    a. This unit shall provide for each zone: alarm indications, using a red alarm an yellow trouble long-life LEDs and control switches for the control of fire alarm control panel functions. The annunciator will also have an ON-LINE LED, local piezo electric signal, local acknowledge/lamp test switch, and custom slide-in zone/function identification labels.
    b. Switches shall be available for remote annunciation and control of output points in the system, system acknowledge, telephone zone select, speaker select, global signal silence, and global system reset within the confines of all applicable standards.

H. All interfaces and associated equipment are to be protected so that they will not be affected by voltage surges or line transients consistent with UL standard 864.

I. Field Wiring Terminal Blocks

For ease of service all panel I/O wiring terminal blocks shall be removable, plug-in types and have sufficient capacity for #18 to #12 AWG wire. Terminal blocks that are permanently fixed are not acceptable.

2.5 SYSTEM COMPONENTS - ADDRESSABLE DEVICES

A. Addressable Devices - General

1. Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an address in a range of 001 to 159.
2. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute.
3. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.
4. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
5. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.

6. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.
7. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Bases shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 7 applications.
8. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
9. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
10. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
11. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.
12. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.
13. Addressable modules shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.

B. Addressable Manual Fire Alarm Box (manual station)

1. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

C. Intelligent Photoelectric Smoke Detector

1. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
2. Provide CO carbon monoxide where shown.

D. Intelligent Photo Smoke Detector

1. The intelligent photo smoke detector shall be a spot type detector that incorporates an extremely bright laser diode and an integral lens that focuses the light beam to a very small volume near a receiving photo sensor. The scattering of smoke particles shall activate the photo sensor.
2. The detector shall have conductive plastic so that dust accumulation is reduced significantly.
3. The intelligent photo detector shall have nine sensitivity levels and be sensitive to a minimum obscuration of 0.03 percent per foot.
4. The detector shall not require expensive conduit, special fittings or PVC pipe.
5. The intelligent photo detector shall support standard, relay, isolator and sounder detector bases.
6. The photo detector shall not require other cleaning requirements than those listed in NFPA 72. Replacement, refurbishment or specialized cleaning of the detector head shall not be required.
7. The photo detector shall include two bicolor LEDs that flash green in normal operation and turn on steady red in alarm.

E. Intelligent Ionization Smoke Detector

1. The detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

F. Intelligent Multi Criteria Acclimating Detector

1. The intelligent multi criteria Acclimate detector shall be an addressable device that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine it's environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smoldering fires and thermal properties all within a single sensing device.
2. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes).
3. The intelligent multi criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.

G. Intelligent Thermal Detectors

1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

H. Intelligent Duct Smoke Detector

1. The smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.
2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

I. Addressable Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs.
2. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.

J. Two Wire Detector Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).
2. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

K. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances.
2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation.
3. Audio/visual power shall be provided by a separate supervised power circuit from the main fire alarm control panel or from a supervised UL listed remote power supply.
4. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

L. Addressable Relay Module

1. Addressable Relay Modules shall be available for HVAC control and other building functions. The relay shall be form C and rated for a minimum of 2.0 Amps resistive or 1.0 Amps inductive. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.

M. Isolator Module

1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.
2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
3. The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
4. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

2.6 BATTERIES:

A. The battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.

B. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.

C. If necessary to meet standby requirements, external battery and charger systems may be used.

PART THREE – EXECUTION

3.1 INSTALLATION:

A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

D. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.2 TEST:

The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72, Chapter 7.

A. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

B. Open initiating device circuits and verify that the trouble signal actuates.

C. Open and short signaling line circuits and verify that the trouble signal actuates.

D. Open and short notification appliance circuits and verify that trouble signal actuates.

E. Ground all circuits and verify response of trouble signals.

F. Check presence and audibility of tone at all alarm notification devices.

G. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.

H. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

I. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

J. When the system is equipped with a Voice Evacuation Control panel, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying voice messages.

3.3 FINAL INSPECTION:

A. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

END OF SECTION

Section 31 11 00

CLEARING AND GRUBBING

PART ONE - GENERAL

1.1 WORK INCLUDED

1. Removing and disposing of existing trees, vegetation, buildings, fencing, pavements, sidewalks, utilities, storm drains, etc. as shown on the drawings.
2. Preserving trees and vegetation in designated areas.
3. Disposing of removed material.

1.2 RELATED WORK

1. Grading Section 31 22 00

PART TWO - PRODUCTS

No products included.

PART THREE - EXECUTION

3.1 PREPARATION

A. Protect existing trees from damage by equipment when removing designated trees and during site grading operation.

B. Mark clearly the areas of preserved vegetation, the clearing limits along the boundary of the site, and the individual trees to be saved as designated by the Architects and/or Drawings.

3.2 CLEARING

A. Clear the site within the limits of proposed improvements as shown on the Drawings, of trees, saplings, brush, shrubs, roots, undergrowth, buildings, fencing, pavements, sidewalks, utilities, storm drains, and other debris.

B. Remove stumps from building, paving, and embankment areas.

1. Remove all stumps in building and paving areas.
2. Cut stumps in other areas flush with or below existing ground elevations.
3. Backfill and compact stump holes and foundation holes except in areas to be excavated.

C. Backfill holes within the building area using suitable fill materials as defined in Paragraph 2.1 of Section 31 22 00. Fill shall be compacted according to the requirements of Paragraph 3.3 of Section 31 22 00.

D. Do not park or service equipment under the branches of trees designated to remain.

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E. Restrict movement and operation of equipment so that trunks, branches and roots of trees and shrubs designated to remain will not be broken, scarred, or otherwise damaged.

F. Apply an approved tree wound paint to any lightly damaged trees.

3.3 DISPOSAL

A. Dispose of cleared materials at an offsite location secured by the Contractor.

3.4 PROTECTION

A. Erect temporary barricades, and other protection required to protect all persons and property from preparation and construction operations.

3.5 UTILITIES

A. Protect and preserve in operating condition, all active utility services that traverse or border the site, and repair any damages that may occur to these services due to work performed the site preparation, demolition and construction operations. Utility lines that are to be abandoned shall be completely removed from the site and plugged at the street as required by the serving utility.

END OF SECTION

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Section 31 22 00

GRADING

PART ONE - GENERAL

1.1 WORK INCLUDED

A. Stripping and stockpiling surface layer of topsoil and organic matter in building and traffic areas and in all cut and fill areas.

B. Removing and disposing of boulders, fractured rock, and other material unsuitable for use in fill under structures (controlled fill).

C. Excavating site to required subgrade for controlled fill and traffic areas and grading site to required slopes.

D. Placing and compacting excavated material to required density and at required subgrade and slope for structures, pavement areas, and fill slopes.

1.2 RELATED WORK

A. Testing Laboratory Services Section 01 45 29

1.3 QUALITY ASSURANCE

A. Testing agency:

1. Soil classification tests on material for controlled fill to be performed by testing laboratory selected by the Architect.
2. In-place soil compaction tests to be performed by testing laboratory at locations selected by the Architect.
3. Refer to section 01 45 29 - Testing Laboratory Services for details of testing procedures.

B. Reference Standards:

1. American Society for Testing and Materials (ASTM):
   a. ASTM D2487-69 (175), Classification of Soils for Engineering Purposes.
   b. ASTM D-1557 Modified Compaction Procedures.
   c. ASTM D 1556-64 (1974) Method of Test for Density of Soil in Place by the Sand-cone Method.
   d. ASTM D 2167-66 (1977), Method of Test for Density of Soil in Place by the Rubber Balloon Method.
   e. ASTM D 2922-71, Methods for Determining the Density of Soil and Soil-aggregate by Nuclear Methods (shallow depth).

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1.4 SUBMITTALS

A. Have the testing laboratory submit reports that material for controlled fill meets the requirements of this Section:

1. On site excavated material.
2. Borrow material.

B. Have testing laboratory submit reports of density tests of controlled fill.

1.5 SITE CONDITIONS

A. Establish positive surface drainage during and following clearing and site grading by proper ditching or sloping.

B. Provide measures to prevent mud and silt from flowing onto adjacent property.

C. Erect sheeting, shoring, and bracing as necessary for protection of persons, improvements, and excavation.

PART TWO - PRODUCTS

2.1 SUITABLE MATERIAL FOR CONTROLLED FILL

A. On site excavated soils:

1. Sandy or gravelly clays having a liquid limit less than 40.
2. Unified Soils Classification System Soils:
   a. Class SC, SW, SM
   b. Class GC, GW, GM
   c. Class CL (when approved by Soils Engineer).
3. Overburden soils with low plasticity.

B. Borrow Material:

1. Material meeting the requirements of selected material as described in Section 210 of the Arkansas State Highway Department's Standard Specifications for Highway Construction, Edition of 2003.
2. All borrow material shall be approved by the soils engineer prior to placement.

2.2 UNSUITABLE MATERIAL FOR CONTROLLED FILL

A. All areas: Organic top soils and soils containing roots, vegetable matter, or trash.

B. Building area:

1. Cobbles, boulders, and fractured rock more than 6 inches in greatest dimension anywhere in the fill.
2. Cobbles and fractured rock more than 3 inches in greatest dimension within 12 inches of the finished subgrade.

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C. Paving area:

1. Cobbles, boulders, and fractured rock more than 8 inches in greatest dimension anywhere under the paving area.
2. Cobbles and fractured rock more than 4 inches in greatest dimension within 12 inches of the finished subgrade.

2.3 SUITABLE MATERIAL FOR CLEAN SAND OR GRAVEL UNDER SLABS (DRAINAGE FILL)

A. All materials clean free of shale, clay, friable materials and debris.

1. Gravel: Clean natural stone, free of organic material. Maximum size 1/2".
2. Sand: Clean natural river or bank sand, free of organic material.

PART THREE - EXECUTION

3.1 PREPARATION

A. Complete clearing work:

1. Remove unsuitable materials from the site before beginning site grading.

B.. Stake the work: By the Contractor.

C. Notify Architect 24 hours before controlled fill is to begin.

3.2 EXCAVATION

A. Excavation procedures:

1. Strip surface layer of top soil, organic matter, and any remaining trash in cut and fill areas of the site and stockpile for later use in landscaping operations.
   a. Removed material containing unacceptable quantities of trash or rock in the mixture shall be disposed of off the site or may be spread in thin layers in the outerpart of fill slopes outside of controlled fill areas.
2. Remove soft or spongy material at the exposed subgrade of cut and fill areas and replace with approved material and compact.
3. Remove rock and boulders in cut areas to a minimum depth of 8 inches below sub-grade and replace with approved material and compact.
4. Use all suitable excavated material, as far as practicable, in the formation of controlled fills and fill slopes.
5. Material determined by the Soils Engineer to be unsuitable for proper compaction may be placed in the fill slopes outside controlled fill areas.
6. Excavated boulders and rock determined by the Soils Engineer to be too large for use in fill slopes shall be disposed of off the site.
7. Do not leave undrained pockets where boulders or rocks have been removed.
8. Keep all excavation dry by pumping or draining water from the Work.
9. In cut areas where fill is not required, scarify exposed subgrade soils to a depth of at least 8 inches, adjust the soil moisture, and recompact to the same density as required for each layer of controlled fill; or, proof-roll the areas with a loaded tandem axle dump truck or similar equipment to aid in identifying soft areas.

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10. Grade excavated slopes to a neat, smooth condition with no loose material or scars left on the surface.
11. Refer to the geotechnical investigation for further information regarding excavation, site preparation, fill placement, etc.

3.3 CONTROLLED FILL

A. Scarify cleared surfaces in fill areas to a depth of at least 8 inches, adjust the soil moisture, and re-compact to the same density as required for each layer of controlled fill; or proof-roll as described in sub-paragraph 9 of Article 3.2.1.

B. Fill placed on hillsides:

1. Bench continuously as the work is brought up in layers.
2. Begin each horizontal cut at the intersection of the original ground and the vertical sides of the previous cuts.
3. Re-compact the cut-out material along with the new fill material.

C. Place fill material in lifts no greater than 8 inch loose-lift uniform thickness and compact to a minimum of 95% of maximum dry density at or near optimum moisture content as determined by the Modified Compaction Procedures, ASTM D-1557.

1. Compact lifts containing low plasticity clay soils at 2% to 4% above optimum moisture content.
2. Add water when the soil is too dry and mix with the material before compacting.
3. Aerate material when too wet by manipulation with suitable equipment before compacting.

D. Each fill lift will be tested and approved for adequate density and proper moisture content before additional lifts shall be placed.

E. Grade fill slopes to a neat, smooth condition with no loose material, protruding rock, or scars left on the surface.

3.4 FIELD QUALITY CONTROL

A. In-place tests of density and moisture content of controlled fill in accordance with either ASTM D1556-64 (1974), ASTM D2167-66 (1977), or ASTM D2922-71 (1976) by testing laboratory.

B. Soil Classification of fill material and placement location of each type to be determined by Soils Engineer.

C. Provide a minimum of 2 tests of density and moisture content per lift.

END OF SECTION

Section 31 23 00

EXCAVATION AND FILL

PART ONE - GENERAL

1.1 WORK INCLUDED

A. Excavate for the following structures and stockpile subsoil on site or, if suitable, use fill material on the site.

1. Footings, for building and other structures.
2. Sidewalks and steps.

B. Shore and brace excavations as required.

C. Place and compact fills to rough grade elevations.

D. Dewater excavations.

1.2 RELATED WORK

A.	Testing Laboratory Services	Section 01 45 29
B.	Clearing and Grubbing	Section 31 11 00
C.	Grading	Section 31 22 00
D.	Seeding	Section 32 92 19
E.	Concrete	Division Three

1.3 BACKFILL COMPACTION TESTING

A. Testing of compacted backfill materials will be performed by an independent testing laboratory employed and paid for by the Owner. Testing will be performed so as to least encumber the performance of Work. Refer to Section 01 45 29.

B. When work of this Section or portions of work are completed, notify the testing laboratory to perform density tests. Do not proceed with additional backfill work until results have been verified.

C. If, during progress of work, tests indicate that compacted materials do not meet specified requirements, remove defective work, replace, and retest at no cost to Owner, as directed by the Architect.

D. Ensure compacted fills are tested before proceeding with placement of surface materials.

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1.4 SUBMITTALS

A. Submit minimum 10 pounds samples of each type of excavated backfill material to be used. Forward samples to appointed testing laboratory, packed tightly in containers to prevent contamination.
   1. Protect trees, shrubs, and lawns, areas to receive planting, rock outcropping, and other features remaining as part of final landscaping.
   2. Protect bench marks and existing structures, roads, sidewalks, paving, and curbs against damage from equipment and vehicular or foot traffic.
   3. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods, as required to prevent cave-ins or loose dirt from falling into excavations.
   4. Underpin adjacent structures, which may be damaged by excavation work, including service lines and pipe chases.
   5. Notify Architect of unexpected sub-surface conditions and discontinue work in areas until Architect provides notification to resume work.
   6. Protect bottom of excavations and soil around and beneath foundations from frost or freezing.
   7. Grade around excavations to prevent surface water run-off into excavated areas.

PART TWO - PRODUCTS

2.1 SUITABLE BACKFILL MATERIALS

A. Gravel: Angular crushed natural stone free from shale, clay, friable materials, and debris.

B. Pea gravel: Clean natural stone free from clay, shale, and organic matter.

C. Sand: Clean natural river or bank sand free from silt, clay, loam, friable or soluble materials, and organic matter.

D. Under areas not to be paved: Sub-soil free from roots, rock larger than 3 inches in size, and building debris.

E. Under structures or areas to be paved: Material meeting requirements for controlled fill as specified in Section 31 22 00, Article 2.1.

F. Fill under landscaped areas: Free from alkali, salt, petroleum products. Use sub-soil excavated from site only if conforming to specified requirements in Paragraphs 4 or 5 above.

PART THREE - EXECUTION

3.1 PREPARATION AND LAYOUT

A. Establish extent of excavation by area and elevation; designate and identify datum elevation.

B. Set required lines and levels.

C. Maintain bench marks, monuments and other reference points.

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3.2 UTILITIES

A. Before starting excavation, establish location and extent of underground utilities occurring in work area.

B. Notify utility companies to remove and relocate lines which are in the way of excavation.

C. Maintain, re-route, or extend as required existing utility lines to remain which pass through work area.

D. Pay costs for this work except those covered by utility companies.

E. Protect utility services uncovered by excavation.

3.3 EXCAVATION

A. Excavate sub-soil in accordance with lines and levels required for construction of the work, including space for forms, bracing and shoring, foundation drainage system, and to permit inspection.

B. Do additional excavation only by written authorization of Architect.

C. Machine-slope banks.

D. Hand trim excavations and leave free from loose or organic matter.

E. Footings shall always be poured the same day that excavations are made, and water shall never be allowed to stand in excavated footing trench.

F. When complete, verify soil bearing capacities, depths and dimensions.

G. Correct unauthorized excavation as directed, at no cost to Owner.

H. Fill over-excavated areas under structure bearing surfaces with concrete as specified for foundations.

I Excavations are not to interfere with normal 45 degree bearing splay of any foundation.

J. Stockpile excavated sub-soil for reuse where directed. Remove excess or unsuitable excavated sub-soil from site.

K. Do not disturb soil within branch spread of existing trees or shrubs that are to remain.

3.4 BACKFILLING

A. Stockpile fill material in area(s) designated by Architect.

B. Ensure areas to be backfilled are free from debris, snow, ice and water, and that ground surfaces are not in a frozen condition.

C. Do not backfill over existing sub-grade surfaces which are porous, wet, or spongy.

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D. Compact existing sub-grade surfaces if densities are not equal to that required for backfill materials.

E. Cut out soft areas of existing sub-grade. Backfill with sand and compact to required density.

F. Backfill areas to grades, contours, levels and elevations.

G. Backfill systematically and as early as possible to allow maximum time for natural settlement and compaction.

H. Place and compact back fill materials in continuous layers not exceeding 6 inches loose depth.

I. Maintain optimum moisture content of backfill materials to attain required compaction density.

J. Where temporary unbalanced pressures are liable to develop on walls, erect necessary shoring to counteract imbalance. Leave in place until their removal is approved by Architect.

3.5 FILL TYPES AND COMPACTION

A. Within building area: Restore controlled fill to underside of stabilizing base course for floor slabs to density requirements specified in Section 31 22 00, Article 3.3.

B. Backfill under areas not to be paved: Compact with mechanical tampers until material is as firm and unyielding as the surrounding material undisturbed by excavation.

C. Fill under structures and backfill under paving areas: Compact to top of subgrade to density requirements specified in Section 31 22 00, Article 3.3.

D. Fill under landscaped areas: Sub-soil to within 12 inches of finish grade elevation.

3.6 FIELD QUALITY CONTROL

A. In-place tests of density and moisture content of backfill specified to be compacted to specific density requirements shall be performed by the testing laboratory in accordance with either ASTM D1556-64 (1974), ASTM D2167-66 (1977), or ASTM D2922-71 (1976).

END OF SECTION

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Section 31 25 00

EROSION AND
SEDIMENTATION CONTROL

PART ONE – GENERAL

1.1 DESCRIPTION

A. All new slopes and disturbed areas shall be treated for erosion control in accordance with these specifications including silt fencing and placement of hay bales. Contractor will provide a Storm Water Pollution Prevention Plan (SWPPP) and permit complying with all Arkansas Department of Environmental Quality Standards.

1.2 RELATED SECTIONS

A. Clearing and Grubbing Section 31 11 00

B. Grading Section 31 22 00

1.3 REFERENCES

A. United States Environmental Protection Agency (EPA):

1. NPDES – National Pollutant Discharge Elimination System

B. Arkansas Highway & Transportation Department (AHTD):

1. AHTD – Arkansas Highway & Transportation Department Standard Specifications for Highway Construction.

C. Arkansas Department of Environmental Quality (ADEQ):

1. ADEQ – Arkansas Department of Environmental Quality requirements.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with the following ADEQ standards:

1. Section 220 – Temporary Erosion, Sedimentation and Stormwater Pollution Prevention and Control.
2. Section 223 – Temporary Silt Fence.
3. Section 224 – Temporary Sediment Control Filters.
4. Section 226 – Temporary Sediment Removal.

B. Regulatory Requirements: Conform to requirements of local authority having jurisdiction for prevention of erosion and sediment control.

1. Conform to NPDES requirements where required.

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1.5 PROJECT CONDITIONS

A. Protect adjacent properties and water resources from erosion and sediment damage throughout work. Take all necessary measures to prevent sedimentation from construction operations to enter adjacent property. Offsite discharge of sedimentation is not permitted.

PART TWO – PRODUCTS

2.1 MATERIALS

A. Seeding: Bermuda Grass, common, unhulled, (March 1st through September 1st) broadcast at a rate of 30 pounds per acre. All other times, seed shall be Rye applied at the rate of 20 pounds per acre and unhulled Bermuda at 20 pounds per acre.

B. Fertilizer: 10-20-10 spread at the rate of 400 pounds per acre.

C. Fencing for Siltation Control: UV resistant geotextile fabric.

D. Temporary Mulches: Loose straw, netting, wood cellulose, or agricultural silage free of seed. Mulch material with asphalt tack shall be spread as required to hold grass during establishment of turf.

E. Bale Stakes:

1. Minimum 3 feet length.
2. (2) No. 4 steel reinforcing bars or
3. (2) steel pickets or
4. (2) 2 x 2 inch hardwood stakes driven 18 inches to 24 inches into ground.

PART THREE – EXECUTION

3.1 The Contractor shall produce a Storm Water Pollution Prevention Plan (SWPP) that meets the requirements set forth by the Arkansas Department of Environmental Quality.

3.2 The Contractor shall fill our inspection reports and log rainfall data as required by the SWPP.

3.3 The Contractor shall install all erosion control measures prior to commencing dirtwork activities on this site.

3.4 The Contractor shall immediately clean up any sediment that leaves this site.

3.5 The Contractor shall re-establish all disturbed areas in accordance with the SWPP.

3.6 The Contractor shall removal all erosion control measures once the site has been re-established.

END OF SECTION

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Section 31 31 16

TERMITE CONTROL

PART ONE - GENERAL

1.1 WORK INCLUDED

A. Soil treatment under slabs for termite control.

B. Soil treatment at concrete foundation for termite control.

C. Termite damage guarantee with annually renewable termite inspection control contract.

1.2 RELATED WORK

A.	Excavation and Fill	Section 31 23 00
B.	Concrete Work	Division Three

1.3 QUALITY ASSURANCE

A. The applicator shall be licensed by the State of Arkansas to perform the Work of this Section.

B. The applicator shall be bonded and insured by an insurance company authorized to practice business in the State of Arkansas.

1.4 REGULATORY REQUIREMENTS

A. Local Laws: All Work performed under this Section shall conform with the Arkansas Pest Control Law, Act III of 1965.

1.5 GUARANTEE

A. Submit a five year written guarantee, without monetary limits, stating that all additional treatment of areas where termites appear, and any damages caused by the termite appearance, will be performed at no cost to the Owner.

B. Provide the Owner an annually renewable termite inspection control contract, effective five years from date of the original soil treatment, to assure necessary re-treatment and liability for termite damage.

C. Draw the guarantee in favor of the Owner, with copies of the guarantee of the renewable inspection control contract provided for the Owner, the Contractor, and the Architect.

D. No payment will be made for termite control work until the above guarantee has been submitted in satisfactory form.

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PART TWO - PRODUCTS

2.1 MATERIALS

A. Chemicals:

1. Use chemicals formulated as an emulsible concentrate for subsequent dilution with water.
2. Fuel oil will not be permitted as a diluent.
3. Use chemicals of a type currently known to give insurable protection for the soil and fill at the foundation and under the new addition.

PART THREE - EXECUTION

3.1 PREPARATION

A. The applicator shall visit the job site to determine the soil texture or otherwise obtain the information from the County Agent, the U.S. Soil Conservation Service, or other approved authorities.

B. The Contractor shall remove all wood and other cellulose containing materials from the area within the building walls before the solution is applied.

C. The Contractor shall set tentative dates with the applicator for initial treatment services and schedule subsequent service as deemed necessary for completion of the termite control work.

D. The Contractor shall give the applicator 24 hour notice prior to installing the moisture barrier in preparation for placement of the floor slabs.

3.2 APPLICATION

A. Soil Conditions:

1. Do not apply the working solution when soil is frozen, excessively wet, or immediately after heavy rains.
2. Do not disturb treated areas during subsequent construction operations.

B. Apply the working solution to the soil over the entire surface under slabs and at the concrete foundations at the rate of application recommended by the chemicals manufacturers and in accordance with regulatory requirements to provide the required guarantee.

C. If after an area has been treated and before the General Contractor can pour the concrete slab, it should rain, the entire area shall be retreated, without additional cost to the Owner. No more area than will be covered with slab shall be treated at one time.

END OF SECTION

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Section 32 12 16

ASPHALTIC PAVING

PART ONE - GENERAL

1.1 WORK INCLUDED

A. Project Description:

1. Prepare sub-grade to receive base course.
2. Provide compacted base course.
3. Place asphaltic concrete hot mix (ACHM) surface course.
4. Repair existing paving following placement of utility line crossings and new culverts.
5. Sawcut all intersections of existing and new paving.

1.2 RELATED WORK

A.	Testing Laboratory Services	Section 01 45 29
B.	Grading	Section 31 22 00

1.3 REFERENCE STANDARDS

A. Arkansas Highway and Transportation Dept. (AHTD).

B. American Society for Testing and Materials (ASTM).

1. ASTM D1557-70, Test for Moisture - Density Relationship of Soils using 10 lb. (4.5 kg) rammer in 18 inch (457 mm) drop.
2. ASTM D2922-78, Methods for Determining the Density of Soil and Soil Aggregate in Place by Nuclear Methods (shallow depth).
3. ASTM 3515-76, Specifications for Hot-Mixed, Hot- Laid, Bituminous Paving Mixtures.
4. ASTM D1074-76, Test for Compressive Strength of Bituminous Mixtures.

PART TWO - PRODUCTS

2.1 BASE COURSE MATERIALS

A. Crushed stone: SB-2, meeting the requirements of sub-section 303.02 of the AHTD Standard Specifications, or approved equal.

2.2 ASPHALT PAVEMENT MATERIALS

A. ACHM: Type 2 mix as described in Division 400 of the AHTD Standard Specifications.

B. The surface course shall be composed of a mixture of mineral aggregate and asphalt cement in the proportions by weight for the type mixture designated.

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PART THREE - EXECUTION

3.1 PREPARATION

A. Sub-grade:

1. Ensure grading of the sub-grade to the required elevation.
2. Scarify to a depth of six inches the sub-grade where the base course is to be placed.
3. Water and thoroughly mix sub-grade where the base course is to be placed.
4. Water and thoroughly mix sub-grade until optimum moisture content exists. When excess of moisture exists, rework and aerate sub-grade until optimum moisture content is obtained.
5. Recompact the sub-grade to a minimum of 95% of the maximum dry density at or near the optimum moisture content as determined by ASTM D 1557.
6. Before final rolling, grade the entire area to the required cross section, adding additional sub-soil as required and compact the sub-grade surface to the required density.

3.2 PLACEMENT

A. Base Course:

1. Place the crushed stone base material over the prepared sub-grade in accordance with the construction methods described in sub-section 303 of the AHTD Standard Specifications. COMPACTED THICKNESS AS SHOWN ON PLANS.
2. Add water during compaction to bring the base course materials to optimum moisture content. When an excess moisture exists, rework the base course materials until optimum moisture content is obtained.
3. Compact the base course to 98% of the maximum dry density as determined by ASTM D 1557.

B. ACHM Surface Course:

1. Construction Methods: Division 400, AHTD Standard Specifications.
2. Temperature range of mix:
   a. When discharged from mixer: 285 degrees F to 325 degrees F.
   b. When placed on base course: 275 degrees F to 325 degrees F.
3. Temperature of air: Do not place ACHM when air temperature in the shade is below 40 degrees F.
4. Place asphalt pavement to COMPACTED DEPTH AS SHOWN ON PLANS.
5. Compact to required density, with approved rolling equipment. Start compaction as soon as pavement will bear equipment without checking or undue placement.
6. Required density: 92% of maximum theoretical density.
7. Carry out compaction in three operations in pass sequence. Ensure each pass of roller overlaps previous passes to ensure smooth surface free of roller marks. Keep roller wheels sufficiently moist so as not to pick up material.
8. Perform hand tamping in areas not accessible to rolling equipment.
9. Ensure joints made during paving operations and at connection to existing pavement are straight, clean vertical and free of broken or loose material. Prime vertical surfaces of joints to ensure tight bond.

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10. Ensure surface of completed asphalt pavement is true to lines, profiles and elevations indicated, and is free from depressions exceeding 1/4 inch when measured with a 10 foot straight edge.
11. Do not allow vehicular traffic on newly paved areas until surface has cooled to atmospheric temperature.

3.3 FIELD QUALITY CONTROL

A. Testing laboratory make in-place tests of density and moisture content of the sub-grade and the base course in accordance with ASTM D2922-78.

B. Testing laboratory make density tests of compacted asphalt paving in accordance with ASTM D1074-76.

C. Provide four inch wide white center line and parking bay markings as shown on the drawings.

END OF SECTION

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Section 32 31 13

CHAIN LINK FENCES AND GATES

PART ONE - GENERAL

1.1 DESCRIPTION

A. Work included: All labor and material to complete all fencing, chain link and vinyl coated with privacy slats, and related items, complete in place as shown on the drawings and herein specified or otherwise required for a complete installation.

B. Related work described elsewhere:

1.	Clearing and Grubbing	Section 31 11 00
2.	Grading	Section 31 22 00

1.2 QUALITY ASSURANCE

A. Qualifications of manufacturers: Products used in the work of this Section shall be produced by Manufacturer's regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.

B. Qualifications of personnel: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

C. Reference standards:

1. Chain Link Fence Manufacturers Institute
2. ASTM A-392 Zinc-coated Steel Chain Link Fence Fabric
3. ASTM A-120 Hot-Dipped Zinc-coated Welded and Seamless Steel Pipe for Ordinary Use

1.3 SUBMITTALS

A. General: Comply with the provisions of Section 01 33 23.

B. Product data: Within 30 calendar days after award of the Contract, submit:

1. Complete materials list of all items proposed to be furnished and installed under this Section.
2. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.
3. Shop drawings showing all proposed work of this section.
4. Manufacturer's recommended installation procedures.

   The manufacturer's recommended installation procedures, when approved by the Architect, will become the basis for inspecting and accepting or rejecting actual installation procedures used on the Work.

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1.4 GUARANTEE

A. The Contractor and any Subcontractors hereunder guarantees their respective work against defective materials or workmanship for a period of one (1) year from date of filing notice of completion and an acceptance by the Owner. Provide vinyl coated fencing manufacturer's standard limited warranty that its' coated chain link fencing is free from color coating flaking and peeling and other defects in material or workmanship for a period of 15 years from the date of purchase.

PART TWO - PRODUCTS

2.1 CHAINLINK FABRIC

A. Fabric shall be zinc-coated, after fabrication, No. 11 gauge and one and three-fourths inch (1-3/4") or two inch (2") mesh. Top selvage shall have a knuckle finish. 4'0" height typical unless noted otherwise on plans.

B. All fabric shall be free of barbs, icicles, or other projections resulting from the galvanizing process, and any fabric not free thereof will be rejected even though erected.

2.2 POSTS

A. All posts shall conform to hot dipped zinc-coated (galvanized) welded and seamless pipe for ordinary uses, ASTM A-120, SS20.

1. All 6' or less line posts shall have outside diameter of not less than 1-7/8" with terminal and gate post diameter of not less than 2-3/8".
2. All 8' or more line posts shall have outside diameter of not less than 2-7/8" with terminal and gate post diameter of not less than 4".

2.3 RAILS

A. All top rails shall meet the same specifications of quality as posts and have an outside diameter of one and five-eights inch (1-5/8") and weight 2.27 pounds per lineal foot. An outside sleeve-type coupling measuring not less than seven inches (7") in length shall be provided at each interval of twenty feet (20').

2.4 TERMINAL AND GATE POST FITTINGS

A. Terminal and gate post fittings, including tension bands, and top rail connections, shall be No. 11 gauge, hot-dipped, galvanized, cold-rolled carbon steel. No aluminum, cast iron, or pot metal fittings will be accepted as equal or substitutes. Top rails shall not be less than one inch (1") wide, secured by three-eights inch (3/8") diameter carriage bolts and nuts.

2.5 BOTTOM TENSION WIRE

A. Bottom tension wires shall be No. 9 gauge galvanized steel coil tension wire, high carbon or hard drawn, ASTM Designation A-116, Class 11, galvanized, fastened to the chainlink fabric at intervals of twenty-four inches (24") with No. 11 gauge galvanized steel hog rings.

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2.6 POST TOPS

A. Tops of line posts shall be of a malleable casting or pressed steel. The base of tops shall extend below the top of the post not less than two inches (2"). Terminal post tops shall be of malleable iron or pressed steel, be one of the manufacturer's standard designs as selected or approved by the Architect and be designed so as positively to exclude all moisture from the terminal post.

2.7 GATES

Gates shall be size shown on the drawings. Frames shall be constructed of pipe conforming to Standard specifications for Hot-Dipped Zinc-Coated (galvanized) Welded and Seamless Steel Pipe for Ordinary Uses, ASTM Designation A-120, having an outside diameter of one and one-half inches (1-1/2") and weighing 1.9 pounds per lineal foot. Gate frames shall utilize corner fittings of heavy malleable iron or pressed steel securely riveted to the frame. Fabric matching the fence fabric shall be installed in the frame by means of tension bars and hook bolts. Frames having corner fittings shall be equipped with adjustable truss rods having a diameter of three-eighths inch (3/8"). Hinges shall be of adequate strength to support the gate and have large bearing surfaces for clamping in position. Under no conditions of use or abuse shall the hinges twist or turn under the action of the gate. Gates shall be capable of being opened and closed quickly and easily by one (1) person. Gates shall be equipped with a positive latching device that will accommodate padlocking. Hinges, latches, and catches shall be one of the manufacturer's standard designs as approved by the Architect.

2.8 VINYL COATED FENCING

A. Products from qualified manufacturers having a minimum of five years experience manufacturing thermally fused chain link fencing will be acceptable by the Architect as equal, if approved in writing, ten days prior to bidding, and if they meet the following specifications for design, size gauge of metal parts and fabrication.

B. Obtain chain link fences and gates, including accessories, fittings, slats and fastenings, from a single source.

C. Approved Manufacturer:

Master Halco, Inc.
4000 W. Metropolitan Drive, Suite 400
Orange, CA 92868
Phone (800) 229-5615
Fax (714) 385-0107

D, Chain Link Fence Fabric

1. Polyolefin elastomer coating, thermally fused to zinc-coated steel core wire: Per ASTM F668 Class 2b.
2. Choose color from manufacturer’s standard colors.

2.10 STEEL FENCE FRAMING

A. Steel pipe - Type I: ASTM F 1083, standard weight schedule 40; minimum yield strength of 30,000 psi sizes as indicated. Hot-dipped galvanized with minimum average 1.8 oz/ft² of coated surface area.

B. Polyolefin Coated finish: In accordance with ASTM F1043, apply supplemental color coating of minimum 10 mils of thermally fused polyolefin. Color to be selected from manufacturer's standard colors.

2.11 POLYOLEFIN COATED ACCESSORIES

A. Chain link fence accessories: [ASTM F 626] Provide items required to complete fence system. Galvanize each ferrous metal item and finish to match framing. Fittings should match Master Halco specifications.

B. Post caps: Formed steel, cast malleable iron, or weather tight closure cap for tubular posts. Provide one cap for each post. Cap to have provision for barbed wire when necessary. "C" shaped line post without top rail or barbed wire supporting arms do not require post caps. (Where top rail is used, provide tops to permit passage of top rail.)

C. Top rail and rail ends: Pressed steel per ASTM F626, for connection of rail and brace to terminal posts.

D. Top rail sleeves: 7" expansion sleeve with a minimum .137" wire diameter and 1.80" length spring, allowing for expansion and contraction of top rail.

E. Wire ties: 9 gauge galvanized steel wire for attachment of fabric to line posts. Double wrap 13 gauge for rails and braces. Hog ring ties of 12-1/2 gauge for attachment of fabric to tension wire.

F. Brace and tension (stretcher bar) bands: Pressed steel, minimum 300 degree profile curvature for secure fence post attachment. At square post provide tension bar clips.

G. Tension (stretcher) bars: One piece lengths equal to 2 inches less than full height of fabric with a minimum cross-section of 3/16" x 3/4". Provide tension (stretcher) bars where chain link fabric meets terminal posts.

H. Tension wire: Thermally fused polyolefin applied to zinc coated steel wire: Per ASTM F 1664 Class 2 b, 6 gauge, diameter core wire with tensile strength of 75,000 psi.

2.12 SETTING MATERIALS

A. Concrete: Minimum 28 day compressive strength of 3,000 psi.

OR

B. Drive Anchors: Galvanized angles, ASTM A 36 steel 1" x 1" x 30" galvanized shoe clamps to secure angles to posts.

PART THREE - EXECUTION

3.1 INSPECTION

Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Chainlink fence:

1. Post spacing shall be uniform and not over 10 feet on centers. Posts shall be carefully aligned and plumb in each direction. Set in concrete pads as shown on the Drawings.
2. The top rail shall be continuous through line posts and rigidly connected to all end and corner posts.
3. Chainlink fabric shall be placed with top flush with top of rail and bottom one inch above finished grade at backstop and 3/4" above pad surface. Stretch fabric tightly to eliminate sags and buckles. Lace to posts at intervals, not exceeding 14 inches to top rail, and intermediate rails at 24 inch intervals, with No. 6 galvanizing wire or equivalent. Turn back lacing to eliminate exposed ends.
4. Installation shall meet the recommendations of the Chain Link Fence Manufacturers Institute.

END OF SECTION

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Section 32 92 19

SEEDING

PART ONE - GENERAL

1.1 WORK INCLUDED

A. Preparation of sub-grade

B. Placing topsoil

C. Seeding 10' around new building and areas disturbed by construction

D. Fertilizing and watering

E. Compacting disturbed gray gravel area that is not seeded

1.2 RELATED WORK

A.	Clearing and Grubbing	Section 31 11 00
B.	Grading	Section 31 22 00
C.	Excavation and Fill	Section 31 23 00

1.3 SUBMITTALS

Submit certification that the seed meets the specifications requirements, and that it complies with the requirements of the Arkansas State Plant Board.

PART TWO - PRODUCTS

2.1 MATERIALS

A. Topsoil: Use topsoil excavated from the site only if conforming to the specified requirements:

1. Existing topsoil: Natural, fertile, agricultural soil capable of sustaining vigorous plant growth, not in frozen or muddy condition, containing not less than 6% organic matter, and corrected to pH value of 5.9 to 7.0. Free from subsoil, slag, clay stones, lumps, live plants, roots, sticks, crabgrass, cough grass, noxious weeds, and foreign matter.
2. Imported topsoil: Natural, fertile, agricultural soil typical of locality, capable of sustaining vigorous plant growth, from well drained site free of flooding, not in frozen or muddy condition, not less than 6% organic matter, and lumps, live plants, roots, sticks, crabgrass, cough grass, noxious weeds and foreign matter.

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B. Fertilizer: FS 0-F-241, commercial type.

1. Proportions: 10N-20P-10K, unless soil test analysis indicated different proportions are required.

C. Seed: Common hulled bermuda.

PART THREE - EXECUTION

3.1 PREPARATION OF SUB-GRADE

A. Fine grade sub-grade, eliminating uneven areas and low spots. Maintain lines, levels, profiles, spot elevations, and contours shown on the drawings. Make changes in grade gradual. Blend slopes into level areas.

B. Remove foreign materials, undesirable plants and their roots, stones, and debris subject to termite attack, rot or corrosion. Do not bury foreign material beneath areas to be seeded or sodded. Remove sub-soil which has been contaminated with petroleum products.

C. Cultivate sub-soil to a depth of 3" where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil. Depressions where water will stand or inequalities in the grade shall be corrected before topsoil is spread.

3.2 PLACING TOPSOIL

A. Furnish, place, and spread topsoil to a minimum depth of three inches over entire areas to be sodded or seeded.

B. Place topsoil during dry weather and on dry unfrozen sub-grade.

C. Grade to eliminate rough and low areas, ensuring positive drainage. Maintain levels, profiles, spot elevations, and contours of sub-grade. For seeding areas, rake until surface is smooth. Provide positive surface drainage away from the building walls in all directions.

D. Remove stones, roots, grass, weeds, debris and other foreign non-organic material while spreading.

3.3 FERTILIZING SEEDED AREAS

A. After fine grading apply fertilizer at a rate recommended by the manufacturer.

B. Mix thoroughly into upper two inches of topsoil.

C. Lightly water to aid breakdown of fertilizer and to provide moist soil for seed.

D. Apply fertilizer within 48 hours before seeding.

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3.4 SEEDING

A. Apply seed at rate of one to two pounds per 1000 square feet.

B. Roll seeded area with rollers not exceeding 112 pounds.

C. Apply water with fine spray immediately after sowing.

D. Water shall be applied on all seeded areas in quantities and at intervals to provide optimum growing conditions for the establishment of a healthy, uniform stand and cover of grass. Maintain seeded areas until end of project.

END OF SECTION

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Section 33 40 00

STORM WATER UTILITIES

PART ONE - GENERAL

1.1 WORK INCLUDED

A. This section includes the installation of the concrete paved drain, storm sewers, end sections, curb inlets, inlet boxes, man-holes, head and wing walls, and junction boxes at the location and to the lines and grades shown on the drawings, or as directed by the Architect.

1.2 QUALITY ASSURANCE

A. Qualification of manufacturer: Use Products in the work of this Section produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.

B. Qualifications of installers: Use skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

A. General: Comply with the provisions of Section 01 33 23.

B. Product data: Within 30 calendar days after award of the Contract, submit:

1. Complete materials list of all items proposed to be furnished and installed under this Section.
2. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.
3. Shop drawings showing all proposed work of this section.
4. Manufacturer's recommended installation procedures.

The manufacturer's recommended installation procedures, when approved by the Architect, will become the basis for inspecting and accepting or rejecting actual installation procedures used on the Work.

PART TWO - PRODUCTS

2.1 POLYVINYL CHLORIDE PIPE

A. Polyvinyl chloride pipe (PVC-SDR 26) shall conform to ASTM D-3034 as manufactured by Charlotte Pipe or approved equal.

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2.2 HIGH DENSITY POLYETHYLENE PIPE

A. High density polyethylene pipe (HDPE) less than 12” in diameter shall be watertight and have smooth interior and annular exterior corrugations, meeting AASHTO M 252, Type S. Joints and fittings shall meet the requirements of AASHTO M 252, M 294 or ASTM F2306 and shall be watertight according to the requirements of ASTM D3212.

B. High density polyethylene pipe (HDPE) 12” in diameter and larger shall be soil-tight and have a smooth interior and annular exterior corrugations meeting AASHTO M 294, Type S or SP or ASTM F2306. Joints and fittings shall meet the requirements of ASSHTD M 252, M 294 or ASTM F2306.

C. Gaskets shall meet the requirements of ASTM F477.

D. Only the manufacturers joint lubricant shall be acceptable.

E. All HDPE products shall be provided by Advanced Drainage Systems, Inc. (ADS) or approved equal.

2.3 REINFORCED CONCRETE PIPE

A. Reinforced concrete pipe (RCP) shall conform to the latest ASTM Designation C76-65T, and ASTM Designation C506-63T for concrete arch pipe. The design requirements shall be for H-20 truck loading plus impact meeting all requirements set forth in “Table III-Design Requirements for Class III Reinforced Concrete Pipe, C76-65T and C506-63T”.

PART THREE - EXECUTION

3.1 Provide a gradation plan which will verify all conditions of existing storm drainage connections for approval to the Architect's representative prior to construction.

3.2 All equipment necessary and required for the proper construction of storm sewers shall be on the project in first-class condition and shall have the approval of the Architect. The Contractor shall provide the necessary tampers and pneumatic tampers to obtain the compaction of the pipe bed and backfill as specified.

3.3 Inlets and headwalls shall be constructed as shown on the drawings.

3.4 Pipe outlets shall be sealed and made watertight.

3.5 Excavation: Where a trench is required, it shall be excavated to the line and grade shown on the plans and as established by the Architect, and only to a width sufficient to permit thorough tamping of the backfill material under the haunches and around the pipe as hereinafter specified, but the width shall not exceed the external diameter by more than two feet (2’) on each side except where unsuitable material is encountered.

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3.6 Bedding: The pipe shall be bedding in an earth foundation of uniform density, carefully shaped to conform to the grade and to the camber established by the Architect. When rock in either ledge or boulder formation is encountered, it shall be removed below grade and replaced with suitable materials in such a manner as to provide a compact earth cushion having a thickness under the pipe or not less than six inches (6”). When a firm foundation is not encountered at the grade established due to soft, spongy or other unstable soil, all such unstable soil under the pipe, for a width of at least one-half (1/2) diameter on each side of the pipe or to the side of the trench and for a maximum depths of three (3’) or as directed by the Architect, shall be removed and replaced with well compacted granular material to provide an adequate support for the pipe.

3.7 Lines and Grades for Pipe Laying:

A. The Contractor shall provide the necessary mason’s lines and batter boards to insure the pipe is laid to the lines and grades shown on the drawings or as adjusted by the Architect.
B. The Architect shall inspect all pipe before and after it is laid and reject any pipe damaged or defective. Pipe laying shall be started at the lowest point and laid up-grade.

3.8 Installation and Assembly of Reinforced Concrete Pipe: All pipe shall be carefully laid tongue end up-grade, spigot end fully entered into tongue end, and true to line and grade. All joints shall be filled and wiped. Bituminous joint material conforming to AASHTO Standards. The inside of the joint shall be wiped and finished smooth.

3.9 Installation and Assembly of HDPE Piping: All HDPE pipes and fittings shall be installed in strict accordance with ASTM D2321 and per the manufacturer’s standards and specifications. Only the manufacturer’s joint lubricant shall be used.

3.10 Installation and Assembly of PVC Piping: PVC sewer pipe joints shall be assembled per manufacturer’s joint assembly procedures. Only the manufacturer’s gasket lubricant shall be used. All surfaces of the joint components shall be clean and dry. Use normal force to insert spigot. Contractor may use pipe puller or bucking bar if necessary; however, backhoe is not acceptable.

3.11 Backfilling: The material used for backfilling storm sewers shall be at optimum moisture, shall be free from large lumps, clods, or rocks and shall be placed alongside and over storm sewers in layers of not more than six inches (6”) and thoroughly compacted to at least the density of the adjacent undisturbed earth to an elevation of two feet (2’) above the top of the pipe. The remainder of the backfill material shall then be placed into the trench in not more than eight inch (8”) layers and thoroughly tamped. Open trenches in and across roadways shall be backfilled as specified above, except that the entire depth of the trench shall be backfilled in no more than six inch (6”) layers, each maximum density, both as obtained by the Standard Method of Test for Compaction and Density of Soils, AASHTO T-180, Method D.

END OF SECTION

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