

**PROJECT MANUAL
INCLUDING SPECIFICATIONS
FOR CONSTRUCTION**

**EAST END ELEMENTARY
Sheridan School District
Hensley, Arkansas**

**ARCHITECT PROJECT NO. 25053
DATE: May 18, 2026**

**CONSTRUCTION MANAGER:
C.R. Crawford Construction
1102 South Happy Hollow Road
Fayetteville, Arkansas**



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Not Used

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04 05 23	Masonry Accessories
04 21 13	Brick Masonry
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DIVISION FIVE METALS

05 12 00	Structural Steel
05 31 23	Steel Roof Deck
05 41 00	Lightgage Metal Framing
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06 10 00	Rough Carpentry
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07 14 00	Fluid Applied Air & Water-Resistive Barrier System
07 19 00	Water Repellants
07 21 00	Thermal Insulation
07 25 00	Weather Barrier
07 26 16	Under Slab Vapor Barrier/Retarder
07 41 15	Adjustable Framing System
07 42 43	Composite Wall Panels
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 33 13	Overhead Rolling Counter Door
08 41 00	Entrances, Storefront and Curtain Wall
08 51 13	Aluminum Sliding Windows
08 71 00	Door Hardware
08 80 00	Glazing

DIVISION NINE FINISHES

09 21 00	Gypsum Board Assemblies
09 30 13	Ceramic Tiling
09 51 00	Acoustical Ceilings
09 53 00	Acoustical Ceiling Suspension Assemblies
09 65 13	Resilient Base
09 68 00	Carpeting
09 77 20	Fiberglass Reinforced Wall Panels
09 84 13	Acoustical Wall Panels
09 91 00	Painting
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DIVISION TEN SPECIALTIES

10 11 00	Visual Display Units
10 14 00	Signage
10 28 13	Toilet Accessories
10 41 00	Exterior Security Vault
10 44 16	Fire Extinguishers
10 51 13	Metal Lockers
10 55 00	Mailboxes
10 73 26	Walkway Canopies
10 75 00	Flagpoles

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11 40 00	Food Service Equipment
11 52 13	Project Screen
11 61 43	Stage Curtain & Track
11 66 00	Athletic Equipment

DIVISION TWELVE FURNISHINGS

12 24 13	Roller Shades
12 32 00	Manufactured Wood Casework
12 66 13	Telescoping Bleachers

DIVISION THIRTEEN SPECIAL CONSTRUCTION

13 34 19	Metal Building Systems

DIVISION FOURTEEN CONVEYING EQUIPMENT

Not Used

DIVISION TWENTY ONE FIRE SUPPRESSION

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 37 16	Fabric Air Distribution Devices
23 74 33	Dedicated Outdoor-Air Units

DIVISION TWENTY FIVE INTEGRATED AUTOMATION

Not Used

DIVISION TWENTY SIX ELECTRICAL

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 09 43	Digital Lighting Controls
26 24 13	Switchboards
26 24 16	Panelboards
26 27 26	Wiring Devices
26 28 16	Enclosed Switches and Circuit Breakers
26 29 13	Enclosed Controllers
26 41 00	Facility Lightning Protection
26 43 13	Surge Protection Device
26 51 00	Interior Lighting
26 56 00	Exterior Lighting

DIVISION TWENTY SEVEN COMMUNICATIONS

27 05 00	Common Work Results for Communications
27 10 00	Structured Cabling
27 51 23	Intercommunications and Program Systems
27 51 26	Sound Reinforcement System
27 53 13	Clock Systems

DIVISION TWENTY EIGHT ELECTRONIC SAFETY AND SECURITY

28 05 37	Public Safety BDA System
28 46 00	Fire Alarm Systems

DIVISION THIRTY ONE EARTHWORK

31 11 00	Clearing and Grubbing
31 22 00	Grading
31 23 00	Excavation and Fill
31 25 00	Erosion and Sedimentation Control
31 31 16	Termite Control

DIVISION THIRTY TWO EXTERIOR IMPROVEMENTS

32 12 16	Asphaltic Paving
32 18 13	Synthetic Grass Surfacing
32 31 13	Chain Link Fences and Gates
32 31 19	Decorative Metal Fencing System
32 92 19	Seeding

DIVISION THIRTY THREE UTILITIES

33 00 00 Utilities

33 40 00 Stormwater Utilities

DIVISION THIRTY FOUR TRANSPORTATION

Not Used

DIVISION THIRTY FIVE WATERWAY AND MARINE CONSTRUCTION

Not Used

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 Sheridan 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 Sheridan 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.

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. Proposals shall be addressed to and mailed to the Owner at the Owner's address as shown on the Bid form or delivered to the place designated for opening of bids before the time for opening the bids as set forth in the Notice to Bidders, enclosed in an opaque, sealed envelope, addressed as stated above, marked "Proposal" and bearing the title of work and the name and address of the bidder.

e. 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.

f. 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. Wage Requirements:

a. Contractors attention is called to the fact that the wage rates for laborers and mechanics engaged in the construction of the project will be not less than required in full compliance with any state minimum wage law that may be applicable, or any published wage scales bound here in the project manual.

8. Construction time and liquidated damages:

The Agreement will include a stipulation that the Work be completed in a period of time established in the Bid Form. The Agreement will also include a stipulation that liquidated damages will be established in the amount as indicated on the Bid Form per calendar day for each calendar day after the completion date that the Work is not fully completed and the Owner is unable to occupy and utilize the new construction.

9. 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.

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.

10. 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.

11. 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.

c. Contractor shall name the sub-bidder whose bid he proposes to use on Mechanical (Plumbing, Heating, Ventilation, and Air Conditioning), Electrical and Roofing and Sheet Metal, and any other subcontractor, as provided on the Form of Bid.

d. 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.

12. 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.

13. Submission of post-bid information:

a. Upon receipt of written notice of the acceptance of his bid, the successful Contractor shall execute a contract, in accordance with good and sufficient surety or sureties, within ten (10) calendar days after the prescribed forms are presented for signature. Required bond and insurance documents shall be furnished with the executed contract.

b. Within seven (7) days after execution of the contract, the Contractor shall furnish to the Architect a statement of costs for each major item or the work included in his bid and a list of the subcontractor's proposed for the principal portions of the work. The bidder will be required to establish to the satisfaction of the Architect and the Owner the reliability and responsibility of the proposed subcontractors to furnish and perform the required work.

c. The Contractor will be required to keep an accurate accounting of all labor and materials entering into the job. It will be required that this be brought up to date each month.

14. 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.

15. 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.

16. 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.

17. 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.

18. 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.

19. 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 or condition of acquired immune deficiency syndrome (AIDS) or AIDS-related complex in carrying out its 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.

20. 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.

21. 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 in the best interest of the District to do so.

22. 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.

23. 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.

24. No Smoking Policy: The Sheridan 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.

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.)

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.

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

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 notarized 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



CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

12/09/2025

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 have **ADDITIONAL INSURED** provisions or 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 ABC Insurance Agency Mailing Address City ST 11111		CONTACT NAME: Agency contact person PHONE (A/C, No, Ext): (111) 111-1111 FAX (A/C, No): (111) 111-1111 E-MAIL ADDRESS: agent@emailaddress.com	
INSURED ABC Construction Company Mailing Address City ST 11111		INSURER(S) AFFORDING COVERAGE INSURER A: Insurance Company INSURER B: Insurance Company INSURER C: Insurance Company INSURER D: Insurance Company INSURER E: Insurance Company INSURER F: Insurance Company	
		NAIC # 11111 11111 11111 11111 11111 11111	

COVERAGES**CERTIFICATE NUMBER:** 2025 Sub Sample Cert**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 INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	☒ COMMERCIAL GENERAL LIABILITY ☐ CLAIMS-MADE ☒ OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: ☐ POLICY ☒ PRO-JECT ☐ LOC ☐ OTHER:	Y	Y	Policy Number	12/10/2025	12/10/2026	EACH OCCURRENCE \$ 1,000,000	
	DAMAGE TO RENTED PREMISES (Ea occurrence) \$ 1,000,000							
	MED EXP (Any one person) \$ 5,000							
	PERSONAL & ADV INJURY \$ 1,000,000							
B	☒ AUTOMOBILE LIABILITY ☒ ANY AUTO ☐ OWNED AUTOS ONLY ☐ SCHEDULED AUTOS ☒ HIRED AUTOS ONLY ☒ NON-OWNED AUTOS ONLY			Policy Number	12/10/2025	12/10/2026	COMBINED SINGLE LIMIT (Ea accident) \$ 1,000,000	
	BODILY INJURY (Per person) \$							
	BODILY INJURY (Per accident) \$							
	PROPERTY DAMAGE (Per accident) \$							
C	☒ UMBRELLA LIAB ☒ OCCUR ☐ EXCESS LIAB ☐ CLAIMS-MADE ☐ DED ☒ RETENTION \$ 10,000	Y	Y	Policy Number	12/10/2025	12/10/2026	EACH OCCURRENCE \$ 1,000,000	
	AGGREGATE \$ 1,000,000							
D	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below	Y/N Y	N/A	Y	Policy Number	04/01/2025	04/01/2026	☒ PER STATUTE ☐ OTH-ER
	E.L. EACH ACCIDENT \$ 1,000,000							
	E.L. DISEASE - EA EMPLOYEE \$ 1,000,000							
	E.L. DISEASE - POLICY LIMIT \$ 1,000,000							
E	Builders Risk Property Insurance			Policy Number	04/01/2025	04/01/2026		

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

Project Name

CERTIFICATE HOLDER**CANCELLATION**

SAMPLE CERTIFICATE

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



ADDITIONAL REMARKS SCHEDULE

AGENCY Mark V. Williamson Co. Inc.		NAMED INSURED Lewis, Elliott, McMorran,Vaden, Ragsdale And Woodward Inc.	
POLICY NUMBER			
CARRIER	NAIC CODE		
EFFECTIVE DATE:			

ADDITIONAL REMARKS

THIS ADDITIONAL REMARKS FORM IS A SCHEDULE TO ACORD FORM,

FORM NUMBER: 25 **FORM TITLE:** Certificate of Liability Insurance: Notes

Attach policy forms regarding Additional Insured, Blanket Waiver of Subrogation, Notice of Cancellation, Primary/Non-Contributory status, etc that are applicable to the policies listed on this certificate:

General Liability:

- *Owner & Architect shall be named as an Additional Insured or included in Blanket Additional Insured policy form
- *Per Project Aggregate Limit of Liability
- *Primary Non-contributory endorsement
- *Waiver of Subrogation in favor of Certificate Holder
- *30 Day Notice of Cancellation in favor of Certificate Holder

Workers Compensation:

- *Waiver of Subrogation in favor of Certificate Holder

Umbrella:

- *Confirmation of Following Form for Additional Insured & Waiver of Subrogation on underlying policies

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 receipt 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

GENERAL CONDITIONS

"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."

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".

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".

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 Manager 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 \$1,000,000.00 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.

- 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 A311 and Labor and Material Payment bond on AIA Document A311 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".

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

<u>MONTH</u>	<u>AVERAGE NO. OF DAYS .01" OR MORE</u>
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

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 \$75,000. 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.
- B. AV Allowance: The Construction Manager shall include in the bid an allowance of \$100,000 for AV. Any difference in cost above or below this amount shall be adjusted by change order. Overhead and profit shall not be allowed with the AV allowance.

PART TWO – PRODUCTS

Not Used.

PART THREE – EXECUTION

Not Used.

END OF SECTION

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 _____ 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.

PART TWO – PRODUCTS

Not Used.

PART THREE – EXECUTION

Not Used.

END OF SECTION

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 replace east-west portion of steel canopy with aluminum “T” prefabricated canopy, 120’0” in length and reduce length of widened sidewalk to match canopy.
- B. Deductive Alternate No. 2: State the amount to be deducted from the Base Bid to replace turf with 4” topsoil and seed east of mid-point line, install 5’0” concrete sidewalk at new boundary.

PART TWO – PRODUCTS

Not Used.

PART THREE – EXECUTION

Not Used.

END OF SECTION

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, 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.

PART TWO – PRODUCTS

Not Used.

PART THREE – EXECUTION

Not Used.

END OF SECTION

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.

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.

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

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".

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.

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

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.

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

STATEMENT OF SPECIAL INSPECTIONS
(Completed by the Registered Design Professional in Responsible Charge)

PROJECT: New Elementary
LOCATION: Hensley, Arkansas
PERMIT APPLICANT: Sheridan School District
APPLICANT'S ADDRESS: 400 N. Rock Street, Sheridan, AR 72150
ARCHITECT OF RECORD: Clayton Vaden, AIA
STRUCTURAL ENGINEER OF RECORD: Randy Gangluff, P.E.
MECHANICAL ENGINEER OF RECORD: Randy Ragsdale, P.E., Dan Allison, 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

May 18, 2026

Date

Building Official's Acceptance:

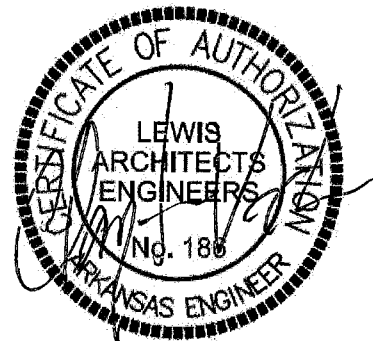
Signature

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” – Shelter
“C” - Otherwise**

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.

Precast concrete walls and diaphragm at Shelter moment frames, braced frames and masonry SW's otherwise.

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, I_p , 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.

(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): Yes

(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)

Precast concrete walls, roof and foundation attachments at Shelter.

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

(Required for systems noted in Building Code Section 1705.12.3)

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 1/2"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)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		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: <i>see Commentary</i>					
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	Y	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		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	N	Observe or Perform as noted (4)		
a. Placement and installation of steel headed stud anchors		N	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 (Table 1.3): Welding procedure Specifications (WPS) available, Manufacturer's certifications for welding consumables available, Material identification (type/grade), welding equipment check.	Field inspection	Y	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
b. During (Table 1.4): Qualified welders, Environmental Conditions, WPS followed	Field inspection	Y	Periodic		
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 (Table 1.6): Manufacturer installation instructions available for mechanical fasteners, Proper tools available for fastener installation, Proper storage for mechanical fasteners	Field inspection	Y	Periodic		
b. During (Table 1.7): Fasteners are positioned as required and fasteners are installed according to manufacturer's instructions	Field inspection	Y	Periodic		
c. After (Table 1.8): Check spacing, type, and installation of support, sidelap, and perimeter	Field inspection	Y	Periodic		
d. After (Table 1.8): Verify repair activities and Document acceptance or rejection of	Field inspection	Y	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.		N			
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)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		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		N			
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	Y	Continuous		
3. Inspection of anchors cast in concrete	Shop (3) and field inspection	Y	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		Y	Continuous		
b. Grouting of bonded prestressing tendons in the seismic-force-resisting system		Y	Continuous		
10. Inspect erection of precast concrete members	Field inspection	Y	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		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	Y	Continuous		
b. Completion of the continuity of reinforcement across joints	Field inspection	Y	Continuous		
c. Completion of connections in the field.	Field inspection	Y	Continuous		
12. Inspect installation tolerances of precast concrete diaphragm connections for compliance with ACI 550.5	Field inspection	Y	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	Y	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)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
1705.4 Masonry Construction					
(A) Level 1, 2 and 3 Quality Assurance:					
1. Prior to construction, 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	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)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		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	Y	Periodic		
20. Observe preparation of grout specimens, mortar specimens, and/or prisms	Field inspection	Y	Level 2 - Periodic		
		Y	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)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		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.					
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. Concealed 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)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		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 premises 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)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		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)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		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 Inspection	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		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)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
2. Mechanical & Electrical Designated Seismic Systems (per					
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 electrical 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)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
c. Distribution Systems					
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					
5) Plumbing	Field Inspection	N	Periodic		
6) Pneumatic tube transport systems	Field Inspection		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	N	Periodic		
2. Inspection during the erection and fastening of interior and exterior non load bearing walls.	Field inspection	N	Periodic		
3. Inspection during anchorage of access floors	Field inspection	N	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		Periodic		
2. Inspection during the anchorage of other electrical equipment.	Field inspection		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		Periodic		
5. Inspection during the installation and anchorage of vibration isolation systems.	Field inspection		Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		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		Periodic		
2. Fabricated storage rack elements.	Field inspection		Periodic		
3. Storage rack anchorage	Field inspection		Periodic		
4. Completed storage rack system, to indicate compliance with the approved construction documents	Field inspection		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)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		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		Periodic		
2. Verify application of sprayed fire-resistant materials.	Field inspection		Periodic		
3. Verify average thickness of sprayed fire-resistant materials applied to structural members.	Field inspection		Periodic		
4. Verify density of the sprayed fire-resistant material complies with approved fire-resistant design.	Field inspection and testing		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		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		Periodic		
1705.17 Exterior Insulation and Finish Systems (EIFS)					
1. Verify materials, details and installations are per the approved construction documents	Field inspection		Periodic		
2. Inspection of water-resistive barrier coating over sheathing substrate	Field inspection		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		Per ASTM E 2393		
1705.19 Smoke Control Systems					
1. Leakage testing and recording of device locations prior to	Field testing		Periodic		
2. Prior to occupancy and after sufficient completion, pressure difference testing, flow measurements, and detection and	Field testing		Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		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		Periodic		
* INSPECTION AGENTS		FIRM	ADDRESS	TELEPHONE NO.	
1.					
2.					
3.					
4.					
5.					
<i>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.</i> <i>2. The list of Special Inspectors may be submitted as a separate document, if noted so above.</i> <i>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</i> <i>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.</i> <i>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.</i> 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

Project: _____

Address: _____

Certification Number: _____

Description of structural members and assemblies that have been fabricated:

[illegible]

Date _____

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.

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: ☐ CONTRACTOR ☐ ENGINEER/ARCHITECT ☐ 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 ≥ 60 ft		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		
<i>(Table continued on next page)</i>				

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	<i>See Requirements of Building Code Section 1705.19.2.</i>			
1705.20 Sealing of Mass Timber		A, C, P		
<i>(Table continued on next page)</i>				

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.*

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.

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 accommodate 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.

PART TWO – PRODUCTS

Not Used.

PART THREE – EXECUTION

Not Used.

END OF SECTION

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

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.

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

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.

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

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.

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.

- 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

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 Manufacturer's:

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.

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

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

as Steel Fabricator shall submit one hard copy (not to be returned) and one electronic copy in PDF format 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.

- 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

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.

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.

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 1/2	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.

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

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.

PART TWO - MATERIALS

2.1 FLOOR SEALER

- A. Verify areas to be Sealed Concrete with the Finish Schedule on drawings.
- B. Material: MasterKure CC 300SB (formerly "Kure-N-Seal 30"), 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.

2.2 POLISHED CONCRETE

- A. Verify areas to be Polished Concrete with the Finish Schedule on drawings.
- B. Finisher to provide finished concrete as required to accept Polished Concrete as noted in specification Section 03 35 43
- C. Refer to specification Section 03 35 43 for Polished Concrete.

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 w/ polished finish	50	30
All other slab on grade areas	30	25

- 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.

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

POLISHED CONCRETE FINISHING

PART ONE - GENERAL

1.01 SUMMARY

Furnish all materials, labor and equipment necessary for the supply and installation of a diamond ground and polished concrete floor as indicated in the drawings and finish schedule by applying densifier impregnator/hardener and polish to specified sheen level and aggregate exposure.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Cast-In-Place Concrete - Section 03 31 00.

1. Concrete pour contractor must meet the following quality specifications to allow polish contractor to achieve the highest quality finish floor:
 - a) Finish concrete shall have a minimum Floor Flatness rating of at least 40.
 - b) Finish concrete shall have a minimum Floor Levelness rating of at least 30.

1.03 REFERENCES

A. American Concrete Institute

1. ACI302.1R-89, Guide for Concrete Floor and Slab Construction

B. American Society for Testing and Materials

1. ASTM C779, Standard Test Method for Abrasion of Horizontal Concrete Surfaces
2. ASTM C805, Impact Strength
3. ASTM G23-81, Ultraviolet Light & Water Spray
4. ASTM 1028, Co-efficient of Friction
5. ASTM C150, Type I, II Portland cement conformity, depending on soil conditions
6. ASTM C33, Aggregate Conformity

C. Other Tests

1. Reflectivity

1.04 SUBMITTALS

- A. Product Data: For each type of chemical product and joint filler indicated. Include manufacturer's technical data, application instructions, and recommendations for each flooring component required. Submit information on all grinding equipment to be used.
- B. Samples: Submit manufacturer's full color palette for concrete coloring material for color selections by Architect.
- C. Letter of Certification from all Machinery and Chemical Manufacturers.

- D. Project Mock Up: Prior to installation of dyed concrete finish system, provide minimum 10' x 10' mock-up at project site in area where floor covering is to be installed over concrete floor slab. Architect shall approve color blend and workmanship of mock-up. Retain mock-up as standard for judging completed work. Mock-up shall not be a part of finished work. Mock up is to be completed upon initial deployment and before any color or pattern work is completed.

1.05 QUALITY ASSURANCE

- A. Contractor is to have completed 5 jobs of similar size, scope and complexity within the last 2 years. Please provide Job Name, General Contractor contact and Customer Contacts accordingly.
- B. Polished concrete contractor has to provide licenses or certifications for regularly performing Polished Concrete work for at least 5 years prior to bid.
- C. Provide work by manufacturer's approved installer. Provide a current letter of certification by all chemical manufacturers that states contractor is a current qualified installer.

1.06 DELIVERY AND STORAGE

- A. Deliver materials in approved containers clearly marked and identified with manufacturer's name and description of contents.
- B. Store materials inside and under cover; keep dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, damage from construction traffic and other causes.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Store materials indoors, protected from damage, moisture, direct sunlight, and try to avoid temperatures below 50 degrees F or above 80 degrees F.

1.08 WARRANTY

- A. 10-year warranty signed by equipment manufacturer and polished concrete contractor for failure and replacement of materials and workmanship.

1.09 COORDINATION

- A. Coordinate work with trades providing concrete finish work. Coordinate pre-construction meeting with General Contractor, Concrete Finishing Contractor and Polished Contractor prior to the first pour.

PART TWO – PRODUCTS

2.01 POLISHED CONCRETE SYSTEM

Ameripolish Polishing System or Architect approved equal, Toll Free 1.800.829.5179, Fax 1.877.465.8061.

2.02 MACHINERY REQUIREMENTS

- A. HTC Systems Unit 800 or SASE Diamatic System unit 780 or equivalent size and head pressure machinery made for grinding concrete.

2.03 CONCRETE DENSIFIER

- A. As approved for the polishing system. Penetrating liquid densifier hardener with the following performance criteria: chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components, odorless, colorless which hardens and densifies concrete surfaces to protect against abrasion, dusting and absorption of liquids.

2.04 STAIN GUARD PROTECTANT

- A. As approved for the Polishing System. A non-film forming, stain resistant, impregnating sealant designed to be used on concrete surfaces previously densified. Multiple coats are typically advised based on field and use conditions.

2.05 JOINT FILLER

- A. Spal-Pro RS 88, semi-rigid polyurea joint filler, as manufactured by Metzger/McGuire, Concord, New Hampshire. Joint filler should be installed full joint depth in saw-cut contraction/control joints (or 2" minimum in saw-cut joints exceeding 2" in depth) per PCA and ACI guidelines.
- B. Standard color is standard gray. Multiple ColorFast and custom colors are available.

2.06 MANUFACTURERS

- A. Approved manufacturers for the Ameripolish Polishing System are as follows:
 - 1. Concrete Polishing Solutions 1.877.472.8200 www.go2cps.com
 - 2. HTC 1.877.482.8700 www.htc-america.com
 - 3. SASE 1.800.522.2606 www.sasecompany.com
 - 4. American Decorative Concrete Supply 479.725.0033 www.ameripolish.com
 - 5. Prosoco 1.800.255.4255 www.prosoco.com
 - 6. VMC Technical Assistance Corp 1.800.460.4862 www.vmctac.com
 - 7. Seal Source International 1.800.305.9144

PART THREE – EXECUTION

3.01 EXAMINATION

- A. After concrete curing period (minimum 7 days) has elapsed, surface must be clean and dry, physically sound and free of contamination.
- B. Surfaces must be free of holes, voids, or defects. Cracks and abrupt changes in surface profile must be corrected. Fins and projections must be removed by the concrete finisher.
- C. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Installer shall examine and approve concrete substrate for conditions affecting performance of finish. Contractor shall correct conditions that are found to be out of compliance with the requirements of this section. Repairs are not acceptable unless specifically approved on a case by case basis by the Architect.
- B. Provide a floor clean of materials and debris.
- C. Protect adjacent surfaces as required to prevent damage by concrete polishing procedure.
- D. Setup grinding machine(s), dust extraction system, tooling, generator, etc.

3.03 INSTALLATION

- A. Comply with all floor system manufacturer's recommendations and instructions regarding preparation and mixing of materials and application of each component of the Ameripolish Polishing System.
- B. Processes listed hereinafter are recommended procedures to obtain specified final floor finish. Grit type in each required step may vary due to unique circumstances including, but not limited to, specific hardness of concrete and other variances due to regional materials used. Actual process will be dictated by that used to perform approved mock-up prior to performing scope of work.
- C. Main Grind is to be started approximately 7 to 10 days after the pour, before walls are placed. The main grind consists of all steps up to a 100 grit resin bonded diamond. Grind the concrete floor to within 2-3 inches of walls with: 16 grit, 25 grit, 40 grit, 80 grit and 150 grit; removing construction debris, floor slab imperfections and until there is a uniform scratch pattern and desired concrete aggregate exposure is achieved. Vacuum the floor thoroughly using a squeegee vacuum attachment.
- D. Surface imperfections: Provide repair material capable of matching final finish of adjacent surface through integral colorant product or material with ability to receive colorant. Fill surface imperfections including, but not limited to: holes, surface damage, micro cracks, air holes, pop-outs, voids, and micro-pitting in finished work. Surface imperfections shall not be reasonably noticed from a distance standing 10 feet away or greater utilizing lighting conditions present after construction.
- E. Apply densifier hardener undiluted at approximately 200 sq feet per gallon (or manufacturer's recommendation) with a long stiff bristled broom or microfiber pad. Cover the entire slab area liberally and allow to sit and crystallize for a period of time recommended by manufacturer (typically 15-60 minutes).
- F. Polish the floor to the specified sheen level, with phenolic resin bonded diamonds 100 grit, 200 grit, 400 grit, 800 grit, 1500 grit, and 3000 grit. All resin bonds listed may not be required due to desired sheen level and existing field/concrete conditions. Contractor shall choose resin bonds and steps based on Architect's specifications and required field testing. Each step of resin polishing should remove all scratches from the previous grit. After each polish, clean the floor thoroughly using clean water and an autoscrubber or a mop and wet vacuum.

- G. Apply Stain Guard Protectant, as per manufacturer's recommendations.
- H. If applicable, provide acid etched and engraved logos where indicated, of contrasting color.
- I. All construction joints and cracks should be filled with products as specified in accordance with the manufacturer's instructions colored to match (or contrast) with concrete color as specified by Architect.
- J. Finished Gloss Level:
 - 1. Finished Gloss Level 3 – High Gloss:
 - a. Reflective Clarity Reading: Not less than 65 per ASTM D5767 prior to stain protector application.
 - b. Reflective Sheen Rating: Not less than 35 per ASTM D523 prior to stain protector application.
- K. Final Aggregate Exposure:
 - 1. CPAA Class B – Fine aggregate (Salt and Pepper)
 - a. Fine aggregate exposure with little or no medium aggregate exposure at random locations.
 - b. Aggregate size up to 1/8" diameter.

3.04 PROTECTION

- A. There is no known solution for the removal of petroleum based products such as oil or hydraulic fluid that won't compromise the finish product. All lifts must be diapered. No vehicles are to be allowed to park on the slab. All Pipe cutting or threading is to be done off of the slab.
- B. Protect finished system against undue soilage and damage by other trades by use of reasonable care and precaution during process of installation and after completion of installation, prior to substantial completion of project.
- C. Check lift tires for screws daily as this can leave divots in the polished concrete floor.
- D. Protect adjacent materials from damage during installation of polished concrete. Some touch-up paint should be expected due to machinery size, cords and hoses.
- E. Chalk lines laid out for any purpose are ok as long as they are not sprayed down with clear acrylic.
- F. General Contractor to protect floor prior to finished floor completion. Recommended product to be a non-woven, puncture and tear resistant, polypropylene fibers laminated with a multi-ply, textured membrane, not less than 18 mils in thickness.

3.05 CLEAN-UP

- A. Clean adjacent materials and surfaces, and work area of foreign materials resulting from work of this section. Remove unused materials and dispose of off-site.

END OF SECTION

PRE-STRESSED CONCRETE

PART ONE - GENERAL

1.1 WORK INCLUDED

- A. These specifications cover precast and precast, pre-stressed structural concrete construction and it's attachment to the foundation system, including product design not shown on contract drawings, manufacture, transportation, erection, and other related items such as anchorage, bearing pads, storage and protection of precast concrete.
- B. Related work specified elsewhere:
 - 1. Cast-In-Place Concrete: Section 03 31 00
 - 2. Concrete Unit Masonry: Section 04 22 00
 - 3. Structural Steel: Section 05 12 00
 - 4. Miscellaneous Steel: Section 05 50 00
 - 5. Sealants and Caulking: Section 07 92 00
 - 6. Painting: Section 09 91 00

1.2 QUALITY ASSURANCE

- A. Manufacture Qualifications: The precast concrete manufacturing plant shall be certified by the Precast/Pre-stressed Concrete Institute, Plant Certification Program, prior to the start of production.
- B. Erector Qualifications: Regularly engaged for at least 5 years in the erection of precast structural concrete similar to the requirements of this project.
- C. Welder Qualifications: In accordance with AWS D1.1
- D. Testing: In general compliance with testing provisions in MNL-116, Manual for Quality Control for Plants and Production of Precast and Pre-stressed Concrete Products.
- E. Requirements of Regulatory Agencies: All local codes plus the following specifications, standards and codes are a part of these specifications:
 - 1. ACI 318 - Building Code Requirements for Reinforced Concrete.
 - 2. AWS D1.1 - Structural Welding Code - Steel.
 - 3. AWS D1.4 - Structural Welding Code - Reinforcing Steel.
 - 4. ASTM Specifications - As referred to in Part 2 Products, of this Specification.

1.3 SUBMITTALS

- A. Shop Drawings: Submit one hard copy (not to be returned) and one electronic copy in PDF format as per Section 01 33 23 to the architect for approval.
 - 1. Erection Drawings:
 - a. Member piece marks and completely dimensioned size and shape of each member.
 - b. Plans and/or elevations locating and defining all products furnished by manufacturer.
 - c. Sections and details showing connections, cast-in items and their relation to the structure.
 - d. Relationship to adjacent material.
 - e. Joints and openings between members and between members and structure.
 - f. Description of all loose, cast-in and field hardware.
 - g. Field installed anchor location drawings.
 - h. Erection sequences and handling requirements.
 - i. All dead, live and other applicable loads used in the design.
 - j. Estimated camber and calculated live load deflection.
 - k. Drawings must be stamped and signed by Registered Engineer.
- B. Product Design Criteria:
 - 1. Loadings for design:
 - a. Initial handling and erection stress limits.
 - b. All dead loads, live loads, wind loads and seismic loads, as specified on the contract drawings.
 - c. All other loads specified for member, where applicable.
 - 2. As directed on the contract drawings, design calculations of products shall be performed by a registered engineer experienced in precast, pre-stressed concrete design and submitted for approval upon request. Engineer must be registered in Arkansas.
 - 3. Design shall be in accordance with ACI 318.
- C. Permissible Design Deviations:
 - 1. Design deviations will be permitted only after the architect/engineer's written approval of the manufacturer's proposed design supported by complete design calculations and drawings.
 - 2. Design deviations shall provide an installation equivalent to the basic intent without incurring additional cost to the owner.
- D. Test Reports: reports of tests on concrete and other materials upon request.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling:

1. Precast concrete members shall be lifted and supported during manufacturing, stockpiling, transporting and erection operations only at the lifting or supporting points, as shown on the shop drawings, and with approved lifting devices. Lifting inserts shall have a minimum safety factor of 4. Reusable lifting hardware and rigging shall have a minimum safety factor of 5.
2. Transportation, site handling, and erection shall be performed with acceptable equipment and methods, and by qualified personnel.

B. Storage:

1. Store all units off ground.
2. Place stored units so that identification marks are discernible.
3. Separate stacked members by battens across full width of each bearing point.
4. Stack so that lifting devices are accessible and undamaged.
5. Do not use upper member of stacked tier as storage area for shorter member or heavy equipment.

1.5 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 PCI certified are considered approved. Other fabricators not PCI certified shall submit the fabricator's written procedural and quality control manual and periodic auditing of fabrication practices by an approved special inspection agency prior the start of fabrication.
- 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.
- D. All fabricators that not approved shall undergo special inspection as required by Section 1704.2.5 of the IBC 2021.

PART TWO - PRODUCTS

2.1 MATERIALS

A. Portland Cement:

1. ASTM C150 - Type I or III.

B. Admixtures:

1. Air-entraining admixtures: ASTM C260.
2. Water reducing, retarding, accelerating, high range water reducing admixtures: ASTM C494.
3. Calcium chloride or admixtures containing chlorides shall not be used.

- C. Aggregates: ASTM C33 or C330.
- D. Water: Potable or free from foreign materials in amounts harmful to concrete and embedded steel.
- E. Reinforcing Steel:
 - 1. Bars:
 - Deformed billet-steel: ASTM A615.
 - Deformed rail-steel: ASTM A616.
 - Deformed axle-steel: ASTM A617.
 - Deformed low-alloy steel: ASTM A706.
 - 2. Wire:
 - Cold-drawn steel: ASTM A82.
 - 3. Welded wire fabric:
 - Welded plain steel: ASTM A185.
 - Welded deformed steel: ASTM A497.
- F. Strand:
 - 1. Uncoated, 7-wire strand:
 - ASTM A416-Grade 250 or 270.
- G. Anchors and Inserts:
 - 1. Materials:
 - a. Structural steel: ASTM A36.
 - b. Malleable iron castings: ASTM A47.
 - c. Stainless steel: ASTM A666, type 304.
 - d. Carbon steel plate: ASTM A283.
 - e. Bolts: ASTM A307 or A325.
 - f. Welded headed studs: AWS D1.1 - Type B.
 - g. Deformed bar anchors: ASTM A496.
 - 2. Finish:
 - a. Shop primer: Manufacturer's standards.
 - b. Hot dipped galvanized: ASTM A153.
 - c. Zinc-rich coating: MIL-P-21035, self curing, one component, sacrificial.
 - d. Cadmium coating: ASTM A165.
- H. Grout:
 - 1. Cement grout: Portland cement, sand, and water sufficient for placement and hydration.
 - 2. Non-shrink grout: Premixed, packaged ferrous and non-ferrous aggregate shrink-resistant grout.
 - 3. Epoxy-resin grout: Two component mineral filled epoxy-resin: ASTM C881 or FS MMM-A-001993.

I. Bearing Pads:

1. Random oriented fiber reinforced: shall support a compressive stress of 3000 psi with no cracking, splitting or delaminating in the internal portions of pad. One specimen shall be tested for each 200 pads used in the project.
2. Plastic: Multi-monomer plastic strips shall be non-leaching and support construction loads with no visible overall expansion.

2.2 CONCRETE MIXES

A. Manufacturing procedures shall be in general compliance with PCI MNL-116.

B. Manufacturing tolerances shall comply with PCI MNL-116.

C. Finishes:

1. Wall Panels:

- a. Exposed to view: Fresno or approved equal finish. All air pockets and holes over 1/4 inch in diameter shall be filled with a sand-cement paste. All form offsets or fins over 1/8 inch shall be ground smooth.
- b. Concealed from view include side exposed to masonry veneer: standard.
- c. Vertical ends: When exposed to view, strands shall be recessed a minimum of 1/2 inch, the holes filled with grout and the ends of the member shall receive Fresno finish, or approved equal.

2. Double Tee:

- a. Underside(as formed): Grade B, all air pockets and holes over 1/4 inch in diameter shall be filled with a sand-cement paste. All form offsets or fins shall be ground smooth.
- b. Top: Raked finish to allow composite action with topping slab. Normal color variations, minor indentations, minor chips and spalls shall be permitted. No major imperfections, honeycomb, or defects shall be permitted.

3. Planks:

- a. Exposed to view: Grade B finish. All air pockets and holes over 1/4 inch in diameter shall be filled with a sand-cement paste. All form offsets or fins over 1/8 inch shall be ground smooth.
- b. Concealed from view (Mech Platform): standard.
- c. Standard top: Result of vibrating screed and additional hand finishing at projections. Normal color variations, minor indentations, minor chips and spalls shall be permitted. No major imperfections, honeycomb, or defects shall be permitted. Light broom finish for bonding of topping slab.
Vertical ends: When exposed to view, strands shall be recessed a minimum of 1/2 inch, the holes filled with grout and the ends of the member shall receive sacked finish.

D. Openings: The manufacturer shall provide for all openings as shown on the structural drawings and openings required for mechanical, electrical and architectural items. If openings require field drilling, openings shall be approved by the architect/engineer and precast concrete engineer before drilling or cutting.

E. Patching: Shall be acceptable providing the structural adequacy of the product and the appearance are not impaired.

- F. Fasteners: Manufacture shall cast in structural inserts, bolts and plates as detailed or required by the contract drawings.
- G. Dimensional tolerances: Conform to Division VI of PCI MNL-116.
- H. Cast-In embeds: Provide all embeds noted on architectural/engineering drawings.
- I. Cast In Conduits: Conduits to be cast in walls shall be oriented vertically only. Conduits shall be provided by electrical contractor.

PART THREE - EXECUTION

3.1 ERECTION

- A. Site access: General contractor shall be responsible for providing suitable access to the building, proper drainage and firm, level bearing for the hauling and erection equipment to operate under their own power.
- B. Preparation: General contractor shall be responsible for:
 - 1. Providing true, level bearing surfaces on all foundations and other field placed supporting members.
 - 2. Placement and accurate alignment of embeds, plates or dowels in foundation and other field placed supporting members.
 - 3. All shoring required for composite beams and slabs.
- C. Installation: Installation of precast, pre-stressed concrete shall be performed by the manufacturer or a competent erector. Members shall be lifted by means of suitable lifting devices at points provided by the manufacturer. Temporary shoring and bracing, if necessary, shall comply with manufacturer's recommendations.
- D. Alignment: Members shall be properly aligned and leveled as required by the approved shop drawings. Variations between adjacent members shall be reasonably leveled out by jacking, loading, or any other feasible method as recommended by the manufacturer and acceptable to the architect/engineer.
- E. Where joints in precast walls exceed 3/8 inch, precast manufacturer shall provide joint protection (FEMA 361) with a continuous rod or plate welded into the joint. This protection shall not be exposed to view.

3.2 FIELD WELDING

- A. Field welding is to be done by qualified welders using equipment and materials compatible to the base material. All welders shall be certified by an approved testing facility. Field and shop welders shall qualify for the following:

Type of Weld	Position of Welding
Groove	Horizontal
Groove	Vertical
Groove	Overhead
Fillet	Vertical
Fillet	Overhead

3.3 ATTACHMENTS

- A. Subject to approval of the architect/engineer, precast, pre-stressed concrete products may be drilled or “shot” provided no contact is made with the pre-stressing steel. Should spalling occur, it shall be repaired by the trade doing the drilling or the shooting.

3.4 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 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

<u>Item Tested</u>	<u>Percentage Tested</u>
1) Fillet Welds	25%
2) Full Penetration Welds	100%
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 5% or more of welds tested for each type of weld listed in 3.4.4, fail testing procedures, all welds shall be tested at no cost to the owner.

3.5 OBSERVATION AND ACCEPTANCE

- A. Final observation and acceptance of erected precast, pre-stressed concrete shall be made by the architect/engineer within a reasonable time after the work is completed.

3.6 SPECIAL INSPECTIONS

Refer to “Special Inspections” for additional observation and testing requirements.

END OF SECTION

CAST-IN-PLACE CONCRETE TOPPING

PART ONE - GENERAL

1.1 DESCRIPTION

- A. This section includes material, mixing, proportioning, sampling, testing, placing, finishing, and curing of cementitious toppings for precast double tees.

1.2 INSPECTION

- A. Give Architect 24 hours notice prior to placing toppings.

1.3 SUBMITTALS

- A. The contractor shall submit one hard copy (not to be returned) and one electronic copy in PDF format as per Section 01 33 23, through an approved testing laboratory, the proposed concrete mix to be used to the architect for approval. The proposed concrete mix must be proved by 3 cylinder tests in accordance with ASTM C-31.

PART TWO - PRODUCTS

2.1 MATERIALS

- A. Portland Cement - Type I conforming to ASTM C150.
- B. Coarse Aggregate - ASTM C33, Size 7, 1/2" to No. 4 sieve.
- C. Fine Aggregate - ASTM C33, 100% shall pass a No. 4 sieve, 10% maximum shall pass a No. 100 sieve.
- D. Water - Drinkable
- E. Concrete Admixture and Bonding Agent – SIKA Thoroseal ACRYL-60
- F. Slurry Coat – One part bonding agent to one part water by volume
One part sand/One-part portland cement by volume
Combine dry mixture and add wet mixture slowly to a one-to-one ratio by volume

PART THREE - EXECUTION

3.1 SURFACE PREPARATION

- A. Precast shall be cleared of dirt, oil, and debris that inhibits bonding of the topping slab to the precast.

3.2 PLACE TOPPING

- A. At the time of application, surfaces should be saturated, surface dry with no standing water.
- B. Brush slurry coat on floor to receive new topping. The maximum time for placement of topping over a fresh slurry coat should not exceed twenty minutes.
- C. Delay troweling newly placed concrete until it can be worked without bringing water and appreciable amounts of fine material to the surface. After the surface is quite hard, burnish with a steel trowel to a hard dense surface. Broom finish.
- D. Topping shall be placed 4" thick to match camber of double tees.

3.3 CURING

- A. Moist cure with a fine mist spray of water or wet burlap for seven days. Curing of this concrete topping shall conform to ACI 308. Protect newly applied material from mechanical injury, rain and freezing.

END OF SECTION

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. Concrete 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.

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

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 ACI 530.1/ASCE 6/TMS 602.

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.

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: None required.
- 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).

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

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): (2'0" o.c. Horizontally, 1'4" o.c. Vertical)
- | | |
|---------------------|---------------|
| DW10-HS | Anchor Plate |
| VBT – Vee-Byna Ties | 3", 4" and 5" |
- B. MULTI-WYTHE WALL: (4" veneer and 6", 8", 10" and 12" block)
- | | |
|-----|---|
| 270 | Ladder Eye Wire with 3/16" diameter pintles. Side rods shall be 9 gage side rods (16" o.c. vertically). |
|-----|---|
- C. SINGLE WYTHE WALL:
- 6", 8", 10", and 12" walls:
- | | |
|-----|---|
| 220 | Ladder Mesh Reinforcement 9 gage side rods (16" o.c. vertically). |
|-----|---|

4" walls:

One (1) 9 gage longitudinal rod (16" o.c. vertically)

- D. VENEER ATTACHMENT (CONCRETE WALL): (2'0" o.c. horizontally, 1'4" o.c. vertically)

305	24 gage Dovetail Anchor Slot
315	3 ½", 4 ½" and 5" Triangle Tie

- E. VENEER ATTACHMENT (STEEL BEAM OR COLUMN): (2'0" o.c. horizontally, 1'4" o.c. vertically)

359	Weld-on Ties
VBT – Vee-Byna Ties	3", 4" and 5"

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, MO.

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.

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 walls or steel beams and columns.
3. Install flexible ties as brick masonry work progresses.

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 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.

END OF SECTION

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
 - 4. Concrete Unit Masonry Section 04 22 00
- 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, 6" block, 2" 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.

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.

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.

\$625.00 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.

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.

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.

END OF SECTION

CONCRETE UNIT MASONRY

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 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.

1.1.2 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.	Brick Masonry	Section 04 22 00
6.	Painting	Section 09 91 00

1.1.3 Reference standards:

Standard Specification ACI 530.1/ASCE 6/TMS 602

1.2 QUALITY ASSURANCE

1.2.1 Qualifications of workmen:

1.2.1.1 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.

1.2.1.2 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

1.3.1 Prior to proceeding with the masonry work, erect a 4'0" x 4'0" sample wall panel. Panel shall include 8" block, foam filled 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.

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.
- 1.4.3 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

- 2.1.1 All concrete masonry units shall meet or exceed the minimum specifications of the ASTM Standard C-90, type I, moisture-controlled units. 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.
- 2.1.2 Minimum compressive strength of concrete masonry unit = 2150 psi.
- 2.1.3 All masonry units above grade shall be lightweight unit masonry with a density of 108 pcf or less.
- 2.1.4 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.
- 2.1.5 All exterior exposed block shall have Iron Oxide pigments equal to Solomon Grind-Chem Service, Inc. Colors to be selected from manufacturer's standard (90 minimum choices). White or gray based block shall be produced with white cement and color additive shall be selected from premium color options of manufacturers full range of colors. Final choice of block color shall be made from actual samples.
- 2.1.6 Mortar: Refer to Section 04 05 13.
- 2.1.7 Provide round corner blocks at window sills and all 90 degree outside corners, including exposed corners of block.

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 performed. Correct conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 COORDINATION

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

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

3.3.2 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.

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

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

3.3.5 Where noted on the Drawings, fill voids in blocks and reinforced bond beams with 3,000 psi concrete using pea gravel as the coarse aggregate.

3.3.6 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.

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

3.3.8 Fill hollow masonry units receiving anchor bolts for plates completely with mortar.

3.3.9 Grout placement:

1. Conform to requirements of ACI 530 "Specifications for Masonry Structures", sub-section 3.5.
2. Limit grout lifts to 5 feet maximum.

3.4 HORIZONTAL AND VERTICAL FACE JOINTS.

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 and rejoin.

6. Remove mortar protruding into cells of cavities to be reinforced or filled.

3.5 CLEANING

1. Leave work and surrounding surfaces clean and free of mortar spots and droppings.
2. Clean mortar boxes at the end of each day's work.

3.6 MASONRY CONTROL JOINTS

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 CERAMIC TILE WALL FINISH

Verify where the wall finish occurs and omit bull-nose blocks at outside corners, these areas only. Coordinate as required with the installer.

3.8 PROTECTION OF WALLS

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

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 \$20,000 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.

- 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 $F_y=50$ ksi.
- B. Angles, round bars, and channels: Specifications for Structural Steel, ASTM A572, $F_y=50$ ksi.
- C. Plates less than $\frac{1}{2}$ " thick: ASTM A36, $F_y=36$ ksi.
- D. Bars and Plates $\frac{1}{2}$ " Thick and Greater: ASTM A-572, $F_y=50$ ksi.
- E. Steel pipe: Specification for Hot-Formed Welded Seamless Carbon Steel Structural Tubing, ASTM A500 Grade C ($F_y = 46$ ksi).
- F. Steel tubing: Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes ASTM A500 Grade C ($F_y = 50$ 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, $F_y=51\text{ksi}$, $F_u=65\text{ ksi}$ 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, $F_y=49\text{ ksi}$, $F_u=65\text{ksi}$ minimum ultimate tensile strength.
- C. Threaded Studs: ASTM A108, $F_y=49\text{ksi}$, $F_u=61\text{ ksi}$ 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

<u>Item Tested</u>	<u>Percentage Tested</u>
1. Full penetration welds for field beam to column connections.	20%
2. Full penetration welds for field beam to beam connections.	20%

- 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 full penetration 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 full penetration 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.

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:

<u>Type of Weld</u>	<u>Position of Welding</u>
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

STEEL ROOF DECK

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).

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.

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.

- 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 Tekes 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.

- 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

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.

- 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 $F_y=50$ ksi. All lightgage framing materials 43 mil. (18 gage) and lighter shall have a yield stress $F_y=33$ 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.
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 maximum 16" 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.
9. Provide stud walls at locations indicated on plans as "shear walls" for frame stability and lateral load resistance.

D. JOISTS, 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. JOISTS: Space joist 16" o.c. UNO

1. Uniform and level joist bearing shall be provided at support by means of shims.
2. Joists shall be located directly over bearing studs or a load distribution member shall be provided at the top of the bearing wall.
3. Web stiffeners shall be provided at reaction points and at points of concentrated loads where indicated on the drawings.
4. Joist bridging shall be provided where indicated on the drawings.
5. Additional joists shall be provided under parallel partitions when the partition length exceeds one-half the joist span, also around all floor and roof openings which interrupt one or more spanning members, unless otherwise noted.
6. End blocking shall be provided where joist ends are not otherwise restrained from rotation.

F. 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

METAL FABRICATIONS

PART ONE - GENERAL

1.1 SCOPE

1.1.1 Work included: Provide miscellaneous metal work, complete, including:

- a. Steel supports for work of other trades.
- b. Miscellaneous metal steel attachments, anchors, plates, angles, etc.
- c. 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.

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. Metal Stair Pans: For integral riser and treads up to 5'0" in length use 14 gage steel; for lengths up to 8'0" use 12 gage steel.
 - l. 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.
 - m. 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.
 - n. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 except containing no asbestos fibers.
 - o. 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".

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 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.
- 2.3.2 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.

3.3 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

METAL LADDERS

PART ONE – GENERAL

1.1 DESCRIPTION

- A. Work included: Provide metal ladders as shown on the drawings, specified herein, and needed for a complete and proper installation.

1.2 REFERENCES

- A. AA – Aluminum Association
- B. ASTM B 209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- C. ASTM B 221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
- D. OSHA 1910.27 – Fixed Ladders

1.3 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.

1.4 SUBMITTALS

- A. General: Comply with provisions of Section 01 33 23.
- B. Manufacturer's data: Within 30 calendar days after award of Contract, submit:
 - 1. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.
 - 2. Complete shop drawings.
 - 3. Provide templates for anchors and bolts specified for installation under other Sections.
 - 4. Provide reaction loads for each hanger and bracket.
 - 5. Manufacturer's recommended installation procedures.

1.5 PRODUCT HANDLING

- A. 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.

- 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. 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 manufacturers' recommendations as approved by the Architect.

PART TWO - PRODUCTS

2.1 GENERAL

- A. Ladders shall be Model 501 heavy duty tubular rail as manufactured by O'Keeffe's Inc., San Francisco, CA or Architect approved equal.
- B. Finish to be mill finish.
- C. Other Materials: All other materials, including but not necessarily limited to anchorage devices, end caps, isolation bearings, etc., shall be only as recommended by the manufacturer, and as approved by 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 proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

END OF SECTION

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.

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:

<u>Item:</u>	<u>Description:</u>
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.

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

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

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.

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

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.

- 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.

- 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 13" 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 throughout 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.

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

FLUID APPLIED AIR & WATER-
RESISTIVE BARRIER SYSTEM

PART ONE – GENERAL

1.1 SUMMARY:

- 1.1.1 Work of this section includes window and door flashing, air and water-resistive barrier membrane system, and accessory materials for application to exterior building envelope substrates as indicated on the drawings.

1.2 PERFORMANCE REQUIREMENTS:

- A. Performance requirements: Comply with the specified performance requirements and characteristics as herein specified.
- B. Performance description:
1. The building envelope shall be constructed with a continuous, air and water-resistive barrier to control water and air leakage into and out of the conditioned space.
 2. Joints, penetrations and paths of water and air infiltration shall be made watertight and airtight.
 3. System shall be capable of withstanding positive and negative combined wind, stack and HVAC pressures on the envelope without damage or displacement.
 4. System shall be installed in an airtight and flexible manner, allowing for the relative movement of systems due to thermal and moisture variations.

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.
- B. Pre-installation conference: Prior to beginning installation of air and water-resistive barrier system, hold a pre-installation conference to review work to be accomplished.
1. Contractor, Architect, installing subcontractor, membrane system manufacturer's representative, and all subcontractors who have materials penetrating membrane system or finishes covering membrane system shall be present.
 2. Contractor shall notify Architect at least seven days prior to time for conference.
 3. Contractor shall record minutes of meeting and distribute to attending parties.
 4. Agenda: As a minimum discuss:
 - a. Surface preparation.
 - b. Substrate condition and pretreatment.
 - c. Minimum curing period.
 - d. Special details and sheet flashing.
 - e. Sequence of construction, responsibilities, and schedule for subsequent operations.
 - f. Installation procedures.
 - g. Inspection procedures.
 - h. Protection and repair procedures.
 - i. Review and approval of all glazing applications.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage, weather, excessive temperatures and construction operations. Remove damaged material from site and dispose of in accordance with applicable regulations.
- B. Protect air and water-resistive barrier components from freezing and extreme heat. Store materials at temperatures of 40 degrees Fahrenheit to 100 degrees Fahrenheit.
- C. Sequence deliveries to avoid delays, and to minimize on-site storage.

1.6 PROJECT CONDITIONS

- A. Weather conditions: Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials used.
 1. Apply at surface and ambient temperatures recommended by the manufacturer. See manufacturer's product data for best practices.
 2. Proceed with installation only when the substrate construction and preparation work are complete and in condition to receive the membrane system.
 3. Exposure limitations: Schedule work to ensure that air and water-resistive barrier system is covered and protected from UV exposure within 180 days of installation. If air and water-resistive barrier membrane system cannot be covered within 180 days after installation, apply temporary UV protection as recommended by membrane manufacturer.

1.7 WARRANTY

- A. Manufacturer's warranty requirements: Submit manufacturer's written warranty stating that installed air and water-resistive barrier materials are watertight, free from defects in material and workmanship, and agreeing to replace defective materials and components.
- B. Warranty period: Five years from Date of Substantial Completion.

PART TWO – PRODUCTS

2.1 MANUFACTURER

2.1.1 PROSOCO, Inc, 3741 Greenway Circle, Lawrence, Kansas or Architect approved equal.

2.2 R-GUARD SPRAY WRAP AIR AND WATER-RESISTIVE BARRIER

- A. Description: Spray Wrap is a fluid-applied air and water-resistive barrier that stops air and water leakage in cavity wall, masonry veneer construction, as well as in stucco, EIFS and most other building wall assemblies. Once on the substrate, the easily applied liquid quickly dries into a rubberized, highly durable, water-resistant, vapor-permeable membrane.
- B. Characteristics:
 - 1. Thickness: Apply according to manufacturer's instructions.
 - 2. Air infiltration: Less than 0.004 cfm per square foot (0.02 L/s/sq m) when tested in accordance with ASTM E2178 or ASTM E283.
 - 3. Air Barrier Assembly: pass when tested in accordance with ASTM E-2357.
 - 4. Water vapor permeability: 10.5 perms when tested in accordance with ASTM E96.
 - 5. Structural performance: Air and water-resistive barrier system shall withstand positive and negative wind pressure loading when tested in accordance with ASTM E330.
 - 6. Water penetration (static pressure): No uncontrolled water penetration when tested in accordance with ASTM E331.
 - 7. Flexibility: No cracking or de-lamination using 1/8 inch mandrel at 14 degrees Fahrenheit before and after aging when tested in accordance with ASTM D522.
 - 8. Tensile strength: Greater than 15 psi or exceeds strength of substrate when tested in accordance with ASTM C297.
 - 9. Nail Sealability: pass when tested in accordance with ASTM D1970.
 - 10. Surface Burning: pass when tested in accordance with ASTM E84.
 - 11. Volatile organic content (VOC): less than 100 g/L.
 - 12. Color: Light Red.

2.3 R-GUARD JOINT & SEAM FILLER FIBER REINFORCED FILL COAT AND SEAM FILLER

- A. Description: Joint & Seam Filler is a high modulus, gun- grade, crack and joint filler, adhesive and detailing compound that combines the best silicone and polyurethane properties. This single-component, 99% solids, fiber-reinforced, Silyl-Terminated-Poly-Ether (STPE) is easy to gun, spread and tool.

B. Characteristics:

1. Thickness: Apply according to manufacturer's instructions.
2. Hardness: Shore A, 45-50 when tested in accordance with ASTM C661.
3. Water vapor permeability: Minimum 14 perms when tested in accordance with ASTM E-96.
4. Tensile strength: 225 psi when tested in accordance with ASTM D412.
5. Lap shear strength: 275 psi when tested in accordance with ASTM D1002.
6. Elongation at break: 275% when tested in accordance with ASTM D412.
7. Peel strength: 30 pli when tested in accordance with ASTM D1781.
8. Volatile organic content (VOC): 30 g/L.
9. Shrinkage: None.
10. Form: Pale Red, Gun Grade.

2.4 R-GUARD FASTFLASH LIQUID-APPLIED FLASHING MEMBRANE

A. Description: FastFlash is a gun-grade waterproofing, adhesive and detailing compound that combines the best of silicone and polyurethane properties. This single component, 99% solids, Silyl-Terminated-Poly-Ether (STPE) is easy to gun, spread and tool to produce a highly durable, seamless, elastomeric flashing membrane in rough openings of structural walls.

B. Characteristics:

1. Thickness: Apply according to manufacturer's instructions.
2. Water vapor permeability: Minimum 14 perms when tested in accordance with ASTM E96.
3. Water penetration (cyclical static air pressure difference): No uncontrolled water penetration when tested in accordance with ASTM E547.
4. Hardness: Shore A, 40-45 when tested in accordance with ASTM C661.
5. Tensile strength: 180 psi when tested in accordance with ASTM D412.
6. Elongation at break: 400% when tested in accordance with ASTM D412.
7. Peel strength: 25 pli when tested in accordance with ASTM D1781.
8. Volatile organic content (VOC): 30 g/L.
9. Form: Brick Red, Gun Grade Sealant.

PART THREE - EXECUTION

3.1 EXAMINATION:

- A. Verify that surfaces and conditions are ready to accept the Work of this section. Notify Architect in writing of any discrepancies. Commencement of the Work or any parts thereof shall mean acceptance of the prepared substrates.
- B. All surfaces must be sound, dry, clean, and free of grease, dirt, excess mortar or other contaminants. Fill voids, gaps, and spalled areas with R GUARD Joint & Seam Filler in substrate to create an even plane. Masonry head joints should be fully filled and tooled.
- C. Where curing materials are used they must be clear resin based without oil, wax or pigments
- D. Condition materials to room temperature prior to application to facilitate extrusion and handling.

3.2 SURFACE PREPARATION:

- A. Refer to manufacturer's product data for requirements for condition of and preparation of substrates.
 - 1. Surfaces shall be sound and free of voids, spalled areas, loose aggregate and sharp protrusions.
 - 2. Remove contaminants such as grease, oil and wax from exposed surfaces.
 - 3. Remove dust, dirt, loose stone and debris.
 - 4. Use repair materials and methods that are acceptable to manufacturer of the air and water-resistive barrier system.

END OF SECTION

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.	Concrete Unit Masonry	Section 04 22 00
4.	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

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 1/2" Durasheath-3, closed-cell polyisocyanurate insulation with an inorganic polymer coated glass fiber mat facer on each side as manufactured 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 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.

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

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.

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.

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.

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

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.

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, Peoria, ILL
3. Architect approved equal.

B. Vapor barrier shall have all the following qualities:

1. Maintain permeance of less than 0.01 Perms [grains/(ft² · 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

ADJUSTABLE FRAMING SYSTEM

PART ONE - GENERAL

1.1 SCOPE

- A. This section includes the requirements applicable to the reroofing Adjustable Framing System to be furnished and installed under the contract. All work involved with the furnishing and installation of the reroofing adjustable framing system shall be accomplished in conformance with the requirements specified herein and with related requirements covered by other sections of this specification.

1.2 RELATED SECTIONS

- A. Section 13 34 19 – Metal Building Systems.

1.3 REFERENCES

- A. American Iron and Steel Construction (AISC) - Manual of Steel Construction - Allowable Stress Design, Latest Edition.
- B. American Iron and Steel Institute (AISI) – 2001 North American Specifications for the Design of Cold-Formed Steel Structural Members.
- C. Metal Building Manufacturer's Association (MBMA) Low Rise Building System Manual.
- D. American Society of Civil Engineers ASCE/SEI 7-100 - Minimum Design Loads for Buildings and Other Structures.
- E. Metal Roof Manufacturer's Structural Calculations, Product Information and Cautions and Erection Instructions.
- F. AWS D1.3 Structural Welding Code - Sheet Steel.
- G. AWS D111 Structural Welding Code - Steel.
- H. International Building Code, 2021 edition with Arkansas Amendments and Arkansas Fire Prevention Code, latest edition.

1.4 SYSTEM DESCRIPTION

- A. The adjustable framing system shall provide support for the new roof system over the storm shelter roof and shall adjust to accommodate the irregularities of the shelter roof and form a structural platform to support the new roof system at the specified slope.
- B. The adjustable framing system shall transfer loads from the new roof system to the shelter roof structure in such a manner as to not overload the existing structural members.

- C. Design the adjustable framing system to resist the forces produced by the following loads:
1. Dead Load: Total of all permanently installed materials including roofing, structural frame, accessories and all equipment that is fixed in position. Dead Load shall not exceed 5 psf.
 2. Live Load = 20 psf.
 3. Collateral Load = 3 psf
 4. Snow Load: per ASCE 7-16
Importance Factor 1.10
 $P_g = 10$ psf
Min. snow load = $1.1 \times P_g$
 5. Wind Load: Per ASCE 7-16
Importance Factor = 1.0.
Wind Speed = 112 mph.
Exposure Category = C.
 6. Seismic Loads:
Seismic Occupancy category = III
Importance Factor = 1.25
SDS = .276
SDI = .137
Site Class = C – per soils engineer
Seismic Design Category = C
 7. Load combinations shall be in accordance with the International Building Code, 2021 edition, with Arkansas Amendments.
 8. Maximum deflection under full Dead Load plus Live Load = $L/180$.
- D. Design of the adjustable framing system shall be in accordance with AISC, Allowable Stress Design Specification for Structural Steel Buildings, Latest Edition and AISI, North American Specification for the Design of Cold Formed Steel Structural Members.

1.5 JOB CONDITIONS

- A. The adjustable roof framing shall bear on the concrete storm shelter. Shelter roof camber shall be field verified and provided to the Adjustable Framing System supplier and incorporated into the design prior to submitting shop drawings for approval.
- B. Bearing locations of the system shall be spaced at not more than 6'-0" in each direction.

1.6 SUBMITTAL: Submit one hard copy (not to be returned) and one electronic copy in PDF format as per Section 01 33 23 for approval by the architect.

- A. Submit manufacturer's product data and installation instructions.
- B. Submit shop drawings showing dimensioned layout and details of adjustable framing system, dimensioned layout of shelter roof, and attachment requirements to concrete structure, bracing, slopes, parts descriptions, top member height chart and a description of how the reroofing shall proceed. Shop drawings shall be sealed and signed by a Professional Engineer registered to practice in the manufacturer's State of Arkansas.

- C. Submit a complete set of adjustable framing system structural calculations prepared exclusively for this project. Structural calculations shall be sealed and signed by a Professional Engineer registered to practice in the State of Arkansas.
- D. Obtain approval of all submittals prior to fabrication and installation.

1.7 QUALITY ASSURANCE

- A. Manufacturer: The reroof framing system manufacturer shall have been in the business as a reroof framing system manufacturer for at least five years. The manufacturer shall submit upon request at least ten projects similar in size and scope prior to commencement of work listing the architect, owner, scope, location and name of project. The manufacturer shall employ a licensed professional engineer qualified to design these systems.
- B. Product: The adjustable framing system shall have demonstrated its suitability for this application in at least one of the following manners:
 - 1. Successful use on similar projects for a minimum of 5 years.
 - 2. Submission of proof of appropriate load testing of the system and detailed engineering analysis.

The suitability of item 2 relating to any specific system shall be at the discretion of the architect.

- C. Installer: The installer shall install the adjustable framing system in strict accordance with the manufacturer's shop drawings and installation instructions. The installer shall have a minimum of five years experience in the installation of reroof framing systems.
- D. Approved Products:
 - 1. This specification is written with the CURA® Adjustable Reroof Framing System by ReRoof America□, Inc., 6711 South Yale Ave., Suite 205, Tulsa, OK 74136-3327, (800)280-2872 as the basis of acceptable performance.
 - 2. Another acceptable manufacturer is NuRoof Framing Systems, by MBCI, (501-312-9062).
 - 3. Another acceptable manufacturer is Architectural Integrated Metals, Inc., Columbus, GA (706)660-1877.
 - 4. Like products of other manufacturer's may be approved, providing they meet or exceed all of the requirements specified herein.
 - a. No substitutions will be considered unless written request for approval is received in the architect's office at least seven days prior to date for receipt of bid. Each such request shall include the name and description of the proposed substitute, drawings, details, cuts, mock-ups, performance and test data, a list of ten projects of similar scope, references, photographs of existing installations, a letter by the manufacturer stating that the proposed substitute meets or exceeds all design criteria specified and any other information necessary for evaluation.
 - b. After evaluation, approval will be issued via written addendum.

PART TWO - PRODUCTS

2.1 MATERIALS

A. Steel:

1. All hot rolled steel used to fabricate the adjustable frames shall have a minimum yield strength of 36,000 psi. All cold formed steel used to fabricate the adjustable frames shall have a minimum yield strength of 40,000 psi. Steel shall meet requirements of an appropriate ASTM standard and shall be certifiable.
2. The adjustable frames shall be coated with a red oxide paint or equivalent by either a spray or dip process. (Optional coatings are G-60 galvanized and G-90 galvanized for corrosive environments. Designer please specify one of the three.)

B. Fasteners:

1. Shop fasteners shall be 5/16" diameter, 18 threads per inch, high strength bolts with zinc coating meeting or exceeding ASTM A449-90A Type 1 bolt requirements with locking nuts meeting the requirements of ASTM A563-90 specifications.
2. Field fasteners shall be minimum 1/4-14x1" HWH#3 self-drilling/self-tapping screws with a corrosion resistant coating. Screws shall be manufactured by a recognized manufacturer and shall be marked with manufacturer's identification symbol.

2.2 FRAMING SYSTEM DESIGN

- A. Provide adjustable framing system with open construction consisting of steel top, bottom and web members that are sized and selected specifically for this project. Adjustable framing system shall incorporate adjustable height ranges as required by this project but in no case shall total adjustability be less than six inches. Adjustability required to establish the proper elevation of the top member shall be achieved by an adjustable top clip, by sliding the web member vertically on the top or bottom member, by diagonal web members that rotate up and down or by cutting any given web member to the precise length required.
- B. The top member of the adjustable framing system shall be a minimum 16 gage structural shape installed in such a manner that it's top flange lies substantially in the same plane as the new roof. The top flange of the top member shall have sufficient width to accommodate attachment of the new roof system. The top member of the adjustable framing system shall accommodate its longitudinal thermal expansion and contraction by means of a slotted connection designed to satisfy the configuration of this project.
- C. The adjustable framing system web members shall be a structural angle or channel factory pre-cut to the exact length required to allow proper function of adjustable elements. Non-adjustable framing systems shall have any given web member cut the precise length required in order to establish the proper top member elevations without adjustable elements. Web members and any associated splices or connections shall be designed to resist any moment created by eccentric loading of the member as well as the axial and shear loads.

- D. Intermittent bottom members shall be factory pre-cut and the bottom flange of the bottom member shall be factory pre-punched for attachment to the existing structure. All bottom members shall be sized and selected to distribute the new roof loads to the existing structure without over stressing the bottom member or exceeding the allowable compressive strength of the roof. Refer to Architectural plans for additional requirements or limitation for loading of existing structure.
- E. The adjustable framing system shall be braced both laterally and longitudinally using steel members designed to satisfy the design loads and the roof system used. When bracing changes direction, component forces are created which must be taken into consideration in the design and erection of the framing system. The framing design shall include bracing as required to resist the following:
 - 1. Applicable horizontal loads.
 - 2. A minimum of 2% of the vertical load.
 - 3. All forces developed in the plane of the roof as a result of vertical roof loads and wind loads.
- F. Adjustable framing system shall be designed for floating attachment of the roof panels. Adjustable framing system manufacturer shall coordinate roof panel fixity with roof panel manufacturer.
- G. Framing design shall not rely on the roof panel or flashing to transfer in plane loads across the ridge of the roof.

PART THREE - EXECUTION

3.1 EXAMINATION

- A. Verify conditions of concrete roof and structural supports before starting installation of the adjustable framing system. Notify the architect of conditions detrimental to the successful installation before erecting the adjustable framing system.

3.2 PREPARATION

- A. Remove any debris from other work & topping slab placement.
- B. Provide blocking and shimming as required.

3.3 INSTALLATION

- A. General
 - 1. Install the adjustable framing system in accordance with manufacturer's shop drawings and installation instructions.
 - 2. Coordinate with installation of roofing and other adjacent work.
- B. Fasten bottom members to substrate according to manufacturer's shop drawings and installation instructions.

- C. Establish required top member elevations at the highest and lowest guide frames within a roof area. Attach web members to the bottom members at the highest and lowest guide frames. Adjust and attach top members at the required elevation to the web members at the highest and lowest guide frames. Provide temporary bracing as required. Install string lines between the highest and lowest guide frames. Ensure that string lines are tight and not sagging. Use wire and turn blocks or other method if necessary to be certain that new roof plane is straight and true. Establish the elevation of intermediate frames according to string lines. Repeat erection sequence as required for continuity.
- D. Install permanent bracing as shown on manufacturer's shop drawings.
- E. Tolerances:
 - 1. Out-of-Plane: The top members of the adjustable frames shall not vary from the theoretical plane of the new roof bearing by more than $\pm 1/4$ inch individually and 1 inch in 180 inches overall slope.
 - 2. The adjustable framing system shall be installed in a plumb and vertical position. Out of plumb tolerance shall not exceed $\pm 1/4$ inch in 60 inches.
 - 3. The top support beam surface of the adjustable framing system supporting the new roof shall not be out of plane with the new roof by more than $1/4$ inch in 12 inches.

3.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver adjustable framing system in marked bundles of like sizes and configuration. Deliver top support members, bottom members and factory pre-cut web members bundled separately.
- B. Store on supports so as to maintain adjustable framing system in a dry, clean segregated condition.
- C. Handle adjustable framing system so that individual members and factory-made joints are not over stressed during shipping, storage and erection.

END OF SECTION

COMPOSITE METAL WALL
PANELS

PART ONE - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division One - General Requirements, and other applicable specification sections in the Project Manual apply to the work specified in this Section.

1.2 SUMMARY

- A. Scope: Provide engineering, labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, erection, and installation for aluminum composite wall panels as required for the complete performance of the work, and as shown on the Drawings and as herein specified.
- B. Section Includes: The work specified in this Section includes fabricated aluminum composite metal panels, including, but not limited to, supports, anchors, fasteners, and sealants required for rain screen and back ventilated type panel system according to design indicated on the Drawings.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Aluminum composite wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Performance: Provide aluminum composite wall panel assemblies capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330-02:
 - 1. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - a. Uniform pressure of +/-75 psf (3600 Pa), acting inward or outward.
 - 2. Deflection Limits: Aluminum composite wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/175 of the span at the perimeter and 1/60 of the span anywhere in the panel.
- C. Air Infiltration: When tested in accordance with ASTM E 283, air infiltration at 1.57 psf (75 Pa) shall not exceed 0.12 cfm/ per square foot of wall area.
- D. Water Infiltration: Water infiltration is defined as uncontrolled water leakage through the exterior face of the assembly. Systems shall be designed to drain any water leakage occurring at the joints.

No water infiltration shall occur in any system under a differential static pressure of 12.00 psf (573 Pa) after 15 minutes of exposure in accordance with ASTM E 331.

- E. Water Penetration at Dynamic Pressure: AAMA 501.1-05 at the same test pressure difference specified for the static pressure test.
- F. Pressure Equalization of Head, Sill, Horizontal & Vertical Joinery—Air Flow Analysis: Shall pass the criteria for a pressure equalized horizontal joint in accordance with AAMA 509-09.

1.4 SUBMITTALS

- A. General: See Section 01 33 23 - Shop Drawings, Product Data & Samples.
- B. Product Data: Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications. Product data shall include, but shall not be limited to, construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of aluminum composite wall panel and accessory.
- C. Shop Drawings: Submit shop drawings for each product and accessory required. Include information not fully detailed in manufacturer's standard product data, including, but not limited to, fabrication and installation layouts of aluminum composite wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
- D. Samples:
 - 1. Submit samples for initial color selection. Submit samples for each type of aluminum composite wall panel indicated with factory-applied color finishes. Submit samples in form of manufacturer's color charts showing full range of colors and finishes available. Where finishes involve normal color variations, include samples showing the full, range of variations expected.
 - a. Include similar samples of panel, trim, and accessories involving color selection.
 - b. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.
 - 2. Submit samples for verification purposes. Submit 12 inch by 12 inch size sample of selected color coating. Additional samples may be required to show design, fabrication techniques, and workmanship. Include fasteners, closures, and other aluminum composite wall panel accessories.
- E. Quality Control Submittals:
 - 1. Qualification Data: Submit qualification data for firms and persons specified in Quality Assurance Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names of architects and owners, and other information specified.
 - 2. Test Reports:
 - a. Product Test Reports: Submit certified product test reports based on tests performed by an accredited inspecting and testing laboratory clearly describing in written form, and in shop drawing form, compliance of the composite metal wall panel assembly with requirements indicated based on comprehensive testing.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. **Manufacturer Qualifications:** Manufacturer shall be a firm engaged in the manufacture of aluminum composite wall panels of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of five years.
2. **Installer Qualifications:** Installer shall be a firm that shall have a minimum of five years of successful installation experience with projects utilizing aluminum composite wall panels similar in type and scope to that required for this Project.
 - a. Installer shall assume undivided responsibility for all components of the composite panel system, including, but not limited to, attachment to sub-construction, panel-to-panel joinery, panel to dissimilar material joinery, and joint seal associated with the composite panel system.
3. **Inspecting and Testing Agency Qualifications:** To qualify for acceptance, an independent inspecting and testing agency hired by the Contractor or manufacturer to test products shall demonstrate to the Architect's satisfaction that they are qualified according to ASTM E 329 to conduct testing indicated.

B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.

C. Pre-Installation Conference: Conduct pre-installation conference prior to commencing the installation, meet at the Project site to review the material selections, installation procedures, and coordination with other trades. Pre-installation conference shall include, but shall not be limited to, the Contractor, the Installer, and any trade that requires coordination with the work. Date and time of the pre-installation conference shall be acceptable to the Owner and the Architect.

D. Single Source Responsibility: Obtain each type of aluminum composite wall panel from a single source with resources to produce products of consistent quality in appearance and physical properties without delaying the work.

E. Coordination: Coordinate composite panel systems with rain drainage work, flashing, trim, and construction of walls and other adjoining work to provide a leakproof, secure, and non-corrosive installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and lot number, if any.

1. Deliver components, sheets, aluminum composite wall panels, and other manufactured items so as not to be damaged or deformed. Package aluminum composite wall panels for protection during transportation and handling.

B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Unload, store, and erect aluminum composite wall panels in a manner to prevent bending, warping, twisting, and surface damage.
2. Store aluminum composite wall panels vertically, covered with suitable weathertight and ventilated covering. Store aluminum composite wall panels to ensure dryness, with positive slope for drainage of water. Do not store aluminum composite wall panels in contact with other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed 120 °F (67 °C).
3. Retain strippable protective covering on aluminum composite wall panel for period of panel installation.

1.7 PROJECT CONDITIONS

- A. Environmental Requirements: Proceed with installation only when existing and forecasted weather conditions permit assembly of aluminum composite wall panels to be performed according to manufacturer's written instructions and warranty requirements.
- B. Measurements: Take field measurements OR Contractor shall guarantee shop drawing rough opening dimension prior to fabrication of the work and preparation of shop drawings, to ensure proper fitting of the work. Show recorded measurements on final shop drawings. Notify the Owner and the Architect, in writing, of any dimensions found which are not within specified dimensions and tolerances in the Contract Documents, prior to proceeding with the fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the work.
 1. Field fabrication is allowed to ensure proper fit but keep field fabrication to minimum with majority of fabrication being done under controlled shop conditions. Where final panel dimensions cannot be established by field measurement before commencement of panel manufacturing, make allowance for field adjustments and thermal movement as recommended by panel manufacturer.

1.8 WARRANTY

- A. Special Warranty: The Contractor shall warrant the work of this Section to be in accordance with the Contract Documents and free from faults and defects in materials and workmanship for a period indicated below. This special warranty shall extend the one year period of limitations contained in the General Conditions. The special warranty shall be countersigned by the manufacturer and the Installer.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 2. Warranty period shall be one year from date of Substantial Completion.
- B. Special Finish Warranty: Submit a written warranty, signed by manufacturer, covering failure of the factory-applied exterior finish within the specified warranty period and agreeing to repair finish or replace work that shows evidence of finish deterioration. Deterioration of finish includes, but shall not be limited to, color fade, chalking, cracking, peeling, and loss of film integrity.
 1. Warranty Period for FEVE Finish: Warranty period shall be 20 years from date of Substantial Completion.

PART TWO - PRODUCTS

2.1 MANUFACTURERS

A. Raw Composite Manufacturers:

1. “Reynobond Composite Material (ACM)” as manufactured by Alcoa Architectural Products, 50 Industrial Boulevard, Eastman, GA 31023; Phone: 800-841-7774 or 478-374-4746; Web Site: www.alcoaarchitecturalproducts.com.
2. “Alpolic Composite Metal Panels” as manufactured by Mitsubishi Plastics Composites America, Inc., 401 Volvo Parkway, Chesapeake, VA 23320; Phone: 800-422-7270; Fax: 757-436-1896; Web Site: www.alpolic-usa.com.
3. “Alucobond” as manufactured by Alcan Composites, P. O. Box 507, 208 W. 5th Street, Benton, KY 42025-0507; Phone: 800.382.6445 & 270.527.4200; Fax: 270.527.1552; Web site: www.alucobond.com
4. “Intrabond” as manufactured by Intrabond LLC, 1976 Joe Rogers Jr. Blvd., Manning, SC 29102; Phone: 803.505.6543; Fax: 803.505.6549; Web site: www.intrabondusa.com

B. Basis of Design: Carter Architectural Panels, Inc. “EVO” rivetless system.

2.2 COMPOSITE METAL PANELS

A. General: Provide factory-formed and factory-assembled, aluminum composite wall panels fabricated from two metal facings bonded, using no glues or adhesives, to solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment system components and accessories required for weathertight system.

1. Aluminum Face Sheets:
 - a. Thickness: 4mm.
 - b. Aluminum Alloy: 3000 Series or equivalent.
2. Fire Resistant (FR) Core: Flame spread rating of 15 and a smoke developed rating of 30 with a center panel joint; flame spread of 0 and a smoke developed of 0 with no joint; tested in accordance with ASTM E 84, Class A building material rating.
3. Panel Thickness: 0.118 inch.
4. Bond Integrity: When tested for bond integrity, in accordance with ASTM D 1781 (simulating resistance to panel delamination), there shall not be an adhesive failure of the bond between the core and the skin, or cohesive failure of the core itself below the following values:
 - a. Peel Strength:
 - 1) PE Core: 40.0 in.lb./inch (178 N·mm/mm) as manufactured, 40.0 in.lb./inch (178 N·mm/mm) after 21 days soaking in water at 70 °F (21 °C).
 - 2) FR Core: 22.5 in.lb./inch (115 N·mm/mm) as manufactured, 22.5 in.lb./inch (115 N·mm/mm) after 21 days soaking in water at 70 °F (21 °C)
5. Tolerances:
 - a. Width: ±0.08 inch.
 - b. Length: ±0.16 inch.
 - c. Panel Bow: Maximum 0.8 percent of any 72 inch panel dimension.

- d. Squareness: Maximum 0.20 inch
- e. Flatness: Maximum deviation from panel flatness shall be 1/8 inch in 5 feet on panel in any direction for assembled units (non-accumulative, no oil-canning).

2.3 FABRICATION

- A. General: Fabricate and finish aluminum composite wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
 - 1. Fabricate aluminum composite wall panels in a manner that shall eliminate condensation on interior side of panel and with joints between panels designed to form rain screen type seals.
- B. Aluminum Composite Wall Panels: Factory form panels in a continuous process with no glues or adhesives or batch process by laminating each sheet using glues or adhesives between dissimilar materials. Trim and square edges of sheets with no displacement of face sheets or protrusion of core material.
 - 1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
 - 2. Fabricate panels with sharply cut edges, with no displacement of face sheets or protrusion of core material.
 - 3. Fabricate panels with panel stiffeners, as required to comply with deflection limits, attached to back of panels with structural silicone sealant or bond tape.

2.5 FINISHES

- A. Comply with NAAMM MFM for architectural metal products for recommendations for applying and designating finishes.
 - 1. Aluminum Finishes: Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
 - a. Standard Two-Coat Polyvinylidene Fluoride (PVDF) Finish Coating: Manufacturer's standard thermocured system, complying with AAMA 2605, composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight, as produced by Arkema, Inc. ("Kynar 500") or by Solvay Solexis, Inc. ("Hylar 5000"). Provide minimum 1.2 mil total dry film thickness. Color(s) shall be selected by the Architect from five (5) custom colors as provided by the manufacturer.
 - b. Basis of Design: "Colorweld 500XL," Alcoa Architectural Products, 50 Industrial Boulevard, Eastman, GA 31023; Phone: 800-841-7774 or 478-374-4746; Web Site: www.alcoaarchitecturalproducts.com.

PART THREE - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Architect, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
 - 1. Examine substrates, areas, and conditions, with the Installer present, for compliance with requirements for installation tolerances, aluminum composite wall panel supports, and other conditions affecting performance of the work.
 - 2. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by aluminum composite wall panel manufacturer.
 - 3. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by aluminum composite wall panel manufacturer.
 - 4. Verify that weather-resistant sheathing paper has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
 - 5. Examine roughing-in for components and systems penetrating aluminum composite wall panels to verify actual locations of penetrations relative to seam locations of panels before panel installation.
 - 6. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

3.2 PREPARATION

- A. Coordination: Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to the Project Site.
- B. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and aluminum composite wall panel manufacturer's written instructions.

3.3 COMPOSITE WALL PANEL INSTALLATION

- A. General: Install aluminum composite wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on the Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor panels and other components of the work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving aluminum composite wall panels.
 - 2. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
 - 3. Anchor panels securely per engineering recommendations and in accordance with final shop drawings to allow for necessary thermal movement and structural support.

4. Where panels are designed for field-applied sealant joints, seal joints completely with specified sealant.
5. Conform to panel fabricator's instructions for installation of concealed fasteners.
6. Do not install component parts that are observed to be defective, including, but not limited to, warped, bowed, dented, scraped, and broken members.
7. Do not cut, trim, weld, or braze component parts during erection in manner which would damage finish, decrease strength, or result in visual imperfection or failure in performance. Return component parts, which require alteration to shop for re-fabrication, if possible, or for replacement with new parts.
8. At flashing butt joints, provide a lap strap under flashing and seal lapped surfaces with a full bed of non-hardening sealant.
9. Separate dissimilar metals and use gasketed fasteners, isolation shim, or isolation tape where needed to eliminate possibility of corrosive or electrolytic action between metals.

B. Erection Tolerances:

1. Maximum variation from plane or location shown on shop drawings shall be 1/2 inch in 30 feet of length and up to 3/4 inch in 300 feet.
2. Maximum deviation for vertical member shall be 0.10 inch in 25 feet run.
3. Maximum deviation for a horizontal member shall be 0.10 inch in 25 feet run.
4. Maximum offset from true alignment between two adjacent members abutting end to end, in line shall be 0.03 inch

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as aluminum composite wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of aluminum composite wall panel installation, clean finished surfaces as recommended by panel manufacturer. Maintain in a clean condition during construction. Masking intentionally left in place after panel installation on an elevation shall become the responsibility of the General Contractor.
- B. After aluminum composite wall panel installation, clear weepholes and drainage channels of obstructions, dirt, and sealant.
- C. Replace aluminum composite wall panels that have been damaged or have deteriorated beyond successful repair by finish touch-up or similar minor repair procedures.
- D. Any additional protection, after installation, shall be the responsibility of the general contractor to remove.
- E. Final cleaning shall not be part of the work of this Section.

3.5 PROTECTION

- A. Provide final protection and maintain conditions in a manner acceptable to the Installer, that shall ensure that the aluminum composite wall panels shall be without damage at time of Substantial Completion.

END OF SECTION

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)	4. Firestone PVC (60 mil)
2. Sika Sarnafil S327 (60 mil)	5. GAF EverGuard (60 mil)
3. Johns Manville JM PVC (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.

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.

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.

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

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.

1.1.2 Related work described elsewhere:

1. Single Ply (Mechanically Fastened) Roof System Section 07 50 00

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 conjunction 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.

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 be 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

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.

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.

- 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.

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

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.

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 SEMI-RIGID JOINT FILLER AT INTERIOR SEALED CONCRETE FLOORS

2.6.1 Spal-Pro RS 88, semi-rigid polyurea joint filler, used in sawcut contraction/control joints for polished concrete flooring. Refer to Section 03 35 43 – Polished Concrete Finishing.

2.7 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.

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.

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

METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Louvers installed in hollow metal doors.
4. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Division 01 Section "General Conditions".
2. Division 04 Section "Masonry".
3. Division 06 Section "Rough Carpentry".
4. Division 06 Section "Finish Carpentry".
5. Division 08 Section "Operations and Maintenance".
6. Division 08 Section "Flush Wood Doors".
7. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
8. Division 08 Section "Glazing".
9. Division 08 Section "Door Hardware".
10. Division 09 Sections "Painting".
11. Division 26 Section "Electrical"

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

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. SDI-113 Standard Practice for Determining the Steady-State Thermal Transmittance of Steel Door & Frame Assemblies.
10. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
11. ASTM C1199 - Standard Test Method for Measuring the Steady-State Thermal Transmittance of Fenestration Systems Using Hot Box Methods
12. ASTM E1423 - Practice for Determining Steady State Thermal Transmittance of Fenestration Systems.
13. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
14. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
15. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
16. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
17. FEMA P-361 2015/2021 - Design and Construction Guidance for Community Safe Rooms.
18. ICC 500 - 2014/2020 ICC/NSSA Standard for the Design and Construction of Storm Shelters.
19. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
20. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
21. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Maintenance manual must be provided for tornado/hurricane storm shelter impact protective systems.
- C. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- D. Shop Drawings: Include the following:
 1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of anchorages, joints, field splices, and connections.
 6. Details of accessories.
 7. Details of moldings, removable stops, and glazing.

8. Details of conduit and preparations for power, signal, and control systems.

E. Samples for Verification:

1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40" above sill) or UL 10C.
 1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 3. Smoke Control Door Assemblies: Comply with NFPA 105.
 - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
- E. 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.
- F. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
 - 1. CECO Door Products (C).
 - 2. Curries Company (CU).

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard polystyrene. Where indicated, provide doors fabricated as thermal-rated assemblies with a minimum R-value of 2.8 or better.
 - 3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
 - 4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, 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, 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" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 - 6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 - 3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.

4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Manufacturers Basis of Design:

1. Curries Company (CU) - Polystyrene Core - 707 Series.

2.4 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".

B. Manufacturers Basis of Design:

1. CECO Door Products (C) - StormPro Series.
2. Curries Company (CU) - StormPro Series.

2.5 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.

3. Manufacturers Basis of Design:
 - a. Curries Company (CU) - M Series.
- C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
 1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
 3. Manufacturers Basis of Design:
 - a. CECO Door Products (C) - BU DU Series.
 - b. CECO Door Products (C) - SU Series.
 - c. Curries Company (CU) - M Series.
- D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.6 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.

2.7 FRAME ANCHORS

- A. Jamb Anchors:
 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
 3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.
- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.8 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.
- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.9 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.10 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
 - 2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
 - 3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
 - 4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
9. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches on-center and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".

11. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.
- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.11 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

- B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.
- E. Verify tolerances against manufacturers installations instructions for tornado and hurricane storm shelter openings.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
 - 1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 - 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

3.5 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

END OF SECTION

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.

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 mineral 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.

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

OVERHEAD ROLLING
COUNTER DOOR

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide rolling counter door, 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 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 precise dimensions of the work of this Section, and all other data needed to ensure proper and adequate provision to accommodate the 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.

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.

PART TWO - PRODUCTS

2.1 ROLLING COUNTER DOOR

Furnish and install interior face of wall mounted manual push up Model 650 as manufactured by Overhead Door Corporation, Dallas, Texas or Architect approved equal.

2.1.1 General:

1. Curtain: Interlocking curtain, slats type F-128 fabricated of galvanized steel. Endlocks shall be attached to alternate slats to maintain curtain alignment and prevent lateral slat movement.
2. Finish: Slats and hood shall receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and powder coated top coat in color as selected by Architect from manufacturer's full range of RAL colors..
3. Guides: 6063-T6 extruded aluminum shapes with retainer grooves for silicone, woolpile strips.
4. Counterbalance: Helical torsion springtype housed in a steel tube or pipe barrel..
5. Hood: Galvanized primed steel.
6. Locking: Provide recessed slide bolts, one on each jamb, with cylinder locks.

2.2 OTHER MATERIALS

All other materials, including but not necessarily limited to anchorage devices for the work of this Section, shall be only as recommended by the manufacturer and as approved by 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 proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 COORDINATION

Use all means necessary to coordinate with other trades and to ensure that proper and adequate provision is made in the work of other Sections to accommodate installation of the work of this Section.

3.3 INSTALLATION

Install the work of this Section in strict accordance with the recommendations of the manufacturers as approved by the Architect, anchoring all components firmly into position for long life under hard use.

END OF SECTION

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.

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.

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

ALUMINUM SLIDING WINDOW

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide aluminum, interior sliding service window, 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. Section 07 92 00 – Joint Sealants
2. Section 08 80 00 - Glazing

1.2 QUALITY ASSURANCE

1.2.1 Reference standards:

1. Architectural Aluminum Manufacturers Association (AAMA).

1.2.2 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.

1.2.3 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.

PART TWO - PRODUCTS

2.1 SLIDING WINDOWS

2.1.1 Frameless pass-thru window as manufactured by C.R. Laurence Architectural Products or Architect approved equal.

2.1.2 “Sharyn”:

- a. “Frameless” appearance
- b. “No-Hole” top hung clamp-on roller assemblies to allow height adjustability.
- c. Double track header with side walls to hide roller assemblies.
- d. Glazing: ¼” tempered glass.
- e. Lockable.

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

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical door hardware.
 - 3. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 01 Section "General Conditions".
 - 2. Division 06 Section "Rough Carpentry".
 - 3. Division 06 Section "Finish Carpentry".
 - 4. Division 08 Section "Operations and Maintenance".
 - 5. Division 08 Section "Hollow Metal Doors and Frames".
 - 6. Division 08 Section "Flush Wood Doors".
 - 7. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
 - 8. Division 26 Section "Electrical"
- D. Codes and References: Comply with the version adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. FEMA P-361 2015/2021 - Design and Construction Guidance for Community Safe Rooms.
 - 3. ICC 500-2014/2020, ICC/NSSA Standard for the Design and Construction of Storm Shelters.
 - 4. ICC/IBC - International Building Code.
 - 5. NFPA 70 - National Electrical Code.
 - 6. NFPA 80 - Fire Doors and Windows.
 - 7. NFPA 101 - Life Safety Code.
 - 8. NFPA 105 - Installation of Smoke Door Assemblies.
 - 9. State Building Codes, Local Amendments.

- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

- C. Shop Drawings: Details of electrified access control hardware indicating the following:
1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.
 2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Proof of Qualification: Provide copy of manufacturer(s) Factory Trained Installer documentation indicating proof of status as a qualified installer of tornado or hurricane storm shelter assemblies.
- E. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- F. Informational Submittals:
1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

- A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.
- B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.5 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Storm Shelter Impact Protective Assembly Installer Qualifications: Installers are to be factory trained for shop and field installation prior to project bid, and are responsible for commissioning, servicing, and warranting the installed equipment specified for the project. A pre-installation site inspection of the frame and floor conditions shall be conducted by the factory trained installer prior to any Storm Shelter Impact Protective assembly hardware applied to the opening.
- F. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- G. Storm Shelter Openings: Provide complete door systems for hurricane or tornado resistant 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.
- H. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
- I. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.

- J. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 - 3. Review sequence of operation narratives for each unique access controlled opening.
 - 4. Review and finalize construction schedule and verify availability of materials.
 - 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- K. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.7 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Storm Shelter Openings: Furnish a complete set of operational and maintenance instructions as needed for Owner's continued adjustment, maintenance, and repairs of door hardware as required by ICC 500 (2020), ICC/NSSA Standard for the Design and Construction of Storm Shelters.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Hardware shall not have any visible manufacturer names on exposed materials, except cylinders, when the door is in a closed position.

2.2 BUTT HINGES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
 - 1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.
 5. Manufacturers:
 - a. Hager Companies (HA) - BB Series, 5-knuckle.
 - b. McKinney (MK) - TA/T4A Series, 5-knuckle.
 - c. dormakaba BEST (ST) - F/FBB Series, 5-knuckle.
- B. Hinges at Storm Shelter Assemblies: At a minimum, provide heavy weight hinges with stainless steel screws used in accordance with and specified as part of a Severe Storm Shelter Opening meeting ICC 500 and FEMA 361.
1. Quantity: Provide the following hinge quantity:
 - a. Three Hinges: For shutters with heights 36 to 60 inches, and doors at height of 80 inches.
 - b. Four Hinges: For shutters with heights > 60 inches to 80 inches, and doors with heights greater than 84 inches.
 2. Quantity: Provide the following hinge quantity:
 - a. Three Hinges: For shutters with heights 36 to 60 inches, and doors at height of 80 inches.
 - b. Four Hinges: For shutters with heights > 60 inches to 80 inches, and doors with heights greater than 84 inches.
 - c. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - d. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - e. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 3. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.

- b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
- 4. Hinge Weight and Base Material: At a minimum, provide heavy weight hinges with stainless steel screws used in accordance with and specified as part of a certified Storm Shelter Opening meeting ICC 500.
- 5. Manufacturers:
 - a. McKinney (MK) - SP3386/SP3786.
 - b. No Substitution.

2.3 CONTINUOUS HINGES

- A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
 - 1. Manufacturers:.
 - a. Hager Companies (HA).
 - b. Pemko (PE).
 - c. dormakaba BEST (ST).

2.4 POWER TRANSFER DEVICES

- A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets with a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
 - 1. Manufacturers:
 - a. McKinney (MK) - QC (# wires) Option.
- B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.
 - 1. Provide one each of the following tools as part of the base bid contract:
 - a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
 - b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

- a. McKinney (MK) - QC-C Series.

C. Storm Shelter Compliance: Power transfer devices to be U.L. listed for windstorm components.

2.5 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
5. Manufacturers:

- a. Rockwood (RO).

B. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Pulls shall be provided with a 10" clearance from the finished floor on the push side to accommodate wheelchair accessibility.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
6. Manufacturers:

- a. Rockwood (RO).

2.6 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

1. Manufacturers:

- a. Schlage (SC) - "E Keyway".

- b. No Substitution – Facility Standards.
- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
 - 1. Threaded mortise cylinders with rings and cams to suit hardware application.
 - 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 - 4. Tubular deadlocks and other auxiliary locks.
 - 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 - 6. Keyway: Match Facility Standard.
- C. Keying System: Each type of lock and cylinders to be factory keyed.
 - 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
 - 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 - 3. Existing System: Field verify and key cylinders to match Owner's existing system.
- D. Key Quantity: Provide the following minimum number of keys:
 - 1. Change Keys per Cylinder: Two (2)
 - 2. Master Keys (per Master Key Level/Group): Five (5).
 - 3. Construction Keys (where required): Ten (10).
- E. Construction Keying: Provide construction master keyed cylinders.
- F. Key Registration List (Bitting List):
 - 1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 - 2. Provide transcript list in writing or electronic file as directed by the Owner.

2.7 KEY CONTROL

- A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
 - 1. Manufacturers:
 - a. Lund Equipment (LU).
 - b. MMF Industries (MM).
 - c. Telkee (TK).

2.8 CYLINDRICAL LOCKS AND LATCHING DEVICES

- A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed cylindrical locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide locksets with functions and features as follows:
 - a. Meets ANSI/BHMA A156.41 for single motion egress.
 - b. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
 - c. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
 - d. Exceeds ANSI/BHMA A156.2 requirements by 2.6 times for 3,100 in-lb. abusive locked lever torque with no entry while maintaining egress.
 - e. Exceeds ANSI/BHMA A156.2 requirements by 8 times for 1,600 lbs. offset lever pull with no entry for protection against attacks.
 - f. Exceeds ANSI/BHMA A156.3 requirements by 2 times for latch retraction with 100 lb. preload while maintaining operation in warped doors.
 - g. Exceeds ANSI/BHMA A156.3 requirements by 20 times for no access with minimum 100 vertical impacts for protection against vandalism attempts.
 - h. Independent return springs allow lock to exceed ANSI/BHMA A156.2 Grade 1 cycle requirements without lever sag.
 - i. Status indicators inside, outside, or on both sides of doors as specified with high visibility red/green or red/white icons to display locked or unlocked state in the rose.
 - j. Ten-year limited warranty for mechanical functions.
2. Electromechanical locksets shall have the following functions and features:
 - a. Universal Molex plug-in connectors that have standardized color-coded wiring and are field configurable in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
 - b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
 - c. Options to be available for request-to-exit or enter signaling.
 - d. Two-year limited warranty on electrified functions.
3. Manufacturers:
 - a. Sargent Manufacturing (SA) - 10X Line.
 - b. Schlage (SC) - ND Series.

2.9 DEADLOCKS AND LATCHES

- A. Cylindrical Deadlocks: ANSI/BHMA A156.36 Grade 1 Certified Products Directory (CPD) listed deadlocks to fit standard ANSI 161 preparation. Provide tapered collars to resist vandalism and 1" throw solid steel bolt with hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other locksets.

1. Manufacturers:
 - a. Sargent Manufacturing (SA) - 480 Series.
 - b. Schlage (SC) - B600 Series.

- B. Narrow Case Deadlocks and Deadlatches: ANSI/BHMA 156.13 Series 1000 Grade 1 narrow case deadlocks and deadlatches for swinging or sliding door applications. All functions shall be manufactured in a single sized case formed from 12 gauge minimum, corrosion resistant steel (option for fully stainless steel case and components). Provide minimum 2 7/8" throw laminated stainless steel bolt. Bottom rail deadlocks to have 3/8" diameter bolts.

1. Manufacturers:
 - a. Adams Rite Manufacturing (AD) - MS1850S / MS1950 Series.

2.10 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 2. Strikes for Bored Locks and Latches: BHMA A156.2.
 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
 4. Dustproof Strikes: BHMA A156.16.

2.11 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
 1. Exit devices shall have a five-year warranty.
 2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.

4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.
1. Electromechanical exit devices shall have the following functions and features:
 - a. Universal Molex plug-in connectors that have standardized color-coded wiring and are field configurable in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
 - b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
 - c. Options to be available for request-to-exit or enter signaling, latchbolt and touchbar monitoring.
 - d. Field configurable electrified trim to fail-safe or fail-secure that operates from 12-24VDC.
 - e. Five-year limited warranty for electromechanical features.
 2. Manufacturers:
 - a. Sargent Manufacturing (SA) - 80 Series.
 - b. Von Duprin (VD) - 35A/98 XP Series.
- C. Multi-Point Exit Devices (Storm Shelter Openings): Multi-point exit devices specifically engineered for out-swinging door applications on tornado or hurricane resistant storm shelter openings. Extra heavy duty steel component construction with each of the latching points automatically activated when the device is locked. The multi-point exit device is approved for usage as part of a complete ICC 500 (2014/2020) and FEMA P-361 (2015/2021) door, frame and hardware assembly.

1. Manufacturers:
 - a. Sargent Manufacturing (SA) - FM8700 Series.

2.12 SURFACE DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
7. Storm Shelter Compliance: Door closers to be U.L. listed for windstorm assemblies where applicable. Provide the appropriate storm shelter products that have been independently third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.

B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.

1. Large body cast iron surface mounted door closers shall have a 30-year warranty.
2. Manufacturers:
 - a. LCN Closers (LC) - 4040XP Series.
 - b. Norton Rixson (NO) - 9500 Series.
 - c. Sargent Manufacturing (SA) - 281 Series.

C. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.

1. Manufacturers:
 - a. LCN Closers (LC) - 1450 Series.
 - b. Norton Rixson (NO) - 8500 Series.
 - c. Sargent Manufacturing (SA) - 1431 Series.

2.13 ARCHITECTURAL TRIM AND ACCESSORIES

- A. Door, Frame and Wall Protective Trim: ANSI/BHMA A156.6, protective products as specified in the hardware sets. Door protection plates shall be not more than 2" less than door width on stop side and 1" less door width on the pull side or on stop side of pairs of doors. Listed manufacturers shall meet all functions and features as specified herein.
 1. Provide protective trim with functions and features as follows:
 - a. Meets ADA requirements for smooth bottom door surfaces.
 - b. UL Classified options for use on fire-rated doors up to 3 hours.
 - c. Fabricated from stainless steel, brass, bronze, aluminum, or high-impact plastic.
 - d. Available in a variety of sizes, finishes, and profiles to suit aesthetic and functional requirements.
 - e. Designed to protect doors, frames, and adjacent walls from damage due to impact, abrasion, or traffic.
 - f. Fasteners included; adhesive-backed options available for select models.
 - g. Ten-year limited warranty.
 2. Manufacturers:
 - a. Ives (IV).
 - b. Rockwood (RO).

2.14 DOOR STOPS AND HOLDERS

- A. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 1. Manufacturers:
 - a. Rockwood (RO).
- B. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:
 - a. Norton Rixson (NO).
 - b. Sargent Manufacturing (SA).

2.15 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 1. Pemko (PE).

2.16 ELECTRONIC ACCESSORIES

- A. Request to Exit Motion Sensor: Passive infrared request to exit (REX) motion sensor designed for detecting exiting through a door from the secure area to a non-secure area.
 1. Provide devices with functions and features as follows:
 - a. Adjustable infrared beam and relock time.
 - b. UL listed.
 - c. 12VDC or 24VDC power.
 - d. Single pole, double throw (SPDT) switch.

2. Manufacturers:

a. Securitron (SU) - XMS2 Series.

- B. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

a. Securitron (SU) - DPS Series.

2.17 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.18 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
- E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

- B. Maintenance manual must be provided for tornado/hurricane storm shelter impact protective systems.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
 - 1. Quantities listed are for each pair of doors, or for each single door.
 - 2. The supplier is responsible for handing and sizing all products.
 - 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
 - 4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. RO - Rockwood
4. SA - SARGENT
5. AD - Adams Rite
6. SC - Schlage
7. NO - Norton Rixson
8. OT - Other
9. SU - Securitron

Hardware Sets

Set: 1.0

Doors: 301.1, 301.2

1 Hinge, Full Mortise, Hvy Wt	T4A3386 QC NRP-HVY 4-1/2" x 4-1/2"	US32D	MK
2 Hinge, Full Mortise, Hvy Wt	T4A3386 NRP-HVY 4-1/2" x 4-1/2"	US32D	MK
1 Rim Exit Device, Storeroom	SE 55 56 8804 x LESS PULL	US32D	SA
1 Offset Door Pull	RM201 Mtg-Type 1XHD	US32D	RO
1 Parallel Heavy Duty w/ Stop Arm Surface Closer	TB 281 CPS	EN	SA
1 Sargent Spacer Block Kit	581-2 (AS REQUIRED)	EN	SA
1 Sargent Drop Plate	281D (AS REQUIRED)	EN	SA
1 Sweep	3452ANB		PE
1 Threshold	253x3AFG		PE
1 ElectroLynx Harness	QC-C1500P (Frame - EPT to Power/Controller)		MK
1 Card Reader	BY SECURITY CONTRACTOR		OT
1 ElectroLynx Harness	QC-CxxxP (Door - EPT to Elec. Exit Device)		MK
1 Position Switch	DPS-M / W		SU
1 Power Supply	BY SECURITY CONTRACTOR		OT
1 Gasketing	PROVIDED BY ALUMINUM DOOR MANUFACTURER		OT
1 Wiring Diagram	ELEVATION AND POINT TO POINT AS SPECIFIED		OT

Notes: Door normally closed, latched and secured.
 Entry by valid card read or key override.
 Entry by pull when when exit device is electrically dogged open by access control system.
 Free egress at all times.

Set: 2.0

Doors: 101.1, 101.2, 101.3, 201.1, 302.3, 401.1, 401.2

2 Hinge, Full Mortise, Hvy Wt	T4A3386 QC NRP-HVY 4-1/2" x 4-1/2"	US32D	MK
4 Hinge, Full Mortise, Hvy Wt	T4A3386 NRP-HVY 4-1/2" x 4-1/2"	US32D	MK
1 Keyed Removable Mullion	L980	PC	SA
1 Rim Exit Device, Storeroom	SE 55 56 8804 LESS PULL	US32D	SA
1 Rim Exit Device, Exit Only	55 56 8810 EO	US32D	SA
1 Mullion Cylinder Kit	SE 980C1	US26D	SA
2 Offset Door Pull	RM201 Mtg-Type 1XHD	US32D	RO
2 Parallel Heavy Duty w/ Stop Arm Surface Closer	TB 281 CPS	EN	SA
2 Sargent Spacer Block Kit	581-2 (AS REQUIRED)	EN	SA
2 Sargent Drop Plate	281D (AS REQUIRED)	EN	SA
2 Sweep	3452ANB		PE
1 Threshold	253x3AFG		PE
2 ElectroLynx Harness	QC-C1500P (Frame - EPT to Power/Controller)		MK
1 Card Reader	BY SECURITY CONTRACTOR		OT
2 ElectroLynx Harness	QC-CxxxP (Door - EPT to Elec. Exit Device)		MK
2 Position Switch	DPS-M / W		SU
1 Power Supply	BY SECURITY CONTRACTOR		OT
1 Gasketing	PROVIDED BY ALUMINUM DOOR MANUFACTURER		OT
1 Wiring Diagram	ELEVATION AND POINT TO POINT AS SPECIFIED		OT

Notes: Doors normally closed, latched and secured.
 Entry by valid card read or key override on active leaf.
 Entry by pulls when exit devices are electrically dogged open by access control system.
 Free egress at all times.

Set: 3.0

Doors: 102.1

1 Hinge, Hvy Wt	SP3386 QC12 NRP-HVY 5" x 4-1/2"	US32D	MK
7 Hinge, Hvy Wt	SP3386 NRP-HVY 5" x 4-1/2"	US32D	MK
1 Fail Secure Exit Device	FM8774 ETL	US32D	SA
1 Multipoint Exit Device	SE FM8706 ETL	US32D	SA
2 Parallel Heavy Duty w/ Stop Arm Surface Closer	TB 281 CPS	EN	SA
2 Latch Cover Kick Plate	BFLG1050 10" X 2" LDW	US32D	RO
2 Door Stop	462	US2C	RO
2 Astragal	305CN		PE
1 Gasketing	S773BL (Head & Jamb)		PE
2 Sweep	345ANB		PE
1 Threshold	1715A x OPENING WIDTH		PE
1 ElectroLynx Harness	QC-C1500P (Frame - EPT to Power/Controller)		MK
1 Card Reader	BY SECURITY CONTRACTOR		OT
1 ElectroLynx Harness	QC-CxxxP (Door - EPT to Elec. Exit Device)		MK
1 Motion Sensor	XMS2		SU
2 Position Switch	DPS-M / W		SU
1 Power Supply	BY SECURITY CONTRACTOR		OT
1 Wiring Diagram	ELEVATION AND POINT TO POINT AS SPECIFIED		OT

Notes: Doors normally closed, latched and secured.

Entry by valid card read on active leaf or by key override on inactive leaf.

Free egress at all times.

Cutout threshold so bottom strike can be mounted to concrete floor and not on the threshold.

(REX is not available at this time.)

Doors will have a 5/8" undercut.

Set: 4.0

Doors: 116.1

2 Hinge, Full Mortise, Hvy Wt	T4A3386 NRP-HVY 5" x 4-1/2"	US32D	MK
1 Hinge, Full Mortise, Hvy Wt	T4A3386 QC NRP-HVY 5" x 4-1/2"	US32D	MK
1 Fail Secure Lock	RX 10XG71 LL SE	US26D	SA
1 Keyed Both Sides Deadbolt	SE 484	US26D	SA
1 Parallel Heavy Duty w/ Stop Arm Surface Closer	TB 281 CPS	EN	SA
1 Kick Plate	K1050 10" X 2" LDW CSK BEV	US32D	RO
1 Gasketing	2891APK		PE
1 Sweep	3452ANB		PE
1 Threshold	253x3AFG		PE
1 Card Reader	BY SECURITY CONTRACTOR		OT
1 ElectroLynx Harness	QC-CxxxP (Door - EPT to Elec. Exit Device)		MK
1 ElectroLynx Harness	QC-CxxxP (Door - EPT to Elec. Lock)		MK
1 Position Switch	DPS-M / W		SU
1 Power Supply	BY SECURITY CONTRACTOR		OT
1 Wiring Diagram	ELEVATION AND POINT TO POINT AS SPECIFIED		OT
1 Viewer With Cover	627	CRM	RO

Notes: Door normally closed, latched and secured.

Entry by valid card read or key override.

Deadbolt must be retracted for card reader to allow entry.

Free egress at all times.

Install gasketing prior to soffit mounted hardware. Do not notch gasketing for soffit mounted hardware.

Set: 5.0

Doors: 302.1, 302.2

1 Hinge, Full Mortise, Hvy Wt	T4A3386 QC NRP-HVY 4-1/2" x 4-1/2"	US32D	MK
2 Hinge, Full Mortise, Hvy Wt	T4A3386 NRP-HVY 4-1/2" x 4-1/2"	US32D	MK
1 Rim Exit Device, Storeroom	SE 55 56 8804 x LESS PULL	US32D	SA
1 Offset Door Pull	RM201 Mtg-Type 1XHD	US32D	RO
1 Parallel Heavy Duty w/ Stop Arm Surface Closer	TB 281 CPS	EN	SA
1 Sargent Spacer Block Kit	581-2 (AS REQUIRED)	EN	SA
1 Sargent Drop Plate	281D (AS REQUIRED)	EN	SA
1 ElectroLynx Harness	QC-C1500P (Frame - EPT to Power/Controller)		MK
1 Card Reader	BY SECURITY CONTRACTOR		OT
1 ElectroLynx Harness	QC-CxxxP (Door - EPT to Elec. Exit Device)		MK
1 Position Switch	DPS-M / W		SU
1 Power Supply	BY SECURITY CONTRACTOR		OT
1 Gasketing	PROVIDED BY ALUMINUM DOOR MANUFACTURER		OT
1 Wiring Diagram	ELEVATION AND POINT TO POINT AS SPECIFIED		OT

Notes: Door normally closed, latched and secured.

Entry by valid card read or key override.

Entry by pull when exit device is electrically dogged open by access control system.

Free egress at all times.

Set: 6.0

Doors: 112.1, 112.2

6 Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
2 Concealed Vert Rod Exit, Classroom	SE AD8613 ETL	US32D	SA
2 Parallel Surface Closer w/ Stop Arm & Hold Open	TB 1431 CPSH	EN	SA
2 Sargent Spacer Block Kit	581-2 (AS REQUIRED)	EN	SA
2 Sargent Drop Plate	1431D (AS REQUIRED)	EN	SA
1 Gasketing	PROVIDED BY ALUMINUM DOOR MANUFACTURER		OT

Set: 7.0

Doors: [102.2](#)

8 Hinge, Hvy Wt	SP3786 5" x 4-1/2"	US26D	MK
2 Multipoint Exit Device	12 SE FM8713 ETL	US32D	SA
2 Parallel Heavy Duty w/ Stop Arm Surface Closer	TB 281 CPS	EN	SA
2 Latch Cover Kick Plate	BFLG1050 10" X 2" LDW	US32D	RO
2 Astragal	18041CNB		PE
1 Gasketing	S773BL (Head & Jamb)		PE
1 Threshold	1715A x OPENING WIDTH		PE

Notes: Notes: Cutout threshold so bottom strike can be mounted to concrete floor and not on the threshold. Doors will have a 5/8" undercut.

Set: 8.0

Doors: [318.2](#), [428.1](#)

2 Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Hinge, Full Mortise, Hvy Wt	T4A3786-MCK QCxx 4-1/2" x 4-1/2"	US26D	MK
1 Fail Secure Lock	RX 10XG71 LL SE	US26D	SA
1 Standard Surface Closer	TB 1431 O	EN	SA
1 Kick Plate	K1050 10" X 2" LDW CSK BEV	US32D	RO
1 Wall Stop	409	US32D	RO
3 Silencer	608/609 RKW		RO
1 ElectroLynx Harness	QC-C1500P (Frame - EPT to Power/Controller)		MK
1 Card Reader	BY SECURITY CONTRACTOR		OT
1 ElectroLynx Harness	QC-CxxxP (Door - EPT to Elec. Lock)		MK
1 Position Switch	DPS-M / W		SU
1 Power Supply	BY SECURITY CONTRACTOR		OT
1 Wiring Diagram	ELEVATION AND POINT TO POINT AS SPECIFIED		OT

Notes: Door normally closed, latched and secured.
Entry by valid card read or key override.
Free egress at all times.

Card reader for door 318.2 to be mounted inside of conference room.

Set: 9.0

Doors: [108.1](#), [311.1](#)

2 Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Hinge, Full Mortise, Hvy Wt	T4A3786-MCK QCxx 4-1/2" x 4-1/2"	US26D	MK
1 Fail Secure Lock	RX 10XG71 LL SE	US26D	SA
1 Parallel Heavy Duty Surface Closer w/ Stop Arm	TB 1431 CPS	EN	SA
1 Kick Plate	K1050 10" X 2" LDW CSK BEV	US32D	RO
3 Silencer	608/609 RKW		RO
1 ElectroLynx Harness	QC-C1500P (Frame - EPT to Power/Controller)		MK
1 Card Reader	BY SECURITY CONTRACTOR		OT
1 ElectroLynx Harness	QC-CxxxP (Door - EPT to Elec. Lock)		MK
1 Position Switch	DPS-M / W		SU
1 Power Supply	BY SECURITY CONTRACTOR		OT
1 Wiring Diagram	ELEVATION AND POINT TO POINT AS SPECIFIED		OT

Notes: Door normally closed, latched and secured.
Entry by valid card read or key override.
Free egress at all times.

Set: 10.0

Doors: [227.1](#), [303.1](#), [318.1](#)

2 Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Hinge, Full Mortise, Hvy Wt	T4A3786-MCK QCxx 4-1/2" x 4-1/2"	US26D	MK
1 Fail Secure Lock	RX 10XG71 LL SE	US26D	SA
1 Surface Overhead Holder/Stop	9-X36	689	NO
1 Standard Surface Closer	TB 1431 O	EN	SA
1 Kick Plate	K1050 10" X 2" LDW CSK BEV	US32D	RO
3 Silencer	608/609 RKW		RO
1 ElectroLynx Harness	QC-C1500P (Frame - EPT to Power/Controller)		MK
1 Card Reader	BY SECURITY CONTRACTOR		OT
1 ElectroLynx Harness	QC-CxxxP (Door - EPT to Elec. Lock)		MK
1 Position Switch	DPS-M / W		SU
1 Power Supply	BY SECURITY CONTRACTOR		OT
1 Wiring Diagram	ELEVATION AND POINT TO POINT AS SPECIFIED		OT

Notes: Door normally closed, latched and secured.
 Entry by valid card read or key override.
 Free egress at all times.

Set: 11.0

Doors: [321.1](#)

3 Hinge, Full Mortise	TA2714-MCK 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom/Closet Lock	10XG04 LL SE	US26D	SA
1 Wall Stop	409	US32D	RO
3 Silencer	608/609 RKW		RO

Set: 12.0

Doors: [107.1](#), [109.1](#), [123.1](#), [203.2](#), [313.1](#), [427.1](#), [429.1](#)

3 Hinge, Full Mortise	TA2714-MCK 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom/Closet Lock	10XG04 LL SE	US26D	SA
1 Surface Overhead Holder/Stop	9-X36	689	NO
3 Silencer	608/609 RKW		RO

Set: 13.0

Doors: [307.1](#)

3 Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom/Closet Lock	10XG04 LL SE	US26D	SA
1 Standard Surface Closer	TB 1431 O	EN	SA
1 Kick Plate	K1050 10" X 2" LDW CSK BEV	US32D	RO
1 Wall Stop	409	US32D	RO
3 Silencer	608/609 RKW		RO

Set: 14.0

Doors: [228.1](#), [229.1](#)

3 Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom/Closet Lock	10XG04 LL SE	US26D	SA
1 Parallel Heavy Duty Surface Closer w/ Stop Arm	TB 1431 CPS	EN	SA
1 Kick Plate	K1050 10" X 2" LDW CSK BEV	US32D	RO
3 Silencer	608/609 RKW		RO

Set: 15.0

Doors: [207.1](#)

3 Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom/Closet Lock	10XG04 LL SE	US26D	SA
1 Surface Overhead Holder/Stop	9-X36	689	NO
1 Standard Surface Closer	TB 1431 O	EN	SA
1 Kick Plate	K1050 10" X 2" LDW CSK BEV	US32D	RO
3 Silencer	608/609 RKW		RO

Set: 16.0

Doors: [114.1](#), [317.1](#)

6 Hinge, Full Mortise	TA2714-MCK 4-1/2" x 4-1/2"	US26D	MK
1 Dust Proof Strike	570	US26D	RO
2 Manual Flush Bolt W/M	557/555- 12"/72" A.F.F.	US26D	RO
1 Storeroom/Closet Lock	10XG04 LL SE	US26D	SA
2 Surface Overhead Holder/Stop	9-X36	689	NO
2 Kick Down Door Stop	461	US26D	RO
2 Silencer	608/609 RKW		RO

Set: 17.0

Doors: [122.1](#), [309.1](#), [310.1](#), [315.1](#), [316.1](#), [320.2](#)

3 Hinge, Full Mortise	TA2714-MCK 4-1/2" x 4-1/2"	US26D	MK
1 Entry/Office Lock	10XG05 LL SE	US26D	SA
1 Wall Stop	409	US32D	RO
3 Silencer	608/609 RKW		RO

Notes:

Set: 18.0

Doors: [117.1](#), [204.1](#), [232.1](#), [233.1](#), [234.1](#), [305.1](#), [308.1](#)

3 Hinge, Full Mortise	TA2714-MCK 4-1/2" x 4-1/2"	US26D	MK
1 Entry/Office Lock	10XG05 LL SE	US26D	SA
1 Surface Overhead Holder/Stop	9-X36	689	NO
3 Silencer	608/609 RKW		RO

Set: 19.0

Doors: [304.1](#)

3 Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Entry/Office Lock	10XG05 LL SE	US26D	SA
1 Parallel Heavy Duty Surface Closer w/ Stop Arm	TB 1431 CPS	EN	SA
1 Kick Plate	K1050 10" X 2" LDW CSK BEV	US32D	RO
3 Silencer	608/609 RKW		RO

Notes:

Set: 20.0

Doors: [205.1](#), [421.1](#)

3 Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Entry/Office Lock	10XG05 LL SE	US26D	SA
1 Surface Overhead Holder/Stop	9-X36	689	NO
1 Standard Surface Closer	TB 1431 O	EN	SA
1 Kick Plate	K1050 10" X 2" LDW CSK BEV	US32D	RO
3 Silencer	608/609 RKW		RO

Notes:

Set: 21.0

Doors: 208.1, 210.1, 212.1, 214.1, 217.1, 219.1, 221.1, 223.1, 225.1, 230.1, [320.1](#), 404.1, 408.1, 410.1, 412.1, 414.1, 416.1, 418.1, 423.1, 425.1, 430.1, 432.1, 434.1, 436.1, 438.1, 440.1

3 Hinge, Full Mortise	TA2714-MCK 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lock	10XG37 LL SE	US26D	SA
1 Wall Stop	409	US32D	RO
3 Silencer	608/609 RKW		RO

Notes:

Set: 22.0

Doors: 122.1B, 203.1, 231.1, 402.1, 403.1, 406.1, 407.1

3 Hinge, Full Mortise	TA2714-MCK 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lock	10XG37 LL SE	US26D	SA
1 Surface Overhead Holder/Stop	9-X36	689	NO
3 Silencer	608/609 RKW		RO

Notes:

Set: 23.0

Doors: 209.1, 211.1, 213.1, 215.1, 218.1, 220.1, 222.1, 224.1, 226.1, 306.1, 435.1, 437.1, 439.1, 441.1

3 Hinge, Full Mortise	TA2714-MCK 4-1/2" x 4-1/2"	US26D	MK
1 Privacy Lock w/ Indicator	V33 10XU65 VSLL	US26D	SA
1 Wall Stop	409	US32D	RO
1 Gasketing	S88BL		PE

Set: 24.0

Doors: 110.2

1 Continuous Hinge	CFMxxxHD1		PE
1 Privacy Lock w/ Indicator	V33 10XU65 VSLL	US26D	SA
1 Wall Stop	409	US32D	RO
3 Silencer	608/609 RKW		RO

Set: 25.0

Doors: 103.1, 104.1, 105.1, 106.1, 118.1, 206.1, 216.1, 314.1, 405.1, 409.1, 411.1, 413.1, 415.1, 416.1B, 419.1, 420.1, 422.1, 424.1, 426.1, 431.1, 433.1

3 Hinge, Full Mortise	TA2714-MCK 4-1/2" x 4-1/2"	US26D	MK
1 Privacy Lock w/ Indicator	V33 10XU65 VSLL	US26D	SA
1 Surface Overhead Holder/Stop	9-X36	689	NO
1 Gasketing	S88BL		PE

Set: 26.0

Doors: 110.1, 111.1

1 Continuous Hinge	CFMxxxHD1		PE
1 Privacy Lock w/ Indicator	V33 10XU65 VSL	US26D	SA
1 Surface Overhead Holder/Stop	9-X36	689	NO
3 Silencer	608/609 RKW		RO

Set: 27.0

Doors: 121.1

3 Hinge, Full Mortise	TA2714-MCK 4-1/2" x 4-1/2"	US26D	MK
1 Passage Latch	10XU15 LL	US26D	SA
1 Wall Stop	409	US32D	RO
3 Silencer	608/609 RKW		RO

Notes:

Set: 28.0

Doors: 312.1

3 Hinge, Full Mortise	TA2714-MCK 4-1/2" x 4-1/2"	US26D	MK
1 Passage Latch	10XU15 LL	US26D	SA
1 Surface Overhead Holder/Stop	9-X36	689	NO
3 Silencer	608/609 RKW		RO

Notes:

Set: 29.0

Doors: 307.1B

3 Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Mortise Deadlock	MS1850S	628	AD
1 Schlage E Keyway Cylinder	X TYPE REQUIRED	.626	SC
1 Thumbturn Cylinder	4066	130	AD
1 Push Pull Bar	RM251	US32D	RO
1 Sargent Spacer Block Kit	581-2 (AS REQUIRED)	EN	SA
1 Parallel Heavy Duty Surface Closer w/ Stop Arm	TB 1431 CPS	EN	SA
1 Sargent Drop Plate	1431D (AS REQUIRED)	EN	SA
1 Gasketing	PROVIDED BY ALUMINUM DOOR MANUFACTURER		OT

Set: 30.0

Doors: 319.1

6 Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Dust Proof Strike	570	US26D	RO
2 Manual Flush Bolt W/M	557/555- 12"/72" A.F.F.	US26D	RO
1 Mortise Deadlock	MS1850S	628	AD
2 Schlage E Keyway Cylinder	X TYPE REQUIRED	.626	SC
2 Push Pull Bar	RM251	US32D	RO
2 Sargent Spacer Block Kit	581-2 (AS REQUIRED)	EN	SA
2 Parallel Heavy Duty Surface Closer w/ Stop Arm	TB 1431 CPS	EN	SA
2 Sargent Drop Plate	1431D (AS REQUIRED)	EN	SA
1 Gasketing	PROVIDED BY ALUMINUM DOOR MANUFACTURER		OT

Set: 31.0

Doors: 120.1

1 Hardware	ALL HARDWARE BY DOOR MANUFACTURER		OT

Set: 32.0

Doors: [115.1](#), [115.2](#)

3 Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Deadbolt	SE 487	US26D	SA
1 Pull Plate	BF 110x70C	US32D	RO
1 Push Plate	70C-RKW	US32D	RO
1 Parallel Heavy Duty Surface Closer	TB 1431 P10	EN	SA
1 Kick Plate	K1050 10" X 2" LDW CSK BEV	US32D	RO
1 Floor Door Stop	440	US26D	RO
1 Kick Down Door Stop	461	US26D	RO
1 Gasketing	S88BL		PE

Notes: Template closer to allow door to open to 180 degrees.

END OF SECTION

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, Storefront and Curtain Wall	Section 08 41 00
4.	Aluminum Windows	Section 08 51 13
5.	Manufactured Wood Casework	Section 12 32 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.

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. Spandrel glass (where shown on drawings) shall be OPACI-COAT-300 as manufactured by ICD High Performance Coatings, Vancouver, WA or approved equal. Color shall be as selected by the Architect from manufacturer's spandrel glass color selection guide.
4. 3M™ Scotchshield Safety & Security Window Film where shown on drawings: Ultra Prestige, 8 mil thick, installed with the 3M™ Impact Protection Attachment (IPA) Sealant.
5. 1/2" monolithic two-ply laminated glass. Two sheets of monolithic glass bonded together with a plastic interlayer by heat and pressure.
6. (Frosted) 1" insulated translucent white inboard glazing (where shown on drawings), DuPont Butacite® or Architect approved equal.

2.1.4 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.

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

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.

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.

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.

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.

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 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 furredowns. 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.

3.4 TEXTURE COAT

By Painting Contractor; see Section 09 91 00.

3.5 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

CERAMIC TILING

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide all glazed ceramic wall tile, 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.

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 Co.

2.2 CERAMIC WALL TILE

2.2.1 Standard grade ceramic tile: TCA 137.1-1988

1. Finish: Semi-gloss glaze.
2. Size: 4-1/4" x 4-1/4".
3. Thickness: 5/16".
4. Field tile shall be selected by Architect from price groups 1 and 2; two (2) accents from all price groups.

2.2.2 Trim shape: Corners and bullnose caps 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

2.4.1 Fusion Pro® single component grout, color as selected from manufacturer's stock colors by the Architect, as manufactured by Custom Building Products or approved equal. Material to meet ANSI A-118.6-1999. Product includes MicroBan® antimicrobial product protection.

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.

3.1.3 Install elastomeric waterproofing material at all wet areas according to manufacturer's published installation instructions.

3.2 INSTALLATION

3.2.1 Completed installation shall be free of broken, damaged, or faulty tile.

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 07920 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

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.

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 LAY-2: Vinyl Faced Gypsumboard - BPB "Capaul" 1/2" Vinyl Faced gypsumboard (2' x 2' or 2' x 4' as shown on drawings) or equal.

2.3 LAY-3: 4" Axiom Trim with LAY-1.

2.4 LAY-4: Armstrong 360° 2' x 2' painted grid. Color shall be selected from the standard RAL colors by the Architect.

2.5 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

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.

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 black factory applied paint finish.

2.1.3 Angles: Cold rolled No. 7800, 7/8" x 7/8", hot dipped galvanized with black 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

RESILIENT BASE

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide all rubber base, 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 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.

PART TWO - PRODUCTS

2.1 MATERIALS, GENERAL

2.1.1 Rubber base shall be 4" high cove base as manufactured by Johnsonite or Architect approved equal. Color as selected by the Architect from standard colors of the approved manufacturer. Furnish pre-formed corners. "Wrapped" corners will not be allowed. Vinyl base is not acceptable.

2.1.2 Adhesives shall be as recommended by the manufacturer of the approved resilient material. Asphalt emulsions and other non-waterproof types will not be acceptable.

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 rubber base is to be placed. Correct conditions detrimental to the proper and timely completion of the Work. Remove all dust and debris. Do not proceed until unsatisfactory conditions have been corrected.

3.1.2 By beginning the work, this subcontractor assumes all responsibility for any debris or imperfections that show through the base material.

3.2 INSTALLATION

3.2.1 General:

3.2.1.1 Install rubber base only after all finishing operations, including painting, have been completed.

3.2.1.2 Place rubber base with adhesive cement in strict compliance with the manufacturer's recommendation.

3.3 CLEANING AND PROTECTION

Remove excess adhesive or other surface blemishes from rubber base, using neutral type cleaners as recommended by manufacturer. Protect installed rubber base from damage until acceptance by the Owner.

END OF SECTION

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.

PART TWO - PRODUCTS

2.1 CARPET

2.1.1 Carpet as manufactured by Mannington Commercial or Architect approved equal.

2.1.2 CPT-1 – “Mainboard” - Modular

- a. Construction: Patterned Loop
- b. Face Fiber: Type 6,6 Nylon
- c. Dye Method: Solution
- d. Gauge: 5/64
- e. Stitches Per Inch: 9.5
- f. Density: 6,667
- g. Pile Thickness: 0.108 Inches
- h. Weight: 20 Ounces Per Square Yard
- i. Backing Type: Infinity® 2 Modular
- j. Standard Size: 24" X 24" Modular Tiles
- k. Installation Method: Herringbone, Horizontal Brick Ashlar, Vertical Ashlar

2.1.3 CPT-2 – “Recoarse II” - Modular

- l. Construction: Patterned Loop
- m. Face Fiber: Type 6 - 33%, 67% Type 6,6 Nylon
- n. Dye Method: Solution
- o. Gauge: 1/12
- p. Stitches Per Inch: 10.33
- q. Density: 7,354
- r. Pile Thickness: .186 Inches
- s. Weight: 38 Ounces Per Square Yard
- t. Backing Type: Infinity® 2 Modular
- u. Standard Size: 24" X 24" Modular Tiles
- v. Installation Method: Monolithic, Quarter Turn

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.

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

FIBERGLASS REINFORCED
WALL PANELS

PART ONE – GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide standard fiberglass reinforced wall (FRP) panels and trim, as required, where 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.

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 provisions of Section 01 33 23.

1.3.2 Manufacturer's data: Within 30 calendar days after award of Contract, submit:

1. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.
2. Manufacturer's recommended installation procedures.

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 manufacturers' recommendations as approved by the Architect.

PART TWO - PRODUCTS

2.1 GENERAL

2.1.1 Standard fiberglass reinforced (FRP) wall panels shall be as manufactured by Marlite, Dover, Ohio, or Architect approved equal.

2.1.2 Fire Rating: Class III/C

2.1.3 Finish: Pebbled surface. Color shall be selected by Architect from manufacturer's standard colors.

2.1.4 Other Materials: All other materials, including but not necessarily limited to adhesive, molding, and corner guards, as required, shall be only as recommended by the manufacturer, and as approved by the Architect.

PART THREE – EXECUTION

3.1 PREPARATION

3.1.1 FRP panels shall be installed over substrate as shown on drawings.

3.1.2 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.

3.2 INSTALLATION

3.2.1 Install all panels in strict accordance with the manufacturer's installation instructions.

END OF SECTION

ACOUSTICAL WALL PANELS

PART ONE – GENERAL

1.1 DESCRIPTION

Provide all acoustically absorbant panels and accessories complete, in place, as shown on the Drawings, specified herein, and needed for a complete and proper installation.

1.2 PERFORMANCE REQUIREMENTS

Acoustical Absorption: Perform testing in accordance with ASTM C 423, Type A mounting method unless otherwise specified.

Flame Spread Rating: Provide all components with Class A flame spread rating when tested in accordance with ASTM E 84, unless otherwise specified.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 23.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Independent testing agency test reports.
- C. Selection Samples: For each product specified, two complete sets of color samples representing manufacturer's full range of available colors and patterns.
- D. Verification Samples: For each product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.4 QUALITY ASSURANCE

- A. 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.
- B. 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.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect acoustical products from moisture during shipment, storage, and handling.

- B. Store products in manufacturer's unopened packaging until ready for installation.
 - 5. 1. Store materials flat, in dry, well-ventilated space.
 - 6. 2. Do not stand panels on end.
 - 7. 3. Protect edges from damage.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.6 PROJECT CONDITIONS

- A. Do not begin installation of acoustical products until building has been enclosed and environmental conditions approximate those that will prevail when building is occupied.
- B. Environmental Requirements: Do not install panels until wet work, such as concrete and plastering, is complete; the building is enclosed; and the temperature and relative humidity are stabilized at 60 – 80 degrees F (16 – 27 degrees C) and 40% to 50% respectively, by the building HVAC system. Use of propane heaters in areas with acoustic panels can cause chemical reactions with resin spots causing them to become visible through the face of the panels. Do not use propane heaters in areas where panels are installed.

PART TWO - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: G&S Acoustics; 3555 Scarlet Oak Blvd., St. Louis, MO 63122. Tel: (636) 225-8800 or (800) 737-0307. Email: inquiry@gsacoustics.com. www.gsacoustics.com.
- B. Provide all acoustical products specified herein by a single manufacturer.

2.2 ACOUSTICAL WALL PANELS

- A. Wrapped Fiberglass Panels: Acousti-Panels AP; fiberglass core of 6 to 7 pcf (96 to 112 kg/cu m) with chemically hardened edges, seamless finish material wrapped and bonded to back side of panels.
 - 1. Thickness: 1 inch (25.4 mm); NRC 0.85.
 - 2. Thickness: 2 inch (51 mm); NRC 1.05.
 - 3. Thickness: 3 inch (76 mm); NRC 1.10.
 - 4. Thickness: 4 inch (101.6 mm); NRC 1.15.
 - 1. Size: As indicated on drawings.
 - 2. Finish: Guilford 701
 - 3. Color: As selected by Architect from manufacturer's standard color offering.
 - 4. Edges: Beveled
 - 5. Corners: Square
 - 6. Mounting: Two-Part hanger bar and Z-clip.

2.3 ACCESSORIES

- A. Two-Part hanger bar and Z-clip. Manufacturer's standard mounting bar mechanically attached to the substrate and the metal Z-Clips are attached to the back of the units.

PART THREE - EXECUTION

3.1 EXAMINATION

- 3.1.1 Do not proceed with installation until all wet work such as painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

3.2 PREPARATION

- 3.2.1 Measure each wall area and establish layout of acoustical units to balance border widths at opposite edges of each wall. Coordinate panel layout with mechanical and electrical fixtures.

3.3 INSTALLATION

- 3.3.1 Install wall panels by attaching the panels to an existing wall per the manufacturer's instructions.
- 3.3.2 Replace any damaged and broken panels.

END OF SECTION

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.

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 section.

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 Section.

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.

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 Pratt and Lambert, Benjamin Moore, Devoe, United, Farrell-Calhoun, Kwal Paint 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.

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.

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 wood surfaces:

3.3.2.1 Clean all wood surfaces until they are free from dirt, oil, and all other foreign substance.

3.3.2.2 Smooth all finished wood surfaces exposed to view, using wood filler (if required) and the proper sandpaper. Where so required, use varying degrees of coarseness in sandpaper to produce a uniformly smooth and unmarred wood surface.

3.3.2.3 Unless specifically approved by the Architect, do not proceed with painting of wood surfaces until the moisture content of the wood is 12% or less as measured by a moisture-meter approved by the Architect.

3.3.3 Preparation of metal surfaces:

3.3.3.1 Thoroughly clean all surfaces until they are completely free from dirt, oil, and grease.

3.3.3.2 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.

3.3.3.3 Allow to dry thoroughly before application of paint.

3.3.4 Preparation of masonry:

1. Mixing of Pro-Mar Block Filler for spray application shall use a maximum of one quart of latex wall paint per gallon pail of block filler. Do not use water or solvent thinned paints. Do not thin block filler for roller application.

2. Prior to any painting work, a sample wall of block fill shall be installed under the Architect's representatives' observation and approval. This wall shall be the minimum standard for the entire work.
3. Application of block fill:
 - a. Uniformly spray apply block fill to the wall.
 - b. Roll with a medium mop roller (long nap rollers are not acceptable) to thoroughly embed block fill into the voids of the block. (Pinholes are not acceptable).
 - c. Apply a fast overspray of block fill to provide a uniform texture and eliminate roller marks.

3.3.5 Preparation of gypsum board surfaces:

3.3.5.1 Apply joint treatment as follows:

1. First and Second Coat: Sheetrock® All-Purpose Joint Compound.
2. Third Coat: Sheetrock® Plus 3 Lightweight Joint Compound.

3.3.5.2 Clean all gypsum board surfaces until they are free from dirt, oil, and all other foreign substance.

3.3.5.3 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.

3.3.5.4 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.

3.4.1.3 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 Concrete Block:

Semi-gloss enamel (total DFT = 11 mils)

1. Surface preparation: Remove all dirt, loose or excess mortar. Allow 30 days drying time before application.
2. First coat: PrepRite Block Filler, B25W25. (DFT 8 mils.)
3. Second and Third Coat: ProMar 200 Latex Semi-gloss Enamel, B31W200 Series. (DFT 1.5 mils/coat.)

3.5.2 Interior concrete block:

Epoxy Paint (Total DFT = 18 mils).

1. Surface preparation: Remove all dirt, loose or excess mortar. Allow 30 days drying time before application.
2. First Coat: Heavy Duty Block Filler, B42W46. (DFT 10 mils.)
3. Second and third coat: Water Based Catalyzed Epoxy, B70-200 Series with B60V25 Semi-Gloss Hardener.

3.5.3 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 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: ProMar 200 0 VOC Interior Latex Semi-Gloss Enamel, B31-26500 Series. (1.5 mils DFT/coat.)

3.5.4 Interior Gypsum Board:

Epoxy paint (Total DFT = 9.3 mils).

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 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: Water Based Catalyzed Epoxy, B70-200 Series with B60V25 Semi-Gloss Hardener.

3.5.5 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: Kem Kromik Universal Metal Primer, B50Z Series. (DFT 3 mils).
3. Second and Third Coat: ProMar 200 Alkyd Semi-Gloss Enamel, B34W200 Series. (1.5 mils DFT/coat).

3.5.6 Interior Ferrous Metal:

Flat Finish

1. Surface preparation: Remove all oil, dust, grese, dirt, loose rust, and other foreign material.
2. First Coat: Pro Industrial Pro-Cryl Universal Acrylic Primer, B66-310 Series.
3. Second and Third Coat: Waterborne Acrylic Dryfall, B42W1.

3.5.7 Exterior Ferrous Metal:

Gloss (Total DFT - 9 mils).

1. Surface preparation: Sand smooth and remove all dust prior to paint application.
2. First coat: Kem Kromik Universal Metal Primer, B50Z Series. (DFT 3 mils).
3. Second and Third Coat: 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

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.

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.

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	Mercurchrome
	Betadyne

2.2 COLORS

- A. Colors shall be as selected by the Architect from manufacturers standard range of colors.

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 Tramox 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

VISUAL DISPLAY UNITS

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide all markerboards and tackboards, 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.

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 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. Manufacturers specifications and other data required to demonstrate compliance with the specified requirements.
3. Shop Drawings for each type of markerboard and tackboard units showing components, arrangements, dimensions, orientation on walls, section of trim members, dimensioned elevations, grounds, reinforcements, and accessories.

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.

PART TWO – PRODUCTS

2.1 GENERAL

This specification is written around Claridge of Harrison, Arkansas. The following manufacturers are accepted as equal, subject to the requirements of the specifications and drawings.

1. Platinum Visual System, Corona, CA
2. PolyVision Corp., Suwanee, GA

2.2 MARKERBOARDS

- 2.2.1 Series 1, Type A.
- 2.2.2 Four foot height, width as shown on plans.
- 2.2.3 Provide blocking pads as required. Verify heights with Architect.

2.3 TACKBOARDS

- 2.3.1 No. 1550 fabricork vinyl tackboard.
- 2.3.2 Factory built, tackboard Series 185, Type CO.
- 2.3.3 Four foot height, width as shown on plans.
- 2.3.4 Fabric cover, 1/4" cork, 1/4" hardboard (total thickness 1/2"). Provide blocking pads as required. Verify heights with Architect.

2.4 MAP RAILS

- 2.4.1 Use Model No. 151 at markerboards and tackboards.
- 2.4.2 Provide Model 51C combination hook and clip at 2'0" o.c. at all map rails.

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 DELIVERY

Deliver factory-built markerboards and tackboards as units completely assembled in one piece without joints, whenever possible. When overall dimensions require delivery in separate units, prefabricate at factory, disassemble for delivery, and make final joint at site.

3.3 INSTALLATION

Install boards 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.

END OF SECTION

SIGNAGE

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide all exterior aluminum letters, 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.

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.

2.3 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.
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 ICC-500 2020.

PART THREE - EXECUTION

3.1 EXTERIOR ALUMINUM LETTERS

Provide all necessary blocking as required by the manufacturer.

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

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.

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.
- D. Shower curtains and rods: Bradley 9531 curtain rod, Bradley 9537 shower curtain with Bradley 9536 hooks. One at each shower stall.
- E. Folding shower seat: Bradley Model 9569, handed per drawing. Provide one (1) for each accessible shower.
- F. Cubicle curtains and track: "Clickeze" track and accessories as manufactured by InPro Corp., Muskego, WI or Architect approved equal. Curtain fabric shall be selected by Architect from manufacturer's standard selection.
- G. Barrier free water dam: Chrome finish, as manufactured by Shower Solutions USA, Inc. or Architect approved equal.
- H. Hand dryer: ThinAir®, model no. TA-SB, recessed, ADA compliant, as manufactured by Excel Dryer, Inc. or Architect approved equal.
- I. Changing Table: Pressalit Care 2000 Hi Lo changing table as manufactured by Max-Ability. Locate as shown on drawings.

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

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.

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

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.

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.

2.2.2 Kitchen Area: Provide Saturn 15 Wet Chemical, Class K extinguisher with bracket 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

METAL LOCKERS

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide metal lockers 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.

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 provisions of Section 01 33 23.

1.3.2 Manufacturers' data: Within 30 calendar days after award of Contract, submit:

1. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.
2. Complete shop drawings.
3. Manufacturer's recommended installation procedures.

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 manufacturers' recommendations as approved by the Architect.

PART TWO - PRODUCTS

2.1 GENERAL

Lockers specified are as manufactured by Penco Products, Inc. The following manufacturer is accepted as equal, subject to the requirements of the specifications and drawings.

1. Superior List
2. WEC

2.1.1 “Vanguard”: Provide 12" x 15" x 72" double tiered lockers. Units shall include 6” legs with a closed base.

2.1.2 Other materials: All other materials, including but not necessarily limited to anchorage devices, edge trim, spacers, etc., shall be only as recommended by the manufacturer, and as approved by the Architect.

2.1.3 To be supplied with combination pad locks (master keyed).

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.

END OF SECTION

MAILBOXES

PART ONE - GENERAL

1.1 DESCRIPTION

Provide mailboxes (data distribution boxes), 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 for the work of this Section produced by manufacturers regularly engaged in the 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 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 01340.

1.3.2 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.
3. Samples of materials proposed for use in the specified requirements.
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.

1.4 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.

PART TWO - PRODUCTS

2.1 MAILBOXES

Mailboxes (data distribution boxes) as manufactured by National Mailboxes, Wauwatosa, Wisconsin or Architect approved equal:

- A. 6-Door Data Distribution Box Unit: Model 2406 without slots. Units shall stacked 4-high for a total of 48 openings. No door slots in units.

PART THREE - EXECUTION

3.1 INSTALLATION

Install the data distribution boxes and rack ladders as shown on the Drawings, and in accordance with the manufacturer's instructions.

END OF SECTION

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

FLAGPOLES

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide flagpoles, complete with all accessories 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.

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 provisions of Section 01 33 23.

1.3.2 Manufacturer's data: Within 30 calendar days after award of Contract, submit:

1. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.
2. Complete shop drawings.
3. Manufacturer's recommended installation procedures.

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.

PART TWO - PRODUCTS

2.1 GENERAL

All products, unless noted otherwise, shall be supplied by Concord Industries, Inc., Addison, Texas or approved equal.

2.1.1 Flagpoles shall be fabricated from seamless extruded aluminum tubing, complying with ASTM B241, alloy 6063-T6, tensile strength of not less than 30,000 psi and yield point of 25,000 psi, standard finish.

2.1.2 Flagpoles shall be 40' high x 8.0" diameter, groundset mount.

2.1.3 External halyard system for raising and lowering flags shall be included. Standard fittings include a spun aluminum ball, a heavy cast aluminum revolving truck assembly with a single sheave, braided polypropylene halyard, snaphooks, cast aluminum cleat, spun aluminum collar and ground sleeve assembly.

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.

3.2 INSTALLATION

Strictly follow manufacturer's installation recommendations and coordinate as required with all trades.

END SECTION

FOOD SERVICE EQUIPMENT

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Provide all food service equipment complete, in place, as shown on the Drawings, specified herein, and needed for a complete and proper installation. Utility connections to equipment shall be made by the electrical and/or mechanical contractor. Food Service Equipment subcontractor shall adjust all kitchen equipment and conduct final tests, demonstrate, operate and instruct school personnel in the correct operation, maintenance, cleaning, up-keep and adjustments of the equipment.

1.2 WARRANTY

1.2.1 General One Year Warranty: Equipment shall be guaranteed for one year, from acceptance of building. The guarantee shall cover replacements, transportation and labor against all defects except those caused by carelessness or misuse of equipment.

1.2.2 Compressors: Shall be warranted for five (5) years.

1.3 SUBMITTALS

1.3.1 General: Comply with the provisions of Section 01 33 23.

1.3.2 Project 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 data required to demonstrate compliance with specified requirements.
3. Detailed plans showing dimensional locations, sizes, heights, and where necessary, capacity of all equipment. Plans shall show all rough-in requirements for electrical, plumbing, and ventilation service, including dimensional locations, sizes, heights, and where necessary, capacity of utility service. After review and comment by the Architect, this plan shall be the basis for all rough-ins for kitchen equipment. Any reworking of utilities and damage to finishes caused by mistakes of omission on this shop drawings plan shall be the responsibility of this subcontractor.

PART TWO - PRODUCTS

2.1 GENERAL

Refer to kitchen plan on the drawings for the locations of the following equipment.

2.1.1

PART THREE - EXECUTION

3.1 GENERAL REQUIREMENTS

3.1.1 Unless otherwise specified or shown on the Drawings all material shall be new of best quality, and delivered to the project in undamaged condition.

3.1.2 All stainless steel shall be U.S. Standard Gauges, 18-8 type 302, not over 12% maximum carbon, No. 4 finish. Welds shall be ground smooth and polished to a No. 4 finish.

3.1.3 All galvanized iron shall be Armco or equal. Framework of galvanized iron shall be of welded construction. All welds shall be smooth; where galvanizing has been burned off, the weld shall be touched up with a high grade of aluminum paint.

3.1.4 All seams and joints shall be shop welded or soldered as the nature of the material used may require. Welds to be ground smooth and polished to match the original finish. Materials 18 gauge or heavier shall be welded.

3.1.5 All metal tops shall be one piece welded construction, reinforced on the underside, so tops can support heavy weights without deflection. Cross braces to be not more than 30" on center.

3.1.6 Drawers shall be 20" x 20" x 5" deep with removable stainless steel liners. Drawer liners shall be fitted with an 18 gauge stainless steel die-stamped front, having an integral depressed, stainless steel, die-stamped handle. Drawers shall be mounted on heavy duty, ballbearing, extension roller slides, having a load capacity of 100 pounds. Drawer enclosure shall be fully enclosed and vermin proof.

3.1.7 Fixture bodies:

Open base structures: 1-5/8" o.d. x 16 gauge seamless steel tubing legs. Secure 1-1/4" o.d. 16 gauge stainless steel crossrails. Fully weld, (360 degrees) and polish crossrails to legs, 10" above floors.

Top of leg: Inserted in Klein No. 483-58 gusset fully welded to table frame or sink bottom.

Bullet foot: Klein No. 222-58-Sr. Bevel the tubing wall at the bottom of leg.

Freestanding fixtures requiring utility connections: Klein No. 222-58-XFL flanged feet at corners anchored to floor with noncorrosive bolts.

Table bases: Maximum leg spacing of 6" o.c.; dishtable and utensil-wash counter bases at 5" o.c.

3.1.8 Overshelves:

General: 16 gauge stainless steel with free edges turned down 1" with 1/2" tight hem at bottom. Round free corners on 3/4" radius.

Turned up 2" raw or adjoining high fixture with coved corner at rear. Round front corners of turnup on 3/4" radius.

Where shelf width exceeds 12" width, reinforce with 1/2" x 3" x 14 gauge stainless steel closed hat channel full length of shelf.

Wall-mounted shelves: Install on Haralson No. 1200 brackets 4' o.c. maximum. Set brackets in 6" from ends.

Freestanding shelves: Where turnup is required at freestanding overshelves, the shelf is to be turned up 2" at ends coved up at rear and hemmed tight to bottom of front turndown. Weld exposed corners.

Freestanding overshelves: Mounted on Haralson No. 490 cantilevered brackets at rear of table; No. 490 double-cantilevered brackets at center of table. Posts for cantilevered overshelves are 1-5/8" o.d. x 16 gauge stainless steel posts, each pair at 4' o.c. maximum.

3.1.9 Sinks:

Utility sinks: 14 gauge stainless steel, all corners coved on 3/4" radius. Provide 1-1/2" wide double-wall partitions with flat tops between compartments.

Exposed exterior panels of multiple-compartment sinks are to be continuous. All gaps between compartment sinks are to be continuous. All gaps between compartments must have 14 gauge stainless steel filler panel welded, ground and polished.

Score and slope sink bottom 1/2" to Type 1 drain with Star type die-stamped recess. Set overflow centerline 1" below drainboard.

Fabricator may use at his option die-stamped sink inserts of size and gauge specified.

Sink backsplash shall terminate with 1-1/2" semi-roll and set off walls 2".

3.1.10 Undershelves:

Open base structures: 16 gauge stainless steel turned down 1-1/2" at front and free ends with 1/2" tight hem at bottom. Notch all corners to fit tubular legs and weld from underside to completely fill gap; grind and polish. cove up 2" at rear and/or ends adjacent to wall, columns, refrigerators, etc. The turnup is to be hemmed tight to bottom of turndown when turnup is specified for freestanding fixtures.

Provide 1" x 4" x 14 gauge galvanized channel at longitudinal centerline of shelf and at each intermediate pair of legs.

3.1.11 Casters:

Casters shall be heavy duty type, ballbearing, disc wheel with 5" diameter polyurethane tires. All casters shall have sealed wheel and swivel bearings, plated finish and shall be N.S.F. approved. Each fixture shall be equipped with two (2) casters having foot operated brakes.

3.1.12 Plumbing/Mechanical Requirements:

Plumbing fittings and accessories: Furnished as follows: Accessories provided loose for field installation, connected under Division 15.

control valves, water pressure regulators and vacuum breakers wherever required on Food Service Equipment.

Wade No. W-10 Shok-Stop shock absorbers for all Food Service Equipment with quick opening or solenoid operated water valves.

Extension of indirect waste fitting to open-sight hub or floor drains from cold pans, frost plates, refrigeration coils, ice machines, iced dispensers, milk-carton dispensers, water stations, beverage-counter drain troughs and relief valves. Drains: 1" minimum, Type "K" copper - by Mechanical Contractor.

All exposed piping and fittings on Food Service Equipment chrome plated. Piping brackets and/or supports beneath dishtables or counter tops.

Gas-heated equipment fittings and accessories furnished as follows: Accessories furnished loose for field installation. connect under Division 15.

Appliance pressure regulator at the primary connection only, (two (2) if the gas supply piping is "looped"). Adjust the regulator as instructed by the equipment manufacturer.

Final plumbing connection provisions: Fabricated equipment containing components, fittings and/or devices indicated on Utility Connection Drawings to be connected to the building systems shall have each component, fitting or group thereof pre-piped to a utility compartment for final connection. Refer to Food Service Consultant drawings for capacities, pressure and sizes.

Field-assembled equipment, (i.e., prefabricated walk-in refrigerator/freezers, conveyor systems, exhaust hoods, conveyor or circular type dishwash machines, (etc.) shall have plumbing components completely interconnected under this Section for final connection arrangements indicated on Utility Connection Drawings.

All plumbing final connection points of equipment shall be tagged, indicating: (1) item number, (2) name of device(s), or component and (3) type of utility (water, gas, steam, drain).

3.1.13 Ducts and Vents:

The necessary flue and/or vents and fans of size and capacity required to operate fixtures specified, together with connection between rough-in vent openings and fixtures, shall be furnished and installed by the Mechanical Contractor unless specifically called for under the ITEMIZED SPECIFICATIONS.

3.1.14 Food Service Equipment Refrigeration Systems:

Install complete all refrigerant, oil, dials, dehydrators, gauge controls as required for the proper operation of the system.

Self-contained or factory-installed compressors: Check and adjust to proper operating temperature.

Refrigeration system installation: Refrigerant lines: type "L" hard copper tubing. Fittings: Wrought copper or brass designed for use with high temperature solder. Piping joints: Made with silver solder, (Sil-Fos). Piping: Properly suspended from and anchored to the structure with adjustable hangers 6' o.c. maximum. Suction lines: Sized to have maximum pressure drop of two (2) pounds in medium temperature systems; one (1) pound in low temperature systems. Liquid lines: Sized to give maximum pressure drop of three (3) pounds from receiver to evaporator. All refrigerant lines: Graded to prevent trapping of oil. Install 1" thick Armaflex insulation on all suction lines.

Evacuation and charging: After completion of the pressure test, the system shall be evacuated using an approved auxiliary vacuum pump. connections for evacuation: In accordance with manufacturer's recommendation.

Charging subsequent to the initial charge which is contained in the condensing unit: Given through the charging valve in the high side passing all the liquid refrigerant through a charging dehydrator. All charging lines and gauges: Purged of air prior to connection with system. Refrigerant: unused and shall be delivered in clean containers. After the system is full charged: Started and placed in full operation.

3.1.15 Faucets:

Type 1 - T&S Model No. B231 with Model No. B-199-1, splash mounted faucet with 8" swing spout with 1.5 GPM aerator.

Type 2 - T&S Model No. B-1121 with Model No. B-199-1, deck mounted faucet with 9" swing spout 1.5 GPM aerator.

Aerators: T&S Model No. B10199-29, 1.5 GPM, 55/64-27 female threads.

Supply Kit: T&S B-0230-KIT including (2) 1/2" NPT inlet shanks, (2) 1/2" NPT close elbows and (2) 24" stainless steel braided flexible supply hose with swivel fittings and integral gaskets.

3.1.16 Drain fittings:

Install the following chrome-plated or stainless steel fittings in die-stamped embossed openings with washers and locknuts. Solder may be used as a sealer but shall be applied to the top surface of the drain fitting.

Type 1 - Fisher Model No. 6104 rotary drain with connected overflow and tailpiece. Provide 14 gauge stainless steel bracket for drain stem welded to sink bottom. construct lever handle flush with sink front.

Type 2 - Klein Model No. SS-489 drain fitting with tailpiece.

3.1.17 Electrical Requirements:

Electrical fittings and accessories: Furnished as follows: Accessories provided loose for field installation, connected under Division 16.

Cord and caps: Coordinate all Food Service Equipment cord/caps with related receptacles.

All 120 volts "plug-in" equipment shall have type SO or SJO cord and plug with ground wire fastened to frame/body of item.

Cord lengths for fixed equipment: Adjusted to eliminate loose hanging excess.

All non-fixed plug-in "buy-out" equipment shall have Hubble Insulgrip, (CA Style) Angle plugs in straight-blade configuration, ratings as required.

All mobile equipment shall have Kellems strain-relief assembly at the cord connection of the appliance.

Switches and controls: Each motor driven appliance or electrically heated unit: equipped with control switch or started in accordance with the requirements or the Underwriter's Laboratories, Inc., which shall provide low-voltage and overload protection.

Disconnect switches by Division 16.

All remote manual starters, magnetic contractors or starters and push button stations shall have a NEMA Type 1 enclosure shall be provided.

Motors: 120 volt motors shall have a manual tumbler type starter with thermal overload protection and interchangeable heating elements.

208 volt and 460 volt motors shall have magnetic starters with low voltage protection and one (1) interchangeable overload relay per phase.

Heating elements: Electrically heated equipment: Thermostatic controls.

Coordinate Food Service Equipment voltages with building system.

Receptacles and switches: Pre-wire receptacles on open base fixtures to a junction box mounted on underside of lower shelf.

Receptacles installed in/on fabricated equipment: Hubbell, Inc. assemblies as per the following schedule, mounted in a metal box.

Type 1 - NEMA 5-20R receptacle, 20 amps/125 volts, GFI duplex.

Light fixtures: Light fixtures installed in/on fabricated or field-assembled equipment shall be pre-wired to a junction box for final connection. Provide each fixture with lamps. Provide continuous-run fixtures when indicated.

Final electrical connection provisions: Fabricated equipment containing electrically-operated components and/or fitting indicated on Utility Connection Drawings to be direct-connected. shall have each component, fitting or group thereof pre-wired to a junction box for final connection. Refer to Food Service Consultant's drawings for circuit loading.

Field-assembled equipment i.e., prefabricated walk-in refrigerator/freezer, exhaust hoods, shall have electrical components completely interconnected under Division 16 for final connection arrangements as indicated on Utility Connection Drawings.

All electrical final connection points of equipment shall be tagged, indicating: (1) Item Number, (2) Name of Device(s) on Circuit, (3) Total Electrical Load and (4) Voltage and Phase.

3.2 SANITARY CONSTRUCTION

3.2.1 All equipment shall be constructed in strict compliance with standards of the National Sanitation Foundation as outlined in their bulletin on Food Service Equipment entitled "Standard Number Two" dated April 1965 and in full compliance with public health regulations of the State of Arkansas.

3.3 WORK BY OTHERS

3.3.1 All traps, grease traps, tail pieces, stops, shut offs and fittings necessary shall be furnished and installed under mechanical subcontract unless specifically called for under the individual item.

3.3.2 Plumbing contractor shall see that all lines are flushed free of foreign matter before connecting fixtures.

3.3.3 All internal wiring for fabricated equipment, including all electrical devices, wiring controls, switches, etc., built into or forming an integral part of these items shall be furnished and installed by kitchen equipment contractor having wiring complete to a junction box within the fixture ready for connection to building lines by the electrical contractor. Cords and plugs will be as specified under the individual item.

END OF SECTION

PROJECTION SCREEN

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide ceiling mounted projection screen, 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 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

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 PROJECTION SCREENS

2.1.1 Provide 298" DA-LITE 37048L Rear Projector Screen as manufactured by DA-LITE Screen Company, Inc. or approved equal. Provide matte white screen, seamless, with 2" standard black drop at top in the size as listed with low voltage 3 button control system.

PART THREE - EXECUTION

3.1 INSTALLATION

3.1.1 Provide manufacturer's mounting bracket for installation above ceiling.

END OF SECTION

STAGE CURTAIN & TRACK

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide stage curtains, tracks, rigging, motors, and accessories, 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. Structural Steel Section 05 50 00

1.2 QUALITY ASSURANCE

1.2.1 Qualifications of manufacturer: Use products for 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 adequate numbers of skilled workmen who are thoroughly 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. Samples of materials proposed for use in the 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.

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.

1.5 WARRANTY

1.5.1 All products provided shall be first quality and warranted against defects in materials and workmanship for a period of two (2) years from date of Substantial Completion. Abuse, neglect and accidental damage are exempt.

PART TWO – PRODUCTS

2.1 MANUFACTURER

A. Manufacturer for basis of curtain fabrication and design:

BellaTEX, Inc. of Jackson, TN
(800) 372-3373 • bellatex.com

B. Approved manufacturers:

H&H Specialities, South El Monte, CA
(800) 221-9995 hhspecialities.com

Thern Stage Equipment, Winona, MN
(800) 553-2204 hernstage.

ADC, Inc., Allentown, PA
(610) 797-6000 automaticdevices.com

Milliken & Company, Spartanburg, SC
(864) 503-2020 milliken.com

KM Fabrics, Inc., Greenville, SC
(864) 295-2550

Fred Krieger & Company, Jericho, NY
(516) 935-1150

2.1.1 STAGE CURTAINS

A. General Construction

1. All napped fabrics shall be sewn nap down unless noted otherwise.

2. Curtains shall be sewn without puckering. Vertical seams and hems shall fall straight and even. Bottom & top hems shall be straight, parallel, and shall not droop or draw up at vertical seams. Unless stated otherwise, seam allowances shall be $\frac{1}{2}$ ", $\pm \frac{1}{4}$ ". Tolerance for all other stitches shall be $\frac{1}{2}$ the specified seam allowance.
3. Panels shall be full length without horizontal splices.
4. Box pleats on valances & borders with 75% fullness or less shall be adjusted in a manner as to not be detectable and prevent vertical seams from falling on the face of the pleat. Amount of pleated fabric shall not be reduced by adjustments and no pleat shall be adjusted more than $\frac{1}{2}$ ".
5. Except for item #4 above all pleats shall be perfectly even in spacing and size, 12" o.c., and sewn in place neat and straight. Pleats shall be formed by first sewing a 4" long vertical stitch to create a 6" (50% fullness), 9" (75% fullness) or 12" (100% fullness) loop of fabric. The loop will then be pressed flat and sewn in place to form a box pleat.
6. 3" wide heavy weight synthetic webbing shall be used to reinforce the top hem. White webbing shall be used for white, light grey, light blue or other light colored fabrics. Black webbing shall be used for all others. Webbing will first be sewn to the face side of the curtain, with the webbing and fabric overlapping not less than $\frac{1}{2}$ ". The webbing will then be flipped over, to the backside of the curtain, and sewn with two additional parallel rows of stitching $\frac{1}{8}$ " from the top and bottom. The top of the webbing shall sit approximately $\frac{1}{8}$ " below the top of the curtain. Horizontal stitching shall be situated so it will not be cut by grommets.
7. Chain weight shall be #8 galvanized Jack Chain and sewn into a 5" canvas pocket with ties sewn every 18" to secure the chain in place. Front Setting curtains shall be weighted with steel weight tape. Weight tape shall weigh no less than 9oz per linear foot, be fully encapsulated in a synthetic sheath and sewn into a 5" canvas pocket to prevent any noise during movement. Lead weight shall not be used.
8. All raw fabric edges shall be tucked under $\frac{1}{2}$ " or more and sewn into hems so the raw edge is not exposed. Alternatively, raw edges may be surged with a 3 thread cover stitch at 12 or more stitches per inch, to prevent fraying.
9. General construction stitches shall be a 2 thread machine-sewn lock stitch and no fewer than 7 stitches per linear inch for durability and to prevent light leaks at seams.
10. Thread shall be nylon or polyester, size TEX 70 or greater with a tensile strength not less than 9 pounds. Thread color shall match face side of fabric. Lightweight fabrics will be sewn with size TEX 40.
11. Grommets shall be brass, size #3, and machine set. Nickel-plated grommets shall be used on white webbing and black oxidized grommets shall be used on black webbing. Grommets shall be placed in the center of each pleat or every 12" o.c. Two grommets shall be placed at each top corner, spaced apx 3" apart. For draw curtains, spacing of corner grommets shall be adjusted to match the master carrier.
12. Curtains attaching to tracks will be equipped with a model #427 bit snap. Fasteners that do not have a spring-loaded gate, are not user replaceable, or are secured with less surface area than a #3 grommet may not be used. S-hooks are not acceptable.
13. Curtains tying to a batten shall be equipped with a 30" long #4 tie line. Both ends of tie line shall be secured to prevent fraying. Frayed tie lines shall be considered a defect for warranty purposes. For curtains with white webbing, white ties shall be used. For curtains with black webbing, black ties shall be used. The center tie shall be the opposite color.

14. For window and door curtains where a standard grommet may be seen by the public, curtains will be equipped with hidden grommets and ties for pipe mounting or harness snaps sewn flush to the curtain top, for track mounting. Grommets, rivets, or other fasteners shall not be visible on the face of the curtain. An exception shall be made in the requirement for being user replaceable.
15. Each curtain shall contain a printed label stating FR/IFR compliance, size, fabric, color, manufacturing date, manufacturer name, product serial/identification number, and Theatrical Contractor's name, address and phone number.
16. FR Test Swatches: All seamless goods and curtain indicated on the schedule or drawing to have a FR Test Swatch shall have a 18" X 18" square of material from the same lot as the face fabric sewn into the upper SL corner. Swatch is provided for NFPA 705 testing.
17. Paging Handles: If indicated on the schedule or drawings drape shall have a total of (4) paging handles. A handle shall be sewn into the inside edge of the turn back and first panel seam on both the stage left and stage right sides. Handles shall be located 60" above the bottom hem of the curtain. Handles shall be formed by sewing 2" white synthetic webbing into a loop approximately 12" long. Handles shall be sewn at an angle so they lay flat against the drape when not in use. The handles shall not be visible from the front of the curtain.

B. Fabrics

1. Curtains of like fabric and color shall be from a single dye lot. In the event the size and quantity of curtains exceeds the maximum dye lot size, no curtain or curtain pair shall be made from more than 1 lot. Dye lots shall be arranged to minimize any differences.
2. Front Setting Curtain and Valance: 20 oz. IFR woven velour, Color to be chosen from standard line containing not less than 38 colors.
"Crescent" by BellaTEX, Inc or preapproved equal.

2.1.2 TRACKS & BATTENS

A. Tracks

1. All track shall include pipe backbone (batten or integral to track).
2. Small curtains weighting no more than 3 pounds per linear foot and no more than 8' H shall be equipped with H&H Model 100 series track, Thern Model T40 track or other approved equal.
3. Midsized Curtains weighing no more than 9 pounds per linear foot and no more than 14' H shall be equipped with H&H Series 200 track, Thern Model T60 track, or other approved equal.
4. Heavy Curtains weighing no more than 20 pounds per linear foot and more than 15' H shall be equipped with H&H Model 400 series track, Thern Model T70 track, or other approved equal.
5. Lightweight curved tracks shall be as specified above when possible or H&H 300 series with a matching curved 1.5" diameter pipe batten backbone.
6. Midsize and Heavy weight curved tracks shall be as specified above when possible or H&H 500 series curved track with 1.5" diameter pipe batten backbone.

B. Carrier & Pulley Sizes

1. Curtains weighing less than 50% of the maximum specified weight above may utilize standard carriers and smaller pulley options. All others shall utilize ball-bearing carriers and large pulley options.
2. All Grand Drape tracks and any rope operated track greater than 32' overall width shall be supplied with rear-fold guides even if not part of the standard model package.
3. All Grand Drape tracks shall utilize a minimum of 3/8" diameter handline.

C. Pipe Battens

1. Pipe Battens shall be constructed from 1.5" id schedule 40 pipe. Lengths greater than 20' shall be formed by means of an internal sleeve not less than 2' long with a 1/4" or greater wall thickness and no more than 1/16" play. Internal sleeve will be fixed in place by means of (4) 3/8" G5 bolts and nylock nuts.
2. Weighting pipe for scrims and cyclorama curtains shall be 3/4" id schedule 40 steel pipe. Lengths shall be 10'. Splices shall be formed by threaded coupling.
3. All burrs and sharp edges are to be removed. Pipe battens are to be cleaned and powder coated black with a non-gloss finish.
4. For each 1.5" batten supply model #680 batten clamps with a 1400 lbs WLL. Supply not less than (1) clamp for every 10' of batten length, or portion thereof, plus (1) clamp and appropriate suspension hardware.

2.1.3 RIGGING HARDWARE FOR OVERHEAD COMPONENTS

- A. With regard to load bearing components, except for wire rope all products shall be manufactured and distributed by entities within the United States. Components shall be load rated and documentation of such shall be freely and publicly available from the manufacturer. Each component must bear a durable manufacturer's mark and must be clearly identifiable by make and model without ambiguity.
- B. Wire rope shall comply with above or may be a product of Korea, provided it is distributed by a domestic corporation who has performed destructive testing to verify tensile strength and who fully backs the product against defect.

PART THREE - EXECUTION

3.1 INSTALLATION

As per manufacturer's instructions.

END OF SECTION

ATHLETIC EQUIPMENT

PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work included: Provide all basketball backstops, backboards, goals and volleyball systems, complete, in place, as shown on the Drawings, specified here in, and needed for a complete and proper installation.

1.2 QUALITY ASSURANCE

1.2.1 Qualifications 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 provisions of Section 01 33 23.

1.3.2 Manufacturer's data: Within 60 calendar days after award of Contract, submit:

1. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.
2. Shop drawings showing goal design, structural components and all supplementary steel required for support of goals. (Note: Supplementary steel required to be supplied by this subcontractor).
3. Manufacturer's recommended installation procedures.

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.

PART TWO - PRODUCTS

2.1 GENERAL

2.1.1 Design is based on the use of products as manufactured by Gared Sports, Noblesville, Indiana. Catalog numbers of that manufacturer are given as an indication of the quality and style required.

2.1.2 Acceptable manufacturers:

1. Porter, Broadview, ILL
2. AALCO, St. Louis
3. Draper, Spiceland, IN
4. Architect approved equal

2.2 BASKETBALL EQUIPMENT

2.2.1 Model No. 2500 Backstop (4 total) - Welded single post rear braced front folding basketball structure and

2.2.2 Model No. 3109 Backstop (2 total) – Welded single post side braced side folding basketball structure

A. Model No. 1194 electric hoist.

B. Model No. 1130 manual height adjuster.

C. Rectangular Glass Backboards

1. Model No. LXP4200 Steel Framed Rectangular Glass Backboard
2. Backboards shall be 42 inches high by 72 inches wide.
3. Backboard shall be manufactured from 1/2" tempered glass set in heavy extruded aluminum or steel framing and cushioned by shock absorbing vinyl. Official border and target area permanently fired into glass.
4. Goal mounting structure shall be a heavy welded formed steel assembly, and directly attached to lower horizontal frame member to minimize stress on glass.
5. Backboard shall have limited lifetime warranty against defects in material and workmanship, and when used with Performance Sports System's Direct Goal Attachment feature shall be protected against shatter and breakage of glass. Board must meet NCAA, FIBA and NFSHSA specifications.
 - a. Provide Model No. PMCE Pro Mold Bolt-On Cushion Edge in ten (10) standard colors (color to be determined by Architect). Five (5) year warranty.

D. Basketball Goals

1. Model No. 2000+ Breakaway Goal
2. Goal shall be fabricated from 5/8" diameter cold drawn alloy steel round formed to an 18" inside diameter ring. Inside of ring shall be positioned 6" from face of backboard by heavy, formed steel hinged-type housing with removable cover to conceal mounting bolts and shock absorption mechanism of goal and to protect against finger entrapment.

3. Goal shall be designed to absorb shock loads from slam dunking or hanging on rim. Shock absorption feature shall be provided by means of a special offset hinge arrangement rim and back plate mounting housing with concealed molded rubber shock absorber.
4. Goal shall meet NCAA, FIBA and NFHS specification on moveable rims, which states, "A moveable basket ring shall have rebound characteristics identical to those of a non-moveable ring." Goal shall be factory set to proper flex and rebound requirements.
5. Goal shall be finished in durable, electrostatic powder coated official orange finish.
6. Goal shall be furnished complete with heavy-duty white anti-whip nylon netting and mounting hardware.

E. Backstop Auto Lock Safety Strap

1. Model No. 1100 Safstop safety strap. Provide one for each backstop. Safety strap shall be inertia sensitive to automatically lock basketball backstop in position at any time (in storage or during raising or lowering cycle) due to any sudden surge of speed created by possible malfunction(s) of hoisting apparatus, winch, cable, pulleys, support fittings, etc.

2.3 TOTAL SYSTEM CONTROL KEYPAD

- A. TSC2000 Total System Control unit allowing one touch operation of basketball backstops or or any other electrically controlled equipment through a wall-mounted keypad.
- B. One keypad and relay box will operate eight motorized systems and auxiliary operations (lighting, scoreboards, etc.). Operates on 110 volts with keypad communications at 24 volts. Mounts in standard twelve by twelve by six inch deep metal box. Relay panel (24" x 24" x 6") can be mounted in any remote location.
- C. System will operate equipment individually and has custom program options for multiple equipment configurations such as "game day" or "practice" set-up. System has unlimited expandability for operating additional equipment by adding relay boxes.

2.4 VOLLEYBALL EQUIPMENT

A. Volleyball Floor Sleeves And Covers (One Set):

1. Model 6430 Cover plate shall be 6-1/4" diameter by 9/16" thick brass alloy with attached hinged cover. Diameter of opening shall be five (5) inches. Hinge and four holes in ring (for screwing into floor) shall be completely concealed under cover when in closed position, allowing for a completely flat surface. When installed in "floating" wood floors, floor plate is connected to floor only, allowing it to move with expansion and contraction of floor.
2. Model 6404 Sleeve shall be 3" I.D. steel measuring 9" long. Steel sleeve eliminates possibility of electrolysis between concrete and sleeve that occurs with aluminum sleeves. Sleeves made of aluminum shall not be considered as equal. Cover plate the sleeve are furnished as separate units to allow for any "floating" of playing surface.

B. Volleyball Standards (One sets):

1. Model No. 5100 Omni-Steel System including: standards, net, antenna, protective upright pads. Provide Model No. 5104 center standards as required for adjacent court layouts. Refer to drawings for configuration of court layouts.
2. Standards are 3" O.D. high strength, steel. The upper telescoping adjustable tube shall be 2 7/8" lightweight high strength aluminum. Uprights shall be removable type designed for use with in ground floor sleeves or above floor tee-bases. Upright shall be provided with adjustable high impact rubber foot to protect finished floors and allow for additional precise net adjustment. The uprights will have spring loaded infinite net height adjustment between 6' to 8'-4" to meet all age group height settings for both men and women. Standards shall meet NCAA, NFSHSA and USVBA specifications. The net tensioner shall incorporate a heavy duty, self-locking ratchet mechanism with a compression clutch brake release. A high tensile nylon strap will be used with the winch to achieve required net tension.

C. Standard Protective Pads (One sets):

1. Model No. 6010 volleyball standard protective pads. Provide model No. 6020 for center standards as required.
2. Pads shall be 72" high and fabricated from 1-1/4" thick polyurethane foam covered with 14 oz. vinyl coated nylon on the outside and jersey inner liner. Each pad shall be tailored to easily fold around upright and fastened by Velcro flaps, covering winch and net tensioning hardware. Front side of pad shall be furnished with an opening for attaching and tensioning bottom strap from net. Available in sixteen (16) standard colors (color to be determined by Architect). Standard pads to meet NCAA, NFSHSA and USVBA specifications.

D. Volleyball Net (One):

1. Model No. 7602 Collegiate volleyball net.
2. Net shall be 32' L x 39" H with #48 black nylon mesh measuring approximately 4" by 4" square. The net shall have a 2" white double thickness binding on all 4 sides. The end sleeves shall feature a 1" diameter wood dowel completely enclosed in vinyl. The net must meet NCAA, NFSHSA and USVBA specifications

E. Net Antenna (One):

1. Model No. 6412 antenna.
2. Antennae is secured firmly to the net by insertion in the full length pockets in then sidelines markers fully eliminating the possibility of the antennae dislodging from the net.

F. Storage Cart:

1. Model 6295 Storage Cart: Heavy-duty unit with swivel casters designed to store and transport standards, net, protection pads, and other components and accessories required for setting up volleyball court.

2.5 OTHER MATERIALS

All other materials, including but not necessarily limited to anchorage devices or the work of this Section, shall be only as recommended by the manufacturer and as approved by 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 proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

END OF SECTION

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.
- 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.

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 shade cloth.
 - 4. Solar Shade cloths:
 - 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 Shade cloth: 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.
 - 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.

- 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

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.
Moser Corp.

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.

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 Tops:

- A. Solid surfacing as manufactured by Wilsonart or Architect approved substitute, Color and finish selected by Architect from Price Groups 1 through 3. Adhesive: as recommended by manufacturer for substrate indicated.
- B. High pressure laminated plastic sheets, 0.048 inch thick on all exposed surfaces and edges as manufactured by Wilsonart International, or approved equal. Color and pattern as selected by Architect and Owner from manufacturer's standard and premium laminate colors.

2.2.2 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.

2.2.3 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.)

2.2.4 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.)

2.2.5 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.)

2.2.6 Bases: 3/4" thick x 4" wide exterior Pine or Fir Plywood applied separately to the bottom of base and tall storage cabinets.

2.2.7 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.

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.

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.

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.
- 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

TELESCOPING BLEACHERS

PART ONE - GENERAL

1.1 SUMMARY

- A. Section Includes: Telescoping Gym Seating includes, electrically operated systems of multiple-tiered seating rows comprising of seat, deck components, understructure that permits closing without requiring dismantling, into a nested configuration for storing or for moving purposes.
- B. Related Sections:
 - 1. Division 9 finishes sections for adequate floor and wall construction for operation of Telescoping Platforms. Flooring shall be level and rear wall plumb within 1/8" in 8'-0". Maximum bleacher force on the floor, of a 25'-6" section, shall be a static point load of less than 300 psi.
 - 2. Division 26 Electrical sections for electrical wiring and connections for electrically operated Telescoping Gym Seats.

1.2 REFERENCES

- A. National Fire Protection Association (NFPA)
 - 1. NFPA 102 Standard for Assembly Seating, Tents and Membrane Structures.
- B. American Welding society (AWS):
 - 1. AWS D1.1 Structural Welding Code - Steel.
 - 2. AWS D1.3 Structural Welding Code - Sheet Steel.
- C. American Institute of Steel Construction (AISC):
 - 1. AISC - Design of Hot Rolled Steel Structural Members.
- D. American National Standards Institute (ANSI).
- E. American Iron & Steel Institute (AISI):
 - 1. AISI - Design Cold Formed Steel Structural Members.
- F. Aluminum Association (AA):
 - 1. AA - Aluminum Structures, Construction Manual Series.
- G. American Society for Testing Materials (ASTM):
 - 1. ASTM - Standard Specification for Properties of Materials.

- H. National Forest Products Association (NFoPA):
 - 1. NFOPA - National Design Specification for Wood Construction.
- I. Southern Pine Inspection Bureau (SPIB):
 - 1. SPIB - Standard Grading Rules for Southern Pine.
- J. National Bureau of Standards/Products Standard (NBS/PS):
 - 1. PS1 - Construction and Industrial Plywood.
- K. Americans with Disability Act (ADA)
 - 1. ADA - Standards for Accessible Design.

1.3 QUALITY ASSURANCE

1.3.1 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.

1.3.2 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.

1.4 SUBMITTALS

1.4.1 General: Comply with the requirements of Section 01 33 23.

1.4.2 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.

1.5 PRODUCT HANDLING

1.5.1 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.

1.5.2 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.

1.6 WARRANTY

1.6.1 Manufacturer's Product Warranty: Submit manufacturer's standard warranty form for telescopic gym seating system with platform seats. This warranty is in addition to, and not a limitation of other rights Owner may have under Contract Documents.

- A. Warranty Period: Five years from Date of Substantial Completion.
- B. Beneficiary: Issue warranty in legal name of project Owner.
- C. Warranty Acceptance: Owner is sole authority who will determine acceptance of warranty documents.

1.7 MAINTENANCE AND OPERATION

- A. Instructions: Both operation and maintenance shall be transmitted to the Owner by the manufacturer of the seating or his representative.
- B. Service: Maintenance and operation of the seating system shall be the responsibility of the Owner or his duly authorized representative, and shall include the following:
 - 1. Operation of the Seating System shall be supervised by responsible personnel who will assure that the operation is in accordance with the manufacturer's instructions.
 - 2. Only attachments specifically approved by the manufacturer for the specific installation shall be attached to the seating.
 - 3. An annual inspection and required maintenance of each seating system shall be performed to assure safe conditions. At least biannually the inspection shall be performed by a professional engineer or factory qualified service personnel.

PART TWO – PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Hussey Seating Company, U.S.A.
 - 1. Address: North Berwick, Maine, 03906
 - 2. Telephone: (207) 676-2271; Fax: (207) 676-9690
 - 3. Product: MAXAM+ Telescopic Gym Seat System by Hussey Seating Company
 - a. MAXAM+ Series Telescopic Platform Seats, adjustable row spacing in 33 inches.
 - b. MAXAM+ Series Telescopic Platform Seats, Rise Spacing: 16”.
 - c. Aisle Type: foot level aisles, front steps, intermediate aisle steps.
 - (1) Seat Type:
 - (a) Metro Chairs color finish: manufacturers 19 custom colors.
 - (b) (See Personalization and Creativity under Accessories section)
 - d. Rail Type: Self-storing end rail, front railings, rear rails, store-in-place aisle hand rails.
 - (1) Rail color finish: Custom colors to match Metro Chairs. (See Personalization and Creativity under Accessories section).
 - e. Operation: Electric

- (1) Electrical Power System: SELECT: Integral power with wireless controller.
 - f. Platform Type
 - (1) Wall Attached Telescoping Platform
 - g. Chair Operation: Semi Automate
 - (1) Semi-Automatic Operation: Rows of chairs shall be manually raised or lowered as one unit with spring-counter-balance to offset weight. Semi-Automatic operation will require depressing a foot pedal to activate the unlocking system to lower each row of spring-counter-balanced chairs. Unlocking shall be performed from an aisle.
 - h. Chair Dimensions
 - (1) Seat up envelope: 15 1/8"
 - (2) Seat down envelope: 21 1/2"
 - (3) Seat height: 17 5/8"
 - (4) Armrest height: 25 1/4"
 - (5) Back height: 31 3/4"
 - i. Chair Construction: polymer seat, polymer back.
- 1. Product Description/Criteria: See drawings.
- 2. Net Capacity; See drawings.
Miscellaneous Product Accessories: seat number's, row letters, full bleed end curtains w/ school logo or design.
- 3. Special Applications: truncated units, elevated-front aisles, and front railing.
Handicap Seating Provisions: Provisions for handicap seating allocated in fixed seating area.
- 4. Strip Aisle Lights: To be (2) 6" [152] long x 5/16" [8] square strip aisle lights with housing mounted in each intermediate aisle step. Strip aisle lights will operate from 24 volts requiring a transformer system. Electrical components to be UL approved and should be installed by an electrician.

2.2 MATERIALS

- A. Lumber: ANSI/Voluntary Product 20, B & B Southern Pine
- B. Plywood: ANSI/Voluntary Product PS1, APA A-C Exterior Grade.
- C. Structural Steel Shapes, Plates and Bars: ASTM A 36.
- D. Uncoated Steel Strip (Non-Structural Components): ASTM A569, Commercial Quality, Hot-Rolled Strip.
- E. Uncoated Steel Strip (Structural Components): ASTM A570 Grade 33, 40, 45, or 50, Structural Quality, Hot-Rolled Strip.
- F. Uncoated Steel Strip (Structural Components): ASTM A607 Grade 45 or 50, High-Strength, Low Alloy, Hot-Rolled Strip.
- G. Galvanized Steel Strip: ASTM A653 Grade 40, zinc coated by the hot-dip process, structural quality.

- H. Structural Tubing: ASTM A500 Grade B, cold-formed.
- I. Polyethylene Plastic: ASTM D 1248, Type III, Class B; molded, color-pigmented, textured, impact-resistant, structural formulation; in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.
- J. Fasteners: Vibration-proof, of size and material standard with manufacturer.

2.3 UNDERSTRUCTURE FABRICATION

B. Frame System:

1. Wheels: Not less than 5" diameter by 1 1/4" with non-marring soft rubber face to protect wood and synthetic floor surfaces, with molded-in sintered iron oil-impregnated bushings to fit 3/8" diameter axles secured with E-type snap rings.
2. Lower Track: Continuous Positive Interglide System interlocks each adjacent CPI unit using an integral, continuous, anti-drift feature and through-bolted guide at front to prevent separation and misalignment. CPI units at end sections of powered banks and manual sections shall contain a Low Profile Posi-Lock LX to lock each row in open position and allow unlocking automatically. Provide adjustable stops to allow field adjustment of row spacings.
3. Slant Columns: High tensile steel, tubular shape.
4. Sway Bracing: High tensile steel members through-bolted to columns.
5. Deck Stabilizer: High tensile steel member through-bolted to nose and riser at three locations per section. Interlocks with adjacent stabilizer on upper tier using low-friction nylon roller to prevent separation and misalignment. Incorporates multiple stops to allow field adjustment of row spacings.
6. Deck Support: Securely captures front and rear edge of decking at rear edge of nose beam and lower edge of riser beam for entire length of section.

C. Deck System:

1. Section Lengths: Each bank shall contain sections not to exceed 19'-5" in length with a minimum of two supporting frames per row, each section.
2. Nose beam and Rear Riser beam: Nose beam shall be continuously roll-formed closed tubular shape of ASTM A653 grade 40, Riser beam shall be continuously roll-formed of ASTM A653 grade 40. Nose and Riser beam shall be designed with no steel edges exposed to spectator after product assembly.
3. Attachment: Through-Bolted fore/aft to deck stabilizers, and frame cantilevers.
4. Deck End Overhang: Not to exceed frame support by more than 5'-11".
5. Decking Option
 - a. Classic Wood Deck: 3/4", AC grade clear-top-coated tongue and groove Southern Yellow Pine; or BC grade polyethylene-top-coated tongue and groove Douglas Fir plywood; both of interior type with exterior glue, 5-ply, all plies with plugged cross-bands, produced in accordance with National Bureau of Standards PS-1-97. Plywood shall be cut and installed with top, center and bottom ply grain-oriented from front of deck to rear of deck (nose beam to riser beam). Adjacent pieces shall be locked together with tongue and groove joint from front to rear of deck. Longest unsupported span: MAXAM+, 28 1/2".

2.4 SEATING FABRICATION

Courtside XC10 Seat Module

- A. XC10 – 10” Comfort Profile
 - 10” wide continuous comfort curve style bench seat
 - Ergonomically contoured forward “waterfall” edge for enhanced spectator comfort and minimization of sensitive pressure point area, regardless of leg positioning.
 - Fore & Aft contoured seat surface for uniform support and minimize high pressure points under the buttocks.
 - Seat height ranges from deck to t/o seat range from 16-1/8” to 18-1/8”
 - 21-1/2” clear foot space area, regardless of leg positioning.
- B. Integrally molded end caps at aisle end locations for clean finished appearance.
- C. Optional: Custom color graphic logo design application for end cap insert.
- D. Integrally molded recess pockets to accept seat number and row letters.
- E. Integrally molded rear closure panel at back of seat to allow for “continuous clean sweep” of debris at deck level and minimized visibility of structural ribbing.
- F. Seat Attachment: Each plastic seat module shall be securely anchored by a 12 ga steel clamp bracket that provides a steel-to-steel, through bolted attachment to the front nose beam of the bleacher. Attachment eliminates fore / aft movement of the seat module on the nose beam.
- G. Bold contoured design lines for maximum architectural appeal and application with modern or traditional facility spaces.
- H. Integrally molded end caps at aisle end locations for clean finished appearance.
- I. Optional: Custom color graphic logo design application for end cap insert.
- J. Integrally molded recess pockets to accept seat number and row letters.
- K. Integrally molded rear closure panel at back of seat to allow for “continuous clean sweep” of debris at deck level and minimized visibility of structural ribbing.

Seat Attachment: Each plastic seat module shall be securely anchored by a 12 ga steel clamp bracket that provides a steel-to-steel, through bolted attachment to the front nose beam of the bleacher. Solid attachment of clamp to nose beam eliminates fore / aft movement of the seat module on the nose beam.

2.5 SHOP FINISHES

- A. Understructure: For rust resistance, steel understructure shall be finished on all surfaces with black "Dura-Coat" enamel. Understructure finish shall contain a silicone additive to improve scratch resistance of finish.

- B. Wear Surfaces: Surface subject to normal wear by spectators shall have a finish that does not wear to show different color underneath:
 - 1. Steel nosing and rear risers shall be pre-galvanized with a minimum spangle of G-60 zinc plating.
 - 2. Decking shall have surfaces to receive a sealer coat with use surfaces to receive high gloss clear urethane finish.
- C. Railings: Steel railings shall be finished with powder coated semi - gloss black.

2.6 FASTENINGS:

- A. Welds: Performed by welders certified by AWS standards for the process employed.
- B. Structural Connections: Secured by structural bolts with prevailing torque lock nuts or Free-spinning nuts in combination with lock washers.

2.7 ELECTRICAL OPERATION

- A. Integral Power: Furnish and install Hussey PF (1/2/3/4), an integral automatic electro-mechanical powered frame propulsion system, to open and close telescopic seating. Integral Power and Control System shall be Underwriters Laboratories, Inc. (UL) approved and listed.
 - 1. Operation shall be with a remote control unit which plugs into seating bank for operator management of stop, start, forward, and reverse control of the power operation.
 - 2. Each Powered Frame unit shall consist of output shaft gear reducer with 6" diameter x 4" wide wheels covered with non-marring 1/2" thick composite rubber. Reducers shall be fitted with 3 phase induction motors which will provide an average operating speed of (46/25) f.p.m.
 - 3. Operating Loads: Each Powered Frame provides (220 / 550) lbs pull force which equals approximately (28 / 35) psi lateral force on the floor..
 - 4. Electrical: Seating Manufacturer shall provide all wiring within seating bank including remote control.
 - a. The electrical contractor shall provide required power source with no greater than 4% voltage drop at the seating's junction box. The electrical contractor shall perform all wiring connections in junction box that are attached to or a part of the building.

2.8 ACCESSORIES

- A. Flex-Row: Provide first row modular recoverable seating units to be utilized by persons in wheelchairs and able-bodied persons. Each Flex-Row unit shall have an unlock handle for easy deployment if wheelchair or team seating access is needed. Unlock handle shall lock the bleacher seats into position when fully opened.
 - 1. Provide a black full-surround steel skirting with no more than 3/4" floor clearance for safety and improved aesthetics.
 - 2. Provide a black injection molded end cap for the nose beam for safety and improved aesthetics.

3. Provide a mechanical positive lock when the Flex-Row system is in the open and used position.
 4. Flex-Row modular units are designed to achieve multi-use front row seating to accommodate team seating, ADA requirements and facility specific requirements. Flex-Row units are available in modular units from 2 to 7 seats wide as well as full section widths.
- B. Front Aisle Steps: Provide at each vertical aisle location front aisle step. Front steps shall engage with front row to prevent accidental separation or movement. Steps shall be fitted with four non-skid rubber feet each 1/2" in diameter. Blow molded end caps shall have full radius on all four edges. Quantity and location as indicated.
- C. Non-Slip Tread: Provide at front edge of each aisle locations an adhesive-backed abrasive non-slip tread surface.
- D. Foot Level Aisles: Provide deck level full width vertical aisles located as indicated.
- E. Intermediate Aisle Steps: Intermediate aisle steps shall be of boxed fully enclosed type construction. Blow molded end caps shall have full radius on all four edges. Step shall have non-skid on surface. Quantity and location as indicated.
- F. Intermediate Aisle Handrails: Provide single pedestal mount handrails 34" high with terminating mid rail. Handrails shall be attached to the socket and shall rotate 90° for easy storage in socket. Aisle handrails that are detached from the socket for storage are unacceptable.
- G. Self Storing End Rails: Provide steel self-storing 42" high above seat, end rail with tubular supports and intermediate members designed with 4" sphere passage requirements.
- H. Safety Accessories: Provide the following safety features:
1. Coin Round or Roll all edges of exposed metal on top and underneath Bleacher to eliminate sharp edges. Provide safety ease edges, coined edges, or rounded edges for the bleacher understructure components as follows. Diagonal or X braces and deck support or deck stabilizers. Systems provided with sharp edges or corners, to be rounded off in the field and field painted.
 2. Provide plastic end cap on nose metal at Bank ends to close off edges to prevent spectator injury.
 3. Provide plastic end cap on back of deck supports on 1st 7 Rows to prevent spectator injury.
 4. On 1st Row, provide front and side skirt boards any where there is an exposed end to prevent players/balls from sliding underneath the 1st Row.
 5. Provide metal cover over motor chains and wheels to protect chains from debris and provide a safety switch that if cover is taken off the power system will not work.
 6. Provide metal end deck cover on each row to cover exposed edge of plywood at the ends of the bleachers.
 7. Powered frames systems without a metal protective housing, covering drive chain and drive wheels are not permitted under this specification.

PART THREE - EXECUTION

3.1 EXAMINATION

3.1.1 Verification of Conditions: Verify area to receive telescoping Platform seats are free of impediments interfering with installation and condition of installation substrates are acceptable to receive telescoping Platform seats in accordance with telescoping Platform seats manufacturer's recommendations. Do not commence installation until conditions are satisfactory.

3.2 INSTALLATION

3.2.1 Manufacturer's Recommendations: Comply with telescoping Platform seats manufacturer's recommendations for product installation requirements.

3.2.2 General: Install telescoping Platform seats in accordance with manufacturer's installation instructions and final shop drawings. Provide accessories, anchors, fasteners, inserts and other items for installation of telescoping Platform seats and for permanent attachment to adjoining construction.

3.3 ADJUSTMENT AND CLEANING

3.3.1 Adjustment: After installation completion, test and adjust each telescoping platform seats assembly to operate in compliance with manufacturer's operations manual.

3.3.2 Cleaning: Clean installed telescoping Platform seats on both exposed and semi-exposed surfaces. Touch-up finishes to restore damage or soiled surfaces.

3.4 PROTECTION

3.4.1 General: Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer to ensure Telescoping Platform seats are without damage or deterioration at time of substantial completion.

END OF SECTION

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 MR-24 panels and VSR panels (both where designated on drawings) 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 as manufactured by Butler Manufacturing Co.:

- A. MWP– 12" wide, 22 gauge panel with a 1" depth. Panel shall have concealed fasteners and supplied with a factory applied color coating selected from manufacturers standard colors.

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.

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 $P_m = I_s \times P_g$
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 $< 1/2:12$.
- e. Ultimate wind speed is 112 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
 $S_s = 0.319$
 $S_1 = 0.137$
 $S_{ds} = 0.276$
 $S_{d1} = 0.137$
Site Class = C
Seismic Design Category = C
Seismic Importance Factor; $I_e = 1.25$
- 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. UNIFORM ROOF LOADS

All roof framing – 8.5 psf.

2. CONCENTRATED ROOF LOADS

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.

<u>MEMBER</u>	<u>SPECIFIED DEFORMATION</u>	<u>MAXIMUM</u>	<u>LOADING</u>
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
Beams Supporting Masonry	Vertical deflection	L/600 (0.3" maximum)	DL+LL+Collateral 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.

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, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems." Manufacturers are not required to be certified by the International Accreditation Service (IAS), but must meet the technical criteria. Upon successful bidding, the manufacturer 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. Manufacturers meeting this criteria shall be considered approved fabricators and not subject to Special Inspections of the IBC 2021. However, approved fabricators shall submit a certification of compliance found in Section 01450 - Special Inspections to the building official at the completion of fabrication.

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.

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).

2.6 ROOF PANELS

2.6.1 The exposed metal roof covering shall be 24-gauge 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, MR-24 and VSR or equal, secured to the purlins with a concealed structural fastening system. (Refer to the drawings for panel designation location.) 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 MISCELLANEOUS

2.7.1 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 WALL SYSTEM

2.8.1 Refer section 1.2.5 for panel description.

2.8.2 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.

2.8.3 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.

2.8.4 Solid Soffit Panels, 24 gauge 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.

2.9 INSULATION

2.9.1 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.

2.9.2 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.

2.10 MISCELLANEOUS FRAMING

2.10.1 Provide frames for all mechanical openings as required.

2.10.2 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.

2.10.3 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.

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:

<u>Type of Weld</u>	<u>Position of Welding</u>
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.

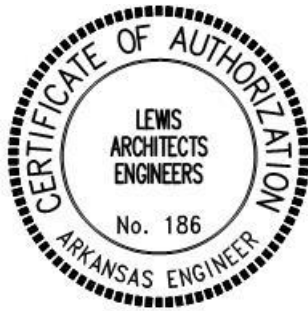
3.6 INSPECTION

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

The Engineer of Record for East End Elementary, Sheridan School District, Hensley, Arkansas Divisions 21 and 22 of the specifications.

May 18, 2026



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 Sheridan East End Elementary in accordance with the specifications and plans, with no additional cost to the Owner unless the scope of the building changes.

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 which has a level 3 certification as provided by NICET. Coordinate fire service, double check assembly and service entrance location shown on plumbing documents. (Refer to C1.2, P1.2 and P2.1.)
3. Designer shall perform current flow test to determine volume and pressure of supply water. Flow test shall be coordinated with Sheridan Fire Dept. Preliminary design may be based on 60 PSIG static and 50 PSIG residual at 1061 GPM.
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 – PE 102 (Area A) is Category D and Seismic Use Group 3 with a Component Importance Factor (I_p) = 1.5.
 - a. The Fire Protection Designer shall be familiar with Section 1613 of the 2021 Arkansas Fire Prevention Code (2021 International Building Code) and American Society of Civil Engineers Standard ASCE7 guidelines such that the system and components are installed to comply.
 - b. Seismic design and construction of the sprinkler system may be in accordance 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 PE 102, 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.
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. Engineer approved

1.1.2 Work shall include, but shall not necessarily be limited to the following:

- 1. All underground piping, which pertains to the fire protection system, which includes the underground main from point of demarcation valve into building, as indicated on the drawings, and/or necessitated by the design, including all required pipe, valves, as well as the required preparatory and finishing work such as trenching and backfilling.
- 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.
- 2. Plot plan indicating location of all underground connections, control valve, piping, and all related items, location of exposed structures within 15'0" of building.
- 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 New Elementary, Sheridan School District, Hensley, 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. Backflow preventer assembly test data.
 - j. All information required to effect or secure emergency repairs or service.

PART TWO - PRODUCTS

2.1 UNDERGROUND MATERIAL

2.1.1 Fire service piping shall be Class 50 ductile iron as manufactured by Johns-Manville and shall meet the requirements of ANSI/AWWA C15YA21.5. Joints shall be bell and elastomeric ring. Fittings shall be mechanical joint ductile iron.

2.1.2 Mechanical joint fittings: Fittings shall be as manufactured by Tyler Pipe Company and shall comply with ANSI A21.10, ANSI A21.11 and Federal Specifications W-P-421c.

2.1.3 Mechanical joint iron gate valve: Gate valve shall be Kennedy model 8071SS. Cast iron resilient wedge with handwheel or operating nut as required.

2.1.4 Piping below slab and 5'0" from building shall be Class 50 Ductile Iron with bell and elastomeric ring joints and ductile iron mechanical joint fittings. Provide in-building riser at entrance riser to pass below foundation equal to Ames IBR.

2.2 INSIDE MATERIAL

2.2.1 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.

2.2.2 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.

2.2.3 Welded branchlet fittings: Fittings shall be UL listed and rated for 300 lb. service and shall be manufactured by Allied Piping Products Company, Inc.

2.2.4 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.

2.2.5 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.)

2.2.6 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.

2.2.7 Check valves: Valve shall be bronze mounted with bronze faced disc, equal to Kennedy Figure 126.

2.2.8 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.

2.2.9 Alarm Check Valve: Viking Model J-1, Ductile Iron Class 150, 250 PSI maximum working pressure complete with trim package, UL/FM approved.

2.2.10 Water pressure gauge: Gauge shall be Grinnell or equal, 0-300 lbs. in 5 lb. increments, brass case, 3-1/2" diameter.

2.2.11 Water flow indicator: Indicator shall be Grinnell Model VSR-F or equal, Vane Type waterflow detector.

2.2.12 Electric Alarm Bell: Potter MBA-10-24, 10" Bell. Coordinate 24V wiring.

2.2.13 Automatic ball drip: Check valves for siamese fittings shall be provided with Potter-Roemer, Inc., No. 5980 or equal, automatic ball drip, piped to drip over drain.

2.2.14 Tamper switch: Switch shall be Potter Roemer Fig. 6220 or equal for gate valve and Fig. 6223 for post indicator valve.

2.2.15 Post Indicator: Mueller P-2360-6 or equal N.R.S. Resilient Wedge Gate Valve. Post shall be equipped with tamper switch.

2.2.16 Fire Department connection: Siamese fitting wall mounted shall be Potter-Roemer, Inc., No. 5023-D or approved equal, fire department connection, 4" outlet single body, two-way inlet with plugs and chain, lettering shall read "AUTOMATIC SPRINKLER", 4" x 2 1/2" x 2 1/2" with rough chrome plated body and polished chrome plated trim. Hose coupling threads shall be Sheridan Fire Department standard threads. (or Storz 6352 5" inlet connection with 30 degree turndown.)

2.2.17 Double check detector assembly:

1. Furnish and install where shown on the drawings AMES 3000SS-OSY or approved equal, double check detector assembly backflow preventer, equipped with cubic feet per minute, 5/8 inch by 3/4 inch meter and ball type test cocks, UL listed resilient seated OS&Y shut-off valves.
2. Unit shall have stainless steel construction, bronze seat and disc holder, stainless steel trim and durable, tight-seating rubber check valve discs, bronze body ball type test cocks and record-all e/r inch bronze meter.
3. Valves shall be equipped with tamper switches.

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. Provide siamese fire department connection on wall at 36" above grade.

5. 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.
6. Backfilling and trenching for piping:
 - a. Excavate to the depths indicated on the Drawings or as otherwise specified. Excavated materials not required or suitable for backfill or fill shall be removed from the site. Do such grading as is necessary to prevent surface water from flowing into trenches or other excavations. Water 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.
 - b. Trench excavation: Bottom of trench for fire protection sprinkler 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.
 - c. 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, shall be protected from damage during excavation and backfilling, and if damaged, shall be repaired by the Contractor, at his expense.
7. Backfilling of trenches:
 - a. Trenches shall not be backfilled until the utilities systems as installed conform to requirements of Drawings and Specifications.
 - b. 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.
 - c. 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.
8. Before assembly of couplings, lightly coat pipe ends and outside of gaskets with cup grease or graphite paste.
9. O S & Y valves and post indicator valves, where shown on the drawings, shall be electrically supervised with a tamper switch wired to alarm bell at central panel. Coordinate wiring for tamper switches with electrical contractor.
10. 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.
11. 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.

12. Provide a spare head cabinet in riser room with twelve (12) extra sprinkler heads and wrench.
13. 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 guarantee period, 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

PLUMBING

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, 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.

1. Systems of sanitary waste and vent piping.
2. Systems of domestic cold and hot water.
3. Systems of storm/roof drain piping.
4. Systems of HVAC condensate piping.
5. Systems of gas piping.
6. Plumbing fixtures and accessories.
7. Insulation.
8. Miscellaneous equipment and accessories.
9. 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.

1. National Electrical Code.
2. American Gas Association Recommended Practices.
3. National Fire Protection Association Recommended Practice.
4. Local, City and State Codes and Ordinances.
5. American Society of Mechanical Engineers Plumbing and Air Conditioning Codes.

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:

1. Plumbing fixtures and accessories.
2. Domestic water heaters.
3. Pumps, valves and regulators.
4. Documentation of water and sewer piping type and manufacturer.
5. Piping labels and valve tags.
6. Water hammer arrestors.
7. 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.

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.

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.

1.14.2 All kitchen equipment shall be roughed-in per kitchen equipment suppliers submittal drawings. Contractor shall not proceed to install waste pipe or water below slab until he has reviewed the submittal drawings. Connection of refrigerator/freezer condensate lines, dishwasher/collector lines and all equipment connections shall be included.

1.15 CLOSE-OUT DOCUMENTS

1. Operation and maintenance manuals (Section 22 01 00, paragraph 1.7).
2. Approved shop drawings (Section 22 01 00, paragraph 1.3).
3. As-built drawings (Section 22 01 00, paragraph 1.8).
4. Backflow preventer test report.

PART TWO - 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 Grease Waste – Interior/Exterior:

1. All grease waste piping shall be coated cast iron equal to Charlotte Edge HP Iron Hub and Spigot. Pipe coating shall be chemically deposited zinc-phosphate pretreatment layer followed by an electrically deposited, high-performance cathodic epoxy coating, and finally an electrically deposited, high-performance anodic epoxy top coat. Fittings shall be pretreated same as piping with a top coat of epoxy acrylic powder. Gaskets shall comply with ASTM C564 rubber.
2. Grease waste vents shall be SCH 40 PVC with solvent welded fittings as specified for non-grease waste piping.
3. Horizontal grease waste shall be 2 percent slope minimum (1/4 inch per foot).

2.1.3 Domestic water piping, interior:

2.1.3.1 Interior piping shall be type "K" copper below grade to 5'0" beyond building foundation and type "L" copper above grade. Piping 4 inches and larger installed below grade shall be epoxy coated ductile iron with mechanical joints coated with mastic and covered with two layers of 6 mil visqueen, secure with duct tape. 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.

2.1.3.2 Water hammer control:

1. 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.
2. All arrestors shall be maintenance free and concealable in wall, pre-tested to last life of system.
3. Air chambers are not acceptable.

2.1.4 Soil, waste, and vents – exterior (non-grease waste):

2.1.4.1 Lines beyond 5'0" from building line shall be SDR-26 heavy wall PVC gasketed sewer pipe. Piping shall be as manufactured by Charlotte Pipe or approved equal.

2.1.4.2 PVC pipe for sanitary sewers shall conform to the latest revision of ASTM Designation D3034 (Type PSM) and shall have a minimum Standard Dimension Ratio (SDR) of 26. The pipe shall have a minimum pipe stiffness (F/dY) of 115 psi at 5% deflection as defined in ASTM D2412.

2.1.4.3 The pipe shall be made of a plastic having a cell classification of 12454-B as defined in ASTM D1784. All pipe and fittings shall be tested in accordance with ASTM Designations D2412, D2152, and D2444.

2.1.5 Storm/Roof Drain - interior:

2.1.5.1 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.

2.1.5.2 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.

2.1.5.3 Horizontal roof drains and piping shall be insulated per section 3.2 Insulation.

2.1.6 HVAC Condensate Drain Piping – Interior and Exterior:

2.1.6.1 Underground and under slab condensate drain pipe, inside building and 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. 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.

2.1.6.2 Fittings shall be solvent welded DWV-PVC, complying with ASTM D2665 Standard, and listed by NSF as manufactured by Lasco Fluid Distribution Products.

2.1.6.3 The bedding and cover material for PVC condensate piping shall be free of any solid material.

2.1.6.4 Piping located in a return air plenum shall be cast iron or enclosed with non-combustible material.

2.1.6.5 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.

2.1.7 Water service entrance piping:

2.1.7.1 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 Designed 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

2.1.8 Gas Piping:

2.1.8.1 Above grade:

2.1.8.1.1 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.

2.1.8.2 Below grade:

2.1.8.2.1 All gas pipe below grade, and exterior of building, shall be approved plastic pipe unless otherwise indicated on plans or directed by local gas company. Plastic pipe shall conform to ASTM-D2513 and shall be installed per Arkansas Gas Code. An approved transition riser shall be used when connecting between plastic and steel. Provide tracer wire along entire length of all plastic below grade. Tracer wire shall not come in contact with the plastic pipeline. Tracer wire shall be 12 GAUGE, THHN copper.

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.

1. 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.
2. Hangers for pipe sizes 2 inch and over shall be carbon steel adjustable, clevis type, Grinnell Fig. 260.
3. Wall support shall be welded steel bracket with wrought steel clamp Grinnell Fig. 194, 195 or 199 as required, or approved equal.
4. 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.
5. 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.
6. Hangers for piping which is insulated with fiberglass insulation shall be installed on exterior of insulation.
7. Support vertical pipes at each floor level and at each coupling or union, using riser clamps which are supported by the floor.
8. Provide copper plated hangers and supports for copper piping which is not insulated.
9. Place hangers within 12" of each horizontal elbow.
10. 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.

2.3.5 Hanger rods shall be sized as follows:

<u>Pipe Size</u>	<u>Rod Diameter</u>
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.

2.3.6 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.

1. Mount pipes to trapeze with two piece pipe straps sized for outside diameter or pipe, B-line series B2000 series.
2. For pipes subjected to axial movement:
 - a. Strut mounted roller, support, B-line series B3126. Use pipe protection shield or saddles on insulated lines.
 - b. Strut mounted pipe guide, B-line series B2417.
3. All rods on trapeze hangers shall be 1/2" minimum.
4. 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.

<u>TYPE</u>	<u>SIZE RANGE</u>	<u>MODEL</u>
<u>Domestic Water</u>		
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
<u>Gas</u>		
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
Plug	1" to 2" (interior only)	A.Y. McDonald 10596 flat/T-head iron bronze body with check, FNPT thread

<u>TYPE</u>	<u>SIZE RANGE</u>	<u>MODEL</u>
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)
Plug	2-1/2" & larger	Nordstrom 142
Plug	(below grade)	Milliken 171M/201M (flange)
<u>Compressed Air</u>		
Ball	2" & smaller (Threaded)	Apollo 94A with yellow handle

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.

1. 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.
2. 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.
3. 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 P-traps for HVAC equipment condensate shall be same as specified for floor drains.

2.6.3 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.

2.8 CONCRETE THRUST BLOCKS

2.8.1 Install thrust blocks on water main or service at each change of direction and as indicated on drawings. Thrust block shall have a minimum compressive strength of 3000 psi at 28 days. Blocking shall be supported by undisturbed soil.

2.9 TANKLESS WATER HEATER

2.9.1 Water heaters(s) shall be externally mounted, instantaneous, multiple point-of-use, gas fired, direct vent, water heater(s) design certified to the ANSI Z2.1 Z21.10.3 standard for gas fired water heaters.

2.9.2 Each water heater shall produce no more than 55 ppm NOx emissions when tested in accordance with the Rules and Regulations of the South Coast Air Quality Management District (SCAQMD).

2.9.3 Water heater(s) shall be configured to operate with natural gas and a 120 volt/60 Hz AC power source.

2.9.4 Water heater(s) shall have a BTU input range of 19,000 BTU/hr to 199,000 BTU/HR, a minimum thermal efficiency rating of 97% and a minimum hot water outlet capacity of 9.8 gallons per minute (with a 30° F temperature rise) and .4 GPM activation.

2.9.5 Water heater(s) shall be microprocessor controlled and utilize a direct electronic ignition system (with no standing pilot), full modulating gas control valve, turbine flow meter, automatic electro-mechanical water flow control valve, and water temperature thermistors to maintain outlet water temperature between $\pm$ 2° F of setpoint temperature.

2.9.6 Water heater(s) shall incorporate the following internal safety devices: flame failure lockout, boiling protection lockout, thermal overheat protection, internal freeze protection for ambient temperatures as low as -30° F, and lockout protection in the event of a blocked flue.

2.9.7 Water heater(s) shall be provided with a temperature thermostat with an adjustable setpoint range of 98 ° F to 140 ° F.

2.9.8 Water heater(s) shall also be capable of storing and displaying a history of up to 9 diagnostic maintenance codes, via the display on the temperature thermostat controller.

2.9.9 Water heater(s) shall have stainless steel burners, solid brass water flow control valve, and solid brass inlet and outlet water connections.

2.9.10 Water heater(s) shall have the following accessories:

- a. Plumbing installation kit.
- b. EZ connect cable for manifold of 2 units/ MSA-2M and MSA-2S as required for manifold of 3 or more units.
- c. 38" concentric roof or wall termination kit as indicated on plan.
- d. Vent and intake piping shall be as recommended by manufacturer.
- e. Required vent pipe extensions and elbows.
- f. Pipe clamps.
- g. Roof/wall flashing assembly.
- h. Control-R wireless module to allow for user access via phone app.

2.9.11 Water heater(s) shall have a heat exchanger warranted against material defects or workmanship for a period of:

- a. 3 years from date of purchase
- b. All other parts shall be warranted against material defects or workmanship for a period of 5 years from the date of purchase or 3 years from date of purchase when used as a circulating water heater within a hot water circulation loop.

2.9.12 Install water heater(s) (including the piping and venting components) in accordance with manufacturer's operation and installation manual. Contractor shall provide the services of a local factory authorized representative to supervise all phases of equipment start-up and training prior to install. A letter of compliance with all factory recommendations and installation instructions shall be submitted to the engineer with operation and maintenance instructions.

PART THREE - 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.

3.1.3 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 Acid Waste Piping (AW): Pipe and fittings shall use electrofusion as the standard method of joining. In easily accessed, open areas, the engineer may allow mechanical joint fittings. If the MJ fitting assembly required grooving the pipe, then Schedule 80 pipe is required.

3.1.4.4 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.

3.1.4.5 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 roof and 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.

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 Sleeve and vent under floor with coated and/or wrapped black steel as required by code and where shown on the plans. Sleeves shall be minimum of 2" diameter but at least two (2) pipe sizes larger than the gas pipe; vent sleeves at each end by stubbing two (2") inches above floor and packing with steel wool. Outside sleeves shall be vented by stubbing 1" vent into top of sleeve and rising to 8" above grade with 180 degree elbow to keep out rain. Cap open ends of sleeves to keep out water and vent as required by code.

3.1.12.4 Gas regulators shall be Sensus Model 243-8 (7"-14" WC), size and capacities as required for pounds to ounce service. Model 043 may be used for low pressure/low demand appliances.

3.1.12.5 Provide electrodes, sleeves, vents, valves, and comply with all applicable portions of the 2006 Arkansas Fuel Gas Code. Minimum depth below grade shall be 18".

3.1.12.6 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.

3.1.12.7 Gas line shall not be run thru return air plenums unless sleeved and vented at both ends.

3.1.12.8 See paragraph 3.1.6 for gas support on roof.

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:

1. Natural Gas	4. Cold Water
2. Hot Water	5. Sanitary Sewer
3. 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 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						
INSULATION THICKNESS FOR PIPE SIZES						
COLD WATER AND ROOF DRAIN LINES		0.5" THICKNESS				
Service Water Heating Tempature	Noncirculating runouts 3/4" and less not exceeding 12 ft. in length	Circulating Main & Runouts (see note)				
		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.
- 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 and 400 Series for PVC (when specified). Furnish extensions and accessories as required for offset tailpiece, 2-compartment sink and disposer installations. Wrap 1/2" Armaflex sheet insulation around disposer with glued joints and seams as required for protection.

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.

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.

3.10.3 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, shall be protected from damage during excavation and backfilling, and if damaged, shall be repaired by the Contractor, at his expense.

3.10.4 Separation of private utilities: Water, gas and sewer piping shall be installed in separate trenches. In no case shall any utility piping be installed in same trench as electrical lines, TV cable, intercom, etc. The underground water service pipe and the building drain, or building sewer shall not be less than 10 feet apart horizontally and shall be separated by undisturbed or compact earth. When approved by Engineer the water and sewer may be installed in same trench provided the water is 12" above the sewer at all points. The combining of gas and water must be approved by the Engineer and the Local Administrative Authority.

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

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	31" AFF to rim (K thru 6)
	2'10" AFF to rim (Adult)
Water Closet	15" AFF to top of seat (K thru 3)
	17 3/4" AFF to top of seat (Adult)
Drinking Fountain	38"/30" AFF to spout – Hi/Lo (K thru 6)
	42"/36" AFF to spout – Hi/Lo (Adult)

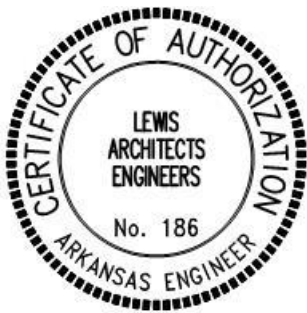
3.16.2 All handicapped fixtures to meet requirements of the Americans with Disabilities Act (ADA) 2010.

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

The Engineer of Record for East End Elementary, Sheridan School District, Hensley, Arkansas Division 23 of the specifications.

May 18, 2026



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.

- 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. Kitchen Hoods
 - g. Manual Dampers
 - h. Electric (Gas) Heaters
 - i. Exhaust Fans
 - j. Duct Takeoffs
 - k. Fabric Duct
 - l. 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.

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.

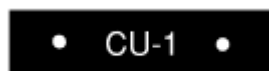
1.8 OPERATION AND MAINTENANCE INSTRUCTIONS

- 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, etc.) 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:



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.
- 1.10.2 Contractor shall review all kitchen rough-in drawings before proceeding with work in kitchen area and shall install ductwork, connections, etc. as indicated on the Drawings.

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:

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.

2.5 CONDENSING FURNACE EXHAUST, CONDENSATE AND INTAKE PIPING AND FITTINGS

- 2.5.1 Piping and fittings shall be schedule 40 PVC conforming to ASTM D1785, D2466 and D2665. PVC primer and cement shall be per ASTM D2564.
- 2.5.2 Piping and fittings, including intake and exhaust piping terminations, shall be sized and installed in strict accordance with manufacturer's recommendation.

- 2.5.3 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).
- 2.5.4 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.
- 2.5.5 Pipe hangers shall be carbon steel adjustable Clevis type, Grinnell Fig. 260 with all-thread rod to structure.
- 2.5.6 Insulate PVC intake and exhaust piping with ¾" Armaflex II pipe insulation as specified for refrigerant piping (2.10.3)
- 2.6 CONDENSATE LINES
 - 2.6.1 Condensate lines shall be Schedule 40 PVC (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.
- 2.7 REFRIGERANT PIPING AND FITTINGS
 - 2.7.1 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.
 - 2.7.2 Joints shall be made with wrought copper fittings and silfos or copper pressure-seal fittings.
 - 2.7.2.1 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.
 - 8. Minimum Allowable Burst Pressure: In accordance with UL 207: 2100 psig.

- 2.7.3 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.
- 2.7.4 Do not run refrigerant lines thru return air plenum unless approved by engineer.
- 2.7.5 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.
- 2.7.6 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.
- 2.7.7 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.
- 2.7.8 Filter dryers and sight glasses are not required for ductless split systems.
- 2.8 MECHANICAL EQUIPMENT
- 2.8.1 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.
- 2.8.2 All electrical wall heaters shall be mounted at 12" A.F.F. unless noted otherwise.
- 2.8.3 Kitchen hoods:
- A. Provide and install a kitchen ventilation hood as manufactured by Greenheck, or approved equal. The hood shall be Model "GX" wall type hood with integral Ansul fire suppression system and back supply hood model "GBSP".
 - B. Overall hood dimension CFM and opening sizes shall be as scheduled on the drawings. Island type shall be provided with a stainless steel divider section between back-to-back hoods.
 - C. Hood shall be constructed with 18-gauge type 304 stainless steel. Internal construction shall consist of galvanized structural steel framing members as required to prevent flexing and fatigue of the inner and outer shells. The assembly at the joints and seams on the hood shall be liquid tight. All external welds shall be ground smooth. Hood shall be UL Classified and fabricated in accordance with NFPA bulletin No. 96, and shall bear the National Sanitation Foundation (NSF) seal of approval.

- D. Hood shall include a filter housing constructed of stainless steel and shall be complete with UL classified aluminum grease filters of sufficient number and sizes to insure optimum performance as specified by the manufacturer. The filter housing shall terminate into an internally pitched full-length grease cup. Filters shall be UL classified, aluminum baffle type.
- E. Hood shall contain UL listed, vapor-proof, marine light fixtures at three (3) foot on centers. Lights shall be pre-wired to a junction box on top of the hood suitable for field connection to power. Lights shall be switched from the control panel on the face of the hood. All wiring shall conform to the requirements of the National Electrical Code.
- F. Hood shall include a stainless steel fire suppression system cabinet mounted on side as indicated on drawings. A flush mounted control panel shall be located on the face of the cabinet. The panel shall include (2) ON/OFF toggle-type switches for control of the hood lights and the exhaust fan. (The supply blower shall be interlocked with the exhaust fan). Panel installation shall have a stainless steel bezel plate with integral etched switch and lamp function description.
- G. Provide concealed, threaded hanger rods to support the hood from the building structure.
- H. Provide 100 watt incandescent lamps as required for hood.
- I. The fire suppression system shall be Ansul Model R-102, or approved equal, pre-engineered liquid agent, cartridge-operated type with fixed nozzle agent distribution network. The system shall be completely factory pre-piped and the agent cylinder and controls shall be housed in a factory assembled cabinet. The system shall be capable of automatic detection and actuation. The system shall be UL 300 listed and shall meet NFPA standards.
- J. The extinguishing agent shall be a mixture of organic and inorganic salts. The agent tank shall be constructed of stainless steel or deep drawn carbon steel finished in red enamel. The tank shall incorporate an adaptor/tube assembly with vent plug integral to the adaptor.
- K. The regulated release mechanism shall be the spring-loaded mechanical/pneumatic type and shall contain a factory installed regulator deadset up 100 psig with an internal relief. The mechanism shall have a visual indicator of the cocked or fired position without having to open the enclosure. The release mechanism shall be activated either automatically by fusible link detection, or by remote manual pull station, or by pushbutton on the front of the release mechanism enclosure. When more than two (2) agent tanks are required, regulated actuators shall be furnished to provide for expelling gas from additional tanks to simultaneously discharge agent.
- L. Detection system shall be of the fusible link type. Fusible links shall be selected and installed according to the operating temperature in the ventilating system. The detector bracket-linkage assembly shall be selected and installed according to the operating temperature in the ventilating system. The detector bracket-linkage assembly shall be connected by 1/16" diameter flexible stainless steel rope in 1/2" rigid steel or EMT conduit. Changes in direction of the conduit and steel rope shall be accomplished with die cast aluminum alloy 90° pulley elbows.
- M. Discharge nozzles shall be tested and listed for specific applications. The nozzle tip shall be brass or chrome-plated brass and nozzle strainers shall be brass with a stainless steel 50-mesh screen. Nozzle tips shall be covered by a protective blow-off cap.

- N. System shall be provided with a remote manual pull station. Pull station shall be of the break rod type and connected to the release mechanism trip lever by means of 1/16" diameter stainless steel rope in 1/2" conduit. Electrical Contractor shall provide J-box and conduit to ceiling space for pull station.
- O. Furnish to the Plumbing Contractor a UL listed mechanical gas valve in the gas line serving the equipment under the head. Field verify gas line size. Valve shall have an external visual indicator of closed or open position.
- P. Provide an UL listed, electric "dual" snap-action switch to shut off electrical power to appliances located under the hood and energize fire alarm system. Switch shall have a rating of 15 amperes at 125 VAC. (See control diagram on electrical drawings).
- Q. Supply fan shall be interlocked with the fire suppression system to shutdown upon system discharge. (By Electrical Contractor).
- R. Hood manufacturer shall provide start-up supervision and field hook-up and testing of the fire suppression system by a factory authorized representative. Submit wiring diagrams and piping schematics with shop drawings.

2.9 MANUAL DAMPERS

- 2.9.1 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.
- 2.9.2 Rectangular dampers shall be equal to Ruskin MD25, 22 ga. galvanized steel 3/8" square axle shaft and molded synthetic bearings.
- 2.9.3 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.

2.10 TAKE-OFF FITTINGS

- 2.10.1 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.
- 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.
- P. Ductwork for kitchen hood shall be double-wall insulated grease duct model 3G, as manufactured by Metal-Fab, Inc. or approved equal.
 - 1. The grease duct shall be insulated double-wall factory –built type for use with Type 1 kitchen hoods, as described in NFPA-96 for the transportation of air and grease-laden vapors from commercial cooking operation.
 - 2. Product Description:
 - a. Zero Clearance Series 3G Grease Duct by Metal-Fab.
 - b. Factory pre-fabricated, double wall type, listed for venting of grease laden air from kitchen hoods requiring grease duct as described in NFPA 96.
 - c. Rated for continuous operation at 500° F and intermittent operation at 2000° F.
 - d. All components of the grease duct system shall be provided by the manufacturer to ensure the system meets the requirements of the listing including duct supports, guides, fittings, cleanouts, and expansion joints required to install the duct.
 - e. Grease duct shall conform to requirements of ASTM E119 Fire Engulfment Test, ASTM E814 3-hour Fire Stop Test, and shall be listed by the following agencies with the associated listed reports:
 - 1) UL 1978 (File MH8251) - Grease Ducts for Restaurant Cooking Appliances.
 - 2) UL 2221 (File R15388) - Standard for Tests of Fire Resistive Grease Duct Enclosure Assemblies
 - 3) ICC-ES (ESR2627)-ICC Evaluation of 3G & 4G Grease Duct Systems.
 - 4) UL103HT (MH8251)-Standard for factory built chimneys and building appliances.
 - f. The duct sections shall be constructed of an inner wall and an outer wall with ceramic fiber insulation between the walls.
 - 1) The inner wall shall be constructed of 304, 316 or 430 stainless steel.
 - a) 6 through 24-inch diameter materials: 0.035-inch-thick inner wall.
 - 2) The outer wall shall be constructed of aluminized steel, 304 or 316 stainless steel.
 - a) 6 thru 24 diameter inch materials: 0.024-inch-thick outer wall.

- 3) The duct shall include a 3" thickness of body soluble ceramic fiber insulation between the inner and outer walls.
- g. The duct wall assembly is Tested and Listed to 0 inch clearance to combustibles.
- 3. Product shall be warranted to be free from defects in material and workmanship for as long as the original consumer owns the system.
- Q. Grease Duct Test: Perform a light test to determine that all welded joints are liquid tight in accordance with Mechanical Code.
- R. Ductwork for dishwasher exhaust hood shall be all light gauge stainless steel with welded joints.
- Or
- Ductwork for dishwasher exhaust hood shall be equal to Metal-Fab, PSW Single Wall, 0.035" thick type 304 stainless steel.

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.
- D. All transfer ducts shall be in a "U" configuration and fully insulated with grilles located on both ends of the duct.
- E. All kitchen make-up air and air conditioning ducts shall be externally insulated.

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 than 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.
- I. Packaged air conditioning system shall be balanced to provide performance specified. Amount of fresh air shall be noted based on minimum/maximum CO² level. (Refer to outside air schedule and sequence of operation.) Provide minimum of three (3) readings at different levels of CO².
- 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 be 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 CO² level. (Refer to outside air schedule and sequence of operation.) Provide minimum of three (3) readings at different levels of CO².
 - 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 Humidity Sensor setting as required to activate Dehumidification 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.
- 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

DIRECT DIGITAL CONTROL
SYSTEM FOR HVAC

PART ONE - GENERAL

1.1 REFERENCES

- 1.1.1 General: The General Provisions of the Contract, including the General Conditions and Supplementary General Conditions, apply to the work specified in this section.
- 1.1.2 Section 15600 - General Conditions for Mechanical Trades.
- 1.1.3 Section 16100 - General Conditions for Electrical Trades.

1.2 GENERAL REQUIREMENTS

- 1.2.1 The Control Systems as specified herein shall be provided in their entirety as indicated on the plans and as required for a complete and operable system.
- 1.2.2 The installing control contractor shall provide extensive customer support throughout the one-year warranty which shall include programming assistance, 24-hour/7-day monitoring and software upgrades. Records shall be maintained verifying monitoring, and shall be made available to the owner. In the event a problem is discovered during monitoring, the Contractor shall take immediate action and notify the proper authorities to have the problem resolved.

1.3 SUBMITTALS

- 1.3.1 Submit complete data of Automatic Control System.
- 1.3.2 The Contractor shall furnish electronic shop drawings using the submittal procedure as detailed in Section 01340. Shop drawings are required even though the equipment is as specified.
- 1.3.3 Provide complete operating data, system drawings, wiring diagrams and written detailed operational description of sequences and description and engineering data on each control system component. Include sizing as requested.
- 1.3.4 At completion of work, submit report of check-out of automatic control system.

1.4 SUBSTITUTIONS

- 1.4.1 System shall be extension of existing BACnet building automation system. Existing system is Automatic Logic as supplied and installed by ES2 AR, (501) 847-8610. Stand-alone price shall be provided to bidding contractor. NO SUBSTITUTIONS.

1.5 SCOPE OF WORK

- 1.5.1 The Contractor shall provide a fully integrated Building Automation System (BAS) incorporating Direct Digital Control (DDC), energy management, and equipment monitoring. The BAS shall be an extension to the owner's existing BACnet building automation system.
- 1.5.2 The BAS shall include the following elements:
- A. Microcomputer based digital controllers interfacing with sensors, actuators, and environmental delivery systems as described in this specification.
 - B. A BACnet compliant communication network to allow data exchange between digital controllers and to a central building management computer transferring real time data at a minimum of 156k-bps baud as active BACnet devices. BACnet Protocol Implementation Conformance Statements (PICS) for each Submitte type of controller and operator interface.
 - C. Existing PC workstation based central monitoring station with associated peripherals and software to function as the primary operator interface for the BAS.
 - D. Electric, and electronic controls for all items indicated on the drawings and described hereinafter including dampers, valves, panels, compressed air plant (if applicable), and complete pneumatic and electrical installation.
 - E. Unless otherwise specified or approved prior to bidding, the primary inputs and outputs of each DDC loop shall be resident in a single digital controller containing the DDC algorithm, and shall function independently of any peer or communication link. Secondary (reset type) analog inputs may be received from the peer network, but approved default values and/or procedures shall be substituted in the DDC algorithm for this secondary input if network communications fail.
 - F. The BAS shall have a fully modular, BACnet architecture, permitting expansion through the addition of more stand-alone networkable BACnet digital controllers, sensors, actuators, operator terminals, and application software. All DDC must be native BACnet. Proprietary controllers are not acceptable.
- 1.5.3 The building systems to be monitored and/or controlled for this installation consist of the HVAC equipment as detailed on the mechanical design drawings.
- 1.5.4 The Contractor shall furnish and install a complete temperature control system including all necessary hardware and all operating and applications software necessary to perform the control sequences of operation as called for in this specification and on the plans. All software required will be turned over to the Owner ready for use including all operating parameters, setpoints, and schedules.
- 1.5.5 The Drawings and Specifications are not intended to show all details. The Contractor shall secure satisfactory information before submitting the proposal and include in the proposal a sum sufficient to cover all items of labor and material required for the complete installation of the devices and system described.

- 1.5.6 All work performed under this section of the specifications will comply with all codes, laws, and governing bodies. If the drawings and/or specifications are in conflict with governing codes, the Contractor shall submit a proposal with appropriate modifications to the project to meet code restrictions. If this specification and associated drawings exceed governing code requirements, the specification will govern.
- 1.5.7 The Contractor shall obtain and pay for all necessary construction permits and licenses.
- 1.5.8 The Contractor shall execute his work in such a manner as to cause the minimum interference to the operation of the building.
- 1.5.9 The Contractor shall furnish and install all motorized control dampers indicated on control drawings.
- 1.5.10 The Contractor shall furnish and install all actuators including all associated linkages, wire, and power wiring.
- 1.5.11 The Contractor shall provide all necessary power and control wiring required for the project and shall coordinate 120V power requirements with the Electrical Contractor.
- 1.5.12 Control and interlock wiring shall be installed in EMT conduit (see Section 16000) in walls and shafts. Plenum rated wiring may be installed above accessible ceilings; however, the cable shall be grouped and connected to the structure with plastic ties. Workmanship shall be neat or the cable shall be removed and re-routed at the Contractor's expense.
- 1.5.13 Conduit in walls for space sensors shall be provided and installed by Electrical Contractor. Coordinate locations as required. All other required conduit shall be sole responsibility of the Controls Contractor.
- 1.5.14 Sensors shall be mounted at 48" A.F.F (to top of).

1.6 COORDINATED WORK

- 1.6.1 This Contractor shall cooperate with other contractors performing work on this project as necessary to achieve a complete coordinated installation. To that end, the Contractor shall consult the drawings and specifications for all trades to determine the nature and extent of the other work associated with this installation. Any discrepancies shall be reported to the Engineer.
- 1.6.2 It will be the duty of the Contractor to work in cooperation with the Owner and with other contractors and employees rendering such assistance, and so arrange his work such that the entire project will be delivered complete, in the best possible condition and in the shortest time.

1.7 RELATED WORK

A. Mechanical Contractor shall provide:

- 1. All pipe openings for monitoring devices, flow switches and sensors furnished by BAS Contractor.
- 2. Installation of pipe, monitoring devices and control valves.

3. All packaged unit control panels.
4. Approved copies of all project specific equipment submittals related wiring diagrams and a complete set of plans and specifications. The BAS Contractor's submittal shall incorporate the wiring diagrams into a composite diagram detailing the building automation system as related to the project specific equipment.
5. Control wiring from air handling unit to condensing unit.
6. Package Unit Equipment shall be furnished with terminal strip for field mounted DDC control module.

B. Sheet metal Contractor shall provide:

1. Installation of airflow monitoring devices.
2. Installation of control dampers furnished by BAS Contractor.

C. Electrical Contractor shall Provide:

1. Fire alarm interlock at fire alarm panels and all smoke detectors and their complete wiring.
2. 120 volt, 20 amp circuits for power as shown on drawings.
3. Conduit and J-Box for wall installation of temperature sensors and thermostats. Conduit will be extended to above ceiling or bar joist as applicable.

D. Access Control

Division 15 Controls Contractor shall provide a complete and operational access control system.

The system shall be Starwatch SMS Access Control with EntroStar Control Panels. The contractor shall refer to the Division 16 Electrical Systems Sheets E3.1 through E3.6 for location of devices. The division of work is described on Detail #2 on Sheet E3.6. The Division 15 Controls contractor is ultimately responsible for providing all equipment, POE switches, UPS, software and cabling as required for a complete and operational system. The Division 15 Controls Contractor shall coordinate with the Division 16 Electrical Contractor for exact locations and requirements for rough-in, back-boxes and raceways required. The Division 16 Telecom contractor to provide the equipment racks as shown on Telecom Riser Detail #5 on Sheet E3.3. The Division 8 Hardware Vendor to provide all hardware located on the doors. The controls contractor shall have a pre-construction meeting with the construction manager, hardware provider and electrician prior to beginning submittals. Contractor shall provide all programming as required to graphically incorporate all the new devices into the existing campus building management and video systems. Contractor to provide a minimum of 4-hours of on-site training.

E. Surveillance System

Division 15 Controls Contractor shall provide a complete and operational video surveillance system.

The system shall be Starwatch SMS Video Management with POE cameras. The contractor shall refer to the Division 16 Electrical Systems Sheets E3.1 through E3.6 for location of devices. The division of work is described on Detail #3 on Sheet E3.6. The Division 15 Controls contractor is ultimately responsible for providing all equipment, POE switches, cameras, server/network storage, software and cabling as required for a complete and operational system. The Division 15 Controls Contractor shall coordinate with the Division 16 Electrical Contractor for exact locations and requirements for rough-in, back-boxes and raceways required. The Division 16 Telecom contractor to provide the equipment racks as shown on Telecom Riser Detail #5 on Sheet E3.3. The controls contractor shall have a pre-construction meeting with the construction manager and electrician prior to beginning submittals. Contractor shall provide all programming as required to graphically incorporate all the new devices into the existing campus building management and access control systems. Contractor to provide a minimum of 4-hours of on-site training.

F. Lighting Control

Division 15 Controls Contractor shall provide a complete Lighting Control system.

The system shall be BlueRidge Technologies Unified Lighting Control system. The contractor shall refer to the Division 16 Electrical System drawings and details for locations of devices. The Division 15 Controls contractor is ultimately responsible for providing all equipment, network communications, software and cabling as required for a complete and operational system. The Division 15 Controls Contractor shall coordinate with the Division 16 Electrical Contractor for exact locations and requirements for rough-in, back-boxes and raceways required. The Division 16 contractor to provide the rough-in, back-boxes and raceways required. The controls contractor shall have a pre-construction meeting with the construction manager and electrician prior to beginning submittals. Contractor shall provide all programming as required to graphically incorporate all the new devices into the existing campus building management systems. Contractor to provide a minimum of 4-hours of on-site training.

1.8 CLEAN UP

- 1.8.1 This Contractor shall assist in maintaining the premises in an orderly fashion at all times during the construction period. He shall move all cartons, containers, crates, etc. as soon as their contents have been removed and he shall remove all debris caused by his work daily. All cartons, debris, etc., shall be removed from the site and premises at the sole expense of the Contractor.
- 1.8.2 At the completion of the work, the Contractor shall clean all of his work, equipment, etc., free from dust, etc., and leave the work in a good housekeeping fashion in a manner acceptable to Owner.

1.9 SUBMITTALS

- 1.9.1 The Contractor shall provide shop drawings on all hardware and software to be provided as a complete set within 60 days after award of contract. No work may begin on any portion of this project until submittals for the respective portion of the work have been reviewed and accepted by the Owners, Engineers, and Consultants for conformity with the plan and design intent of specifications.
- 1.9.2 Quantities of items submitted will not be reviewed by the Engineer and are the responsibility of the Contractor.
- 1.9.3 When manufacturer's cut sheets apply to a product series, rather than a specific product, the data specifically applicable to the project will be highlighted or clearly indicated by other means. General catalogs will not be accepted as cut sheets to fulfill submittal requirements.
- 1.9.4 Provide to the Engineer any additional information or data that the Engineer deems necessary to determine compliance with these specifications or that he deems valuable to the Owner in documenting the system to be installed.
- 1.9.5 Direct Digital Control Hardware:
 - A. Include a complete bill of material of equipment used, indicating quantity, manufacturer, model number, and other relevant technical data.
 - B. Include manufacturer's description and technical data, such as performance curves, product specification sheets, and installation/maintenance instructions for the items listed and other items relevant but not listed below:

Digital Controller	Control Panels
Unitary Controllers	Power Supply
Actuators	Batteries
Dampers	Relays/Switches
Sensors Modem	
Operator Interface Equipment	
 - C. Provide each electrically operated piece of equipment with completely coded interconnection wiring diagrams. Show all termination and wiring numbers.

- D. Provide schematic wiring diagrams for each control panel. Show all termination and wiring numbers.
- E. Provide schematic wiring diagrams for all field sensors and controllers.
- F. Provide floor plan indicating location of field devices and controllers.
- G. Provide schematic diagrams of HVAC systems with location of sensors and controllers.
- H. Provide a point list including all inputs and outputs indicating I/O port number, description of device, location of device, and English language character designation of device.

1.9.6 Direct Digital Control Software:

- A. Provide a complete description of the applications programming language and/or system, and instructions on how to program or re-program any portion of the system.
- B. Provide programming flow diagrams of the applications software.
- C. Include a complete description of the operation of the temperature control system including sequences of operation.
- D. Provide schedules, lists, or other documentation of all operation parameters.
- E. If applicable, provide copies of line-by-line applications software including all control algorithms, calculations, and entire control sequences. (This software is to be provided in English language source code.)
- F. Provide sample copies of all reports and trend logs.

1.10 CONSTRUCTION RECORD DOCUMENTS

- 1.10.1 At the completion of the Work, the Contractor shall submit one (1) set of documents as construction record documents (as built). Construction record documents shall include all departures from Contractor's originally approved documents or the Engineer's documents.
- 1.10.2 Construction record documents to be submitted are those listed under shop drawings pertaining to both hardware and software.
- 1.10.3 Construction record documents for software also require that the Contractor supply the Owner the project software in written paper form and on non-volatile storage media which can be directly loaded into the system controller(s).

1.11 OPERATING AND MAINTENANCE (O & M) MANUALS

- 1.11.1 Four (4) O & M manuals will be submitted for approval and will include the following, at a minimum, bound in 3-ring hardback binders after system acceptance.

- A. Names, addresses, and telephone numbers of Contractor's installing equipment and systems and service representatives for the system.
- B. Shop drawings hardware and software submittals as well as construction record documentation if not duplication of shop drawings submittals.
- C. Complete descriptions on the maintenance of all system components including sensors, controllers, actuators, etc. The descriptions shall include inspection, periodic preventive maintenance suggestions, system/component failure diagnosis and the procedure for repair or replacement of defective components.
- D. Definitions of terms utilized where applicable and necessary for complete Owner understanding of the installed system.

1.12 START-UP/TESTING

- 1.12.1 Prior to testing and verifying proper system operation, the Contractor shall verify with the Owner and the Engineer the start-up/testing procedure proposed. The Owner and Engineer must approve the check-out procedure prior to start-up/testing.
- 1.12.2 The Contractor shall coordinate a start-up date with the Owner and Engineer.
- 1.12.3 On the start-up date, The Contractor shall have on-site qualified field technicians to place the system in operation, making such tests, adjustments, and changes as may be found necessary to insure successful operation of the equipment and systems.
- 1.12.4 The Contractor shall test and verify proper operation for each control loop.
- 1.12.5 Each control loop check will verify that the digital controller, watchdog circuit, fail-safe controls and electric interlocks and operating as intended to accomplish the control strategy.
- 1.12.6 Sensor calibrating/operation will be tested to verify that they are operating and are within the performance parameters established in this specification.
- 1.12.7 Each input and output will be checked to verify that correct termination's/designations of I/O are in place.
- 1.12.8 Summer-winter changeover procedures will be described and simulated.
- 1.12.9 Communications to the digital controller shall be tested and verified that it is in working order.
- 1.12.10 Proper operation of all on-site operator interface hardware will be tested to verify proper operation.
- 1.12.11 Downloading of proper applications programs will be tested, when applicable, from on-site or off-site locations to verify proper operation of down-loading procedures.
- 1.12.12 Reports and/or trend logs will be retrieved to verify proper operation and format.
- 1.12.13 All tests will be documented by the Contractor, verifying that the tests have been performed and that all deficiencies have been corrected.

- A. All testing must be performed in presence of Owner's Engineer and all deficiencies corrected to the Owner's satisfaction.

1.12.14 After start-up and system check-out, if equipment and systems are operating satisfactorily to the Owner and Engineer, the Owner will sign a certificated confirming that the system operation has been tested and accepted in accordance with the terms of the specifications. The date of Owner's acceptance will be the start of the guarantee.

1.13 GUARANTEE

1.13.1 The control systems specified will be guaranteed free from defects of workmanship and material for a period of twelve (12) months after acceptance by the Owner. Any equipment herein described proved to be defective in workmanship or material during guarantee period will be adjusted, repaired, or replaced at no charge to the Owner.

1.13.2 This guarantee shall extend to all material supplied and installed by the Contractor.

1.13.3 During the guarantee period, software updates, digital controller improvements (i.e., microprocessor chip changes) will be provided to the Owner at no charge. Written authorization by the Owner must, however, be granted prior to the software or controller hardware updates.

The intent of this requirement is to insure that the Owner receives any product updates which are directed toward correcting a product problem which may or may not be apparent during the start-up and testing period.

1.14 TRAINING

1.14.1 The Contractor shall provide a minimum of two types of training during the contract period. Contractor shall schedule the training at the time of Owner acceptance.

- A. Covering programming of the Direct Digital Control System (maximum eight (8) hours), that may be scheduled for a minimum of four (4) hours per session. This shall include in-depth instruction on the programming of the system in general and this project in particular.

1.14.2 The instructor(s) shall have full knowledge of the system installed and will provide training specifically oriented to the Owner's installed system.

1.14.3 The instructor will utilize the operating and maintenance manual provided for the system as a reference manual during the training sessions. At a minimum, these sessions will include the following:

- A. Description of the overall control system configuration and physical layout indicating location of all sensors and controlled devices.
- B. Description of all programs and program features.
- C. Description of the control strategies being utilized at the installation.
- D. Description of all the key hardware components utilized in the system.

- E. Instructions on the method of communicating with the system's controller(s).
- F. Description of the programming instructions (if any) required to use the system.
- G. Description of the methods required to retrieve alarm and trend log information and how to react to alarm conditions.
- H. Description of diagnostic trouble-shooting techniques for the entire system.

PART TWO - PRODUCTS

2.1 GENERAL

- 2.1.1 The function of this section is to establish a minimum quality of hardware and installation to be provided, and to establish equipment and/or equipment configurations to be utilized for standardization.
- 2.1.2 Unless indicated in this specification and associated drawings, all materials used will be new.
- 2.1.3 The Contractor shall provide hardware as specified to meet all system performance requirements.

2.2 ARCHITECTURE

Building Automation System (BAS) Contractor shall extend the existing BACnet-based system based on a distributed logic control system in accordance with this specification section. The operator's terminal, all global controllers, logic controllers, and all input/output devices shall communicate using the protocols and local area network (LAN) standards as defined by ANSI/ASHRAE™ Standard 135–2008, BACnet.

- 2.2.1 The following items, when used in Section 15950, are defined as follows:
 - A. Digital Controller - A manufacturer supplied microprocessor-based networkable unit capable of providing stand-alone temperature control functions as minimally specified herein. Additional manufacturer-supplied components may be required by the digital controller to perform monitoring/control functions, installed in series between the controller and the Field Equipment as defined below, shall be considered as part of the Digital Controller hardware.
 - B. Field Equipment - Equipment through which the Digital Controller will interface with the facilities environmental, mechanical and electrical systems.
 - C. Operator Interface - Equipment through which operator personnel are able to access the digital controller(s).
 - D. Global Controller – Manufacturer supplied microprocessor based unit capable of supporting the appropriate LAN and supervisory functions as set forth in this specification.

2.3 OPERATOR WORKSTATION

2.3.1 Operator's Terminal

A. BACnet Conformance

1. Operator's terminal shall as a minimum support Point-to-Point (PTP) and Ethernet BACnet LAN types. It shall communicate directly via these BACnet LANs as a native BACnet device. Operator's terminal shall comply with the requirements of a BACnet conformance class 3 device and support all BACnet services necessary to provide the following BACnet functional groups:
 - a. Clock Functional Group
 - b. Hand Held Workstation Functional Group
 - c. Personal Computer Workstation Functional Group
 - d. Files Functional Group
 - e. Time Master Functional Group
2. Please refer to BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
3. Standard BACnet object types supported shall include as a minimum: Calendar, Command, Device, Event Enrollment, File and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

B. Displays

1. Operator's terminal shall display all data associated with project as called out on drawings and/or object type list supplied. Operator's terminal software shall accept Windows BITMAP (*.bmp) format graphic files for display purposes. Graphic files shall be created using scanned, full color photographs of system installation, AutoCAD drawing files of field installation drawings and wiring diagrams from as-built drawings. Operator's terminal shall display all data using three-dimensional graphic representations of all mechanical equipment.

System shall be capable of displaying graphic file, text, and dynamic object data together on each display. Information shall be labeled with descriptors and shall be shown with the appropriate engineering units. All information on any display shall be dynamically updated without any action by the user. Terminal shall allow user to change all field-resident EMCS functions associated with the project, such as setpoints, weekly schedules, exception schedules, etc. from any screen no matter if that screen shows all text or a complete graphic display. This shall be done without any reference to object addresses or other numeric/mnemonic indications.

2. All displays shall be generated and customized in such a manner by the local DDCS supplier that they fit the project as specified. Canned displays shall not be acceptable. Displays shall use standard English for labeling and readout. Systems requiring factory programming for graphics or DDC logic are specifically prohibited. All graphics and DDC programming shall be supported locally by the installing contractor without factory dependency or assistance.
3. Binary objects shall be displayed as ON/OFF/NULL or with customized text. Text shall be justified left, right or center as selected by the user. Also, allow binary objects to be displayed as individual change-of-state bitmap objects on the display screen such that they overlay the system graphic. Each binary object displayed in this manner shall be assigned up to three bitmap files for display when the point is ON, OFF or in alarm. For binary outputs, toggle the object's commanded status when the bitmap is selected with the system digitizer (mouse). Similarly, allow the terminal operator to toggle the object's status by selecting (with the mouse) a picture of a switch or light, for example, which then displays a different picture (such as an "ON" switch or lighted lamp). Additionally, allow binary objects to be displayed as an animated graphic.

Animated graphic objects shall be displayed as a sequence of multiple bitmaps to simulate motion. For example: when a pump is in the OFF condition, display a stationary picture of the pump. When the operator selects the pump picture with the mouse, the represented object's status is toggled and the picture of the pump's impeller rotates in a time-based animation. The operator shall be able to click on an animated graphical object or switch it from the OFF position to ON, or ON to OFF. Allow operator to change bitmap file assignment and also create new and original bitmaps online. System shall be supplied with a library of standard bitmaps, which may be used unaltered or modified by the operator. Systems that do not allow customization or creation of new bitmap objects by the operator (or with third-party software) shall not be allowed.

4. Analog objects shall be displayed with operator modifiable units. Analog input objects may also be displayed as individual bitmap items on the display screen as an overlay to the system graphic. Each analog input object may be assigned to a minimum of five bitmap files, each with high/low limits for automatic selection and display of the bitmaps. As an example, a graphic representation of a thermometer would rise and fall in response to either the room temperature or its deviation from the controlling setpoint. Analog output objects, when selected with the mouse, shall be displayed as a prompted dialog (text only) box. Selection for display type shall be individual for each object. Analog object values may be changed by selecting either the "increase" or "decrease" arrow in the analog object spinner box without using the keypad. Pressing the button on the right side of the analog object spinner box allows direct entry of an analog value and accesses various menus where the analog value may be used, such as trend logs.

5. Analog objects may also be assigned to an area of a system graphic, where the color of the defined area would change based on the analog object's value. For example, an area of a floor-plan graphic served by a single control zone would change color with respect to the temperature of the zone or its deviation from setpoint. All editing and area assignment shall be created or modified online using simple icon tools.
6. A customized menu label (push-button) shall be used for display selection. Menu items on a display shall allow penetration to lower level displays or additional menus. Dynamic point information and menu label push buttons may be mixed on the same display to allow sub-displays to exist for each item. Each display may be protected from viewing unless operator has appropriate security level. A separate security level may be assigned to each display and system object.
7. A mouse, or other form of digitizer, shall be used to move the pointer arrow to the desired item for selection of new display or to allow the operator to make changes to object data.
8. Displays may be modified on site or via remote communications.
9. Display resolution shall be limited by the CRT hardware and Windows software driver only. As a minimum, operator's terminal shall provide display resolution of 1024x768 @ 256 colors (XVGA).
10. Entire system shall operate without dependency on the operator's terminal.

C. Password Protection

1. Provide security system that prevents unauthorized use unless operator is logged on. Access shall be limited to operator's terminal functions unless user is logged on. This includes displays as outlined above.
2. Each operator's terminal shall provide security for 200 users minimum. Each user shall have an individual User ID, User Name and Password. Entries are alphanumeric characters only and are case sensitive (except for User ID). User ID shall be 0–8 characters, User Name shall be 0–29 characters, and Password shall be 4–8 characters long. Each system user shall be allowed individual assignment of only those control functions and menu items to which that user requires access. All passwords, user names, and access assignments shall be adjustable online at the operator's terminal. Each user shall also have a set security level, which defines access to displays and individual objects the user may control. System shall include 10 separate and distinct security levels for assignment to users.

D. Display of Scheduling Object Information

1. Operator's terminal display of weekly schedules shall show all information in easy-to-read 7-day (weekly) format for each schedule. This includes all ON/OFF times (to the minute) for each day's events.
2. BACnet exception schedules (non-normal schedules, such as holidays or special events) shall display all dates that are an exception to the weekly schedules. These specialty schedules shall be displayed at the operator's terminal in a format similar to the weekly schedules, again allowing easy data entry. Exception schedule data is entered by the following methods: date entries (one day entries), date-to-date (a range or span of days), and by weekday (for example, a given day of a given week each month). User shall be able to scroll easily through the months for each year as a minimum.
3. At the operator's terminal, the system user shall be able to change all information for a given weekly or exception schedule if logged on with the appropriate security access.

E. Alarm Indication

1. Operator's terminal shall provide audible, visual, and printed means of alarm indication. The alarm dialog box shall always become the top dialog box regardless of the application(s), currently running (such as a word processor). Printout of alarms shall be sent to the assigned terminal and port.
2. System shall provide log of alarm messages. Alarm log shall be archived to the hard disk of the system operator's terminal. Each entry shall include a description of the event-initiating object generating the alarm. Description shall be an alarm message of at least 256 characters in length. Entry shall include time and date of alarm occurrence, time and date of object state return to normal, time and date of alarm acknowledgment and identification of operator acknowledging alarm.
3. Alarm messages shall be in user-definable text (English or other specified language) and shall be entered either at the operator's terminal or via remote communication.
4. System shall include an Alarm Wizard for set up of alarms. Wizard shall walk user through all steps necessary for alarm generation. Wizard shall have its own icon for startup or may be started by double clicking on displayed value and then selecting alarm setup.

F. Trend log Information

1. System shall periodically gather historically recorded selected samples of object data stored in the field equipment (global controllers, field controllers) and archive the information on the operator's terminal (server) hard disk. Archived files shall be appended with new sample data, allowing samples to be accumulated over several years. Systems that write over archived data shall not be allowed, unless limited file size is specified. Samples may be viewed at the operator's terminal in a trend log. Logged data shall be stored in database format. Operator shall be able to scroll through all trend log data. System shall automatically open archive files as needed to display archived data when operator scrolls through the data vertically. All trend log information shall be displayed in standard engineering units.
2. Software shall be included that is capable of graphing the trend logged object data. Software shall be capable of creating two-axis (x,y) graphs that display up to ten object types at the same time in different colors. Graphs shall show object type value relative to time.
3. Operator shall be able to change trend log setup information as well. This includes the information to be logged as well as the interval at which it is to be logged. All input, output, and value object types in the system may be logged. All operations shall be password protected. Setup and viewing may be accessed directly from any and all graphics object is displayed on.
4. Graph type shall be adjustable by user to display the data in line, ribbon, bar or log format. The user shall also be able to specify a trend line to be plotted with the data using linear, polynomial, logarithms, moving average, exponential or power equations.

G. Configuration/Setup

Provide means for operator to display and change system configuration. This shall include, but not be limited to, system time, day of the week, date of daylight savings set forward/set back, printer termination, port addresses, modem port and speed, etc. Items shall be modified using understandable terminology with simple mouse/cursor key movements.

System shall include the automatic detection of devices connected anywhere on the BACnet network by scanning of the entire network. This function shall display device instance, network identification, model number and description of connected devices. It shall record and display software file loaded into each controller. A copy of each file shall be stored on the computers hard drive for archiving purposes. If needed, this file shall be downloaded to the appropriate controller by selection using the mouse.

H. Programming Tools

Operator's terminal shall include programming tools for all controllers supplied. All controllers shall be programmed using graphical tools that allow the user to connect function blocks on screen that provide sequencing of all control logic. Function blocks shall be represented by graphical displays that are easily identified and distinct from different types of blocks. Graphical programming that uses simple rectangles and squares is not acceptable.

User shall be able to pick graphical function block from menu and place on screen. Programming tools shall place lines connecting appropriate function blocks together automatically. Provide zoom in and zoom out capabilities. Function blocks shall be downloaded to controller without any reentry of data.

Programming tools shall include a test mode. Test mode shall show user real-time data on top of graphical display of selected function blocks. Data shall be updated by the system in real-time with no interaction by the user. Function blocks shall be animated to show status of data inputs and outputs. Animation shall show change of status on logic devices and countdown of timer devices in graphical format.

Programming tools shall also include a database manager of logic files and associated graphics. Operator shall be able to select unit type, input/output configuration and any other items that completely define unit. Database function shall select preprogrammed logic and graphics for downloading to device(s) and for use as display graphics.

I. Terminal Hardware (Existing)

Provide operator's terminals at locations noted on the plans. Operator's terminal shall include the following as a minimum:

Compatible PC (computer)
Pentium processor @ 1.66GHz (or higher).
128MB RAM on motherboard.
Minimum of (1) one floppy disk drive (1.44 MB, 3.5").
1 CD-ROM drive.
Hard disk drive with a minimum of 20 GB free space
Microsoft Windows
XVGA monitor (1024x768 x 256 min.) and driver.
Mouse compatible with Windows.
XVGA video card with 2 MB RAM
Keyboard
Modem, 33.6Kb Minimum
Color printer (Inkjet)
Ethernet Communications capable of 10Mbps

2.4 DIGITAL CONTROLLER

2.4.1 The Contractor will supply a system of networkable digital controllers capable of meeting or exceeding the performance requirements as specified herein.

2.4.2 Each digital controller will act as a stand-alone unit. The operation of any digital controller will not be dependent on any other digital controller or any central computer system. It will perform automated DDC temperature control functions, control peripheral devices, and perform all necessary calculations. Each digital controller shall be capable of being independently programmable with all operating and applications software residing in that unit.

- 2.4.3 The Contractor must supply a sufficient number of networkable digital controllers to both meet the input/output capacity requirements. The individual controllers shall share sensor input, controlling output and override data with all operating and applications software residing in that unit.
- 2.4.4 When the digital controller qualifies for direct mounting, remaining hardware components required to complete the digital controller shall be mounted in the field interface panel.
- 2.4.5 A. The digital controller shall be enclosed in a protective enclosure. Digital controllers meeting this criteria may be directly mounted. All other digital controllers shall be mounted within a Contractor-supplied enclosure.
- B. The Contractor-supplied enclosure will be of all steel construction, with baked enamel finish, NEMA type 1, have a hinged door and keyed lock. The enclosure will be sized for twenty (20) percent spare mounting space. The lock shall be keyed consistent with the field interface panel.
- 2.4.6 Each digital controller shall be labeled, including all termination's within the controller, with mechanically fabricated or printed letters, numbers, etc., which correspond exactly to the as-built drawings.
- 2.4.7 Each Digital controller shall be the latest version available for the model line provided, including the most up-to-date software and hardware offered by the manufacturer.
- 2.4.8 Input/Output electrical protection shall be as follows:
- A. All analog and digital inputs and outputs and communications port will be protected with 15,000 volt optical isolation.
- B. Provide electrical surge protection on power wiring.
- 2.4.9 The controller shall use non-volatile memory for the purpose of maintaining programs, setpoints, configuration and logged data during or in the event of power loss. The use of rechargeable nicad batteries will be unacceptable.
- 2.4.10 The power supply for each digital controller shall be twenty-four (24) VAC 50/60 Hz.
- 2.4.11 Input and output wiring at job site shall be possible while allowing independent pre-programming of the digital controller before delivery to the site.
- 2.4.12 The digital controller shall be capable of operating under the following environmental conditions:
- A. Temperature range: 0°F - 150°F
- B. Humidity range: 5-90% RH non-condensing
- 2.4.13 Each controller shall be provided with a minimum of 4 or 8 output drivers to control up to 4 to 8 loads or group of loads.
- 2.4.14 The controller shall provide the capability, if required, to remotely indicate normal operation.

- 2.4.15 Run times of all outputs shall be recordable for up to 10,000 hours.
- 2.4.16 The controller shall be capable of monitoring a minimum of 4 or 8 sensors (temperature, humidity, ambient light levels, pressure, kW, and pulse (dry contracts)).
- 2.4.17 The controller shall be capable of monitoring electrical power usage utilizing either a watt transducer or pulse-initiating demand meter.
- 2.4.18 Each of the input channels shall be capable of storing daily high or low peaks of the respective sensor input for the previous thirty-five (35) days, and record 15 minute averaged readings for the previous 48-hour interval.
- 2.4.19 Each of the input channels shall have the ability to store accumulating-type data, such as kilowatt-hours, over a specified period of time.
- 2.4.20 Each of the input channels shall be capable of accepting an industry-standard 4-20mA or 0-10 VDC input signal.

2.5 FIELD EQUIPMENT

2.5.1 Field Interface Panel:

- A. For all input/output devices that require field interface devices, these devices, where practical, will be mounted in the field interface panel. All other field interface devices will be mounted at the point of field interface in a separate enclosure for the location. When the manufacturer provides an enclosure or packaging of the device or sensor that protects the device from dust, moisture, conceals integral wiring and moving parts, this enclosure will be acceptable.
- B. Every field interface device and field termination will be labeled using words, letters, or numbers with permanent mechanically fabricated or printed tags exactly corresponding to the as-built drawings.
- C. Mounted within the field interface panel will be power supplies, interfacing relays and contractors, output status indicators, etc.
- D. Supply an enclosure of all steel construction with baked enamel finish, NEMA type 1 rated, with a hinged door and keyed lock. The enclosure will be sized for twenty (20) percent spare mounting space. All locks will be keyed identically.
- E. All wiring to and from the field interface panel will be to screw-type terminals. Analog or communications wiring may use the field interface panel as a raceway without terminating. The use of wire nuts within the field interface panel is not allowed.
- F. All wiring within the field interface panel will be run in elastic wiring duct(s) to give a neat and workmanlike appearance.

2.5.2 Digital Inputs:

- A. The Contractor shall provide equipment for digital inputs as indicated on the Point List.
- B. All digital inputs will be electrically isolated from the digital controller either by optical isolation or relays.
- C. All digital inputs will be provided by dry contacts single pole double throw. The contacts will be wired normally open or normally closed as required.
- D. Pressure switches will have a repetitive accuracy of $\pm 1\%$ of their operating range and will withstand up to 150% of rated pressure. Switch actuation will be adjustable over the operating pressure range.

2.5.3 Digital Outputs:

- A. The Contractor shall provide equipment for digital outputs as indicated in the Point List.
- B. All digital outputs will be electrically isolated from the digital controller either by optical isolation or relays.
- C. All digital outputs will be provided by dry contacts single pole double throw. The contacts will be wired normally closed or normally open as required.

2.5.4 Analog inputs:

- A. The Contractor must provide equipment for analog sensors as indicated in the point list. This will include the sensor, signal conditioning equipment, and wiring.
- B. Transducers may be supplied as an integral unit with the field sensor, mounted separately from the sensor in a field interface panel, or be packaged as part of the Digital Controller, provided.
- C. The sensor/transducer will be packaged for the application:
 - 1. Architectural housing for space wall mounting.
 - 2. Weatherproof/sunshield housing for outside mounting.
 - 3. Thermal well housing for water applications.
 - 4. Dust and physical protective housing for duct mounting.
- D. The sensor/Transducer will be appropriately selected to withstand ambient conditions:
 - 1. Moisture or condensation where it is a factor.
 - 2. Vibration from ductwork, equipment, etc.
 - 3. Reasonably expected transient conditions such as temperatures, pressures, humidities, etc., outside the normal sensing range.

- E. The sensor/transducer will be appropriately selected to most closely match the expected sensing range.
- F. The system will maintain the specified end-to-end accuracy throughout the warranty period from sensor to Digital Controller readout.
- G. Sensors will be mounted away from machinery generating heat, directly under lights on in diffuser air streams. The Owner reserves the right to make adjustments in exact sensor locations for new sensors without additional cost to the Owner.
- H. Temperature sensors shall be of the thermistor sensing type, producing resistance's corresponding to temperatures between -25°F and +220°F, with a minimum accuracy of $\pm 1^\circ\text{F}$. Temperature sensors shall be capable of being installed 500 feet from controller with 18 to 22 AWG wiring. Two (2) conductor thermostat wires shall be usable to wire the sensors without shielding requirements.
- I. Electric power transducer shall be either:
 - 1. A true watt transducer, measuring voltage, amperage, and power factor to calculate wattage, and accurate to within $\pm 1\%$.
 - 2. A pulse-initiated demand meter, capable of interfacing with the electric utility's pulse demand meter.
- J. Override momentary switches shall be capable of using existing analog inputs and triggered by momentary shorting the corresponding input.

2.5.5 Analog outputs:

- A. The Contractor shall provide equipment for analog outputs as indicated on the point list. This will include digital to analog conversion where called for and wiring or pneumatic tubing to the controlled device.
- B. All controlled devices that are to be modulated at to receive 0-10 VDC signals when controlled directly by the digital controller.

2.5.6 Digital Display Wall Controller (DWC):

- 2.5.6.1 Sensor shall contain digital display and user function keys along with temperature sensor. Controller shall function as room control unit, and shall allow occupant to raise and lower setpoint, and activate terminal unit for override use, all within limits as programmed by building operator. Controller shall also allow service technician access to hidden functions as described in sequence of operation.
- 2.5.6.2 Provide means to view room setpoint, room temperature, room humidity, CO² levels, outside temperature, and the discharge air temperature at each controller. Override time may be set and viewed in 0. 1-hour increments. Override time countdown shall be automatic, but may be reset to zero by occupant from the DWC. Time remaining shall be displayed. Display shall be blank in unoccupied mode unless a function button is pressed.

2.5.6.3 See sequence of operation for specific operation of DWC displays and function keys in field service mode and in normal occupant mode. Provide digital display wall controllers as specified in point list.

2.5.6.4 Field service mode shall be customizable to fit difference applications. If DWC is connected to VAV controller, VAV box shall be balanced and all air flow parameters shall be viewed and set from the DWC.

2.5.6.5 Wall Sensor:

- A. Standard wall sensor shall use solid-state sensor identical to DWC and shall be packaged in aesthetically pleasing enclosure. Sensor shall provide override function, warmer/cooler lever for setpoint adjustment and jack for plug-in of DWC for field adjustments. Override time shall be stored in controller and be adjustable on a zone-by-zone basis. Adjustment range for warmer/cooler lever shall also be stored in EEPROM on controller. All functions of DWC shall be available through wall sensor port.
- B. Sensing only wall thermostats shall be stainless steel tamper proof, and mounted flush to the finished wall. Accuracy: Thermistor $\pm 0.36^{\circ}\text{F}$. Sensor type: Thermistor 10K. Temperature range: $32\text{--}158^{\circ}\text{F}$. Mounting: Directly to wall or single gang box.

2.5.7 Duct Temperature Sensor:

- A. The supply air duct temperature sensor shall be of sufficient length for the equipment's supply air duct to ensure accurate measurement.
- B. The duct temperature sensor shall be of the 10 K thermistor type and an operating temperature of $+23^{\circ}\text{F}$ to 150°F .
- C. The supply air duct temperature sensor reading shall be displayed on the computer screen.

2.5.8 Outdoor Air Temperature Sensor:

General:

- A. The outdoor air temperature sensor shall be of the threaded type and mounted in a die cast, weatherproof enclosure.
- B. The outdoor air temperature sensor shall be of the 10K thermistor type and an operating temperature of $\pm 22^{\circ}\text{F}$ to 122°F .
- C. The outdoor air temperature sensor reading shall be displayed on the operator workstation where applicable.

2.5.9 Humidity Sensors:

- A. Shall have a sensing element of bulk polymer. Accuracy at 77 degrees F = +/- 2% RH, 20 – 95% RH including hysteresis, linearity, and repeatability. Output signal 4 – 20mA DC. Room, duct and outside sensing.

2.5.10 Other Sensors

2.5.10.1 Current Sensing Devices:

- A. Analog Current Sensor: Loop powered and full isolated sensor which converts AC current to linear proportional 4 to 20 mA output. +/- full scale accuracy. Provide the appropriate range to meet application requirements.
- B. Digital Current Switch: Self-powered, adjustable solid-state relay switching up to 30VDC and 1/5 amps in response to AC current. Provide the appropriate range to meet the application requirements.

2.5.10.2 Differential Pressure Transmitters:

- A. Air Static and Velocity Pressure Transmitters: Output signal shall be 4-20 mA DC. Accuracy shall be less than +/- 1.0% full scale including hysteresis, nonlinearity and non-repeatability. Provide the appropriate range to meet the application requirements.
- B. Differential Pressure Switches: Differential air flow switches shall be diaphragm operated SPDT snap acting switches. Sensing range shall be .5 inch to 2 inch W.G. Setpoint to be adjustable.

2.5.10.3 Carbon Dioxide Sensors:

- A. The duct mounted carbon dioxide sensor shall meet these specifications:

Power:	18-36 VAC, 50/60 Hz
18-42 VDC	
70 mA average, 100 mA peak	
Range:	0-2,000 ppm (factory setting) user adjustable up to 0-10,000 ppm
Accuracy:	± 50 ppm or $\pm 3\%$ of reading,
(Typical conditions)	whichever is higher, over 60 ⁰ to 90 ⁰ F (15-30 ⁰ C)
Accuracy:	± 100 ppm or $\pm 5\%$ of reading, whichever is higher, (extended conditions) over 32 ⁰ to 122 ⁰ F (0-50 ⁰ C).
Annual Drift:	± 10 ppm with TEMA enabled ± 20 ppm with TEMA disabled
Calibration Interval:	Five years
Analog Output:	4-20 mA (500 ohms max. load)
	10 VDC (100 ohms output impedance)
	outputs available simultaneously

Control Relay:	Form C (SPDT) 2A @ 24 VAC or VDC factory set 1000 ppm, 50 ppm hysteresis, user adjustable 0-9999 ppm
Operating Temperature:	32° to 122° F (0° to 50° C)
Operating Certification:	0 to 95% RH, noncondensing FCC Part 15 Class B

- B. The sensor shall have LCD display and closed loop pitot style duct sampling accessory equal to Specialty Sensors model P002P.

2.5.10.4 Control Dampers:

- A. Control dampers for HVAC systems not supplied integral to HVAC equipment shall be provided to allow effective modulation or close-off air as required for each fan system. Damper frames and blades must be constructed of either galvanized steel or aluminum for adequate resistance to corrosion. Damper frames must be constructed to facilitate field assembly of several individual sections into a large damper area. Maximum blade length in any section shall be 48 inches (1.2m) in height. All blades must be provided with suitable bearings for smooth operation and all blades must be interconnected to provide unison operation.
- B. Dampers shall be provided with either parallel or opposed blade linkage and arranged for normally open or normally closed operation as specified for each individual fan system. Dampers for mixing applications shall be parallel only. Multi-section dampers must be provided with sufficient interconnecting hardware or jackshaft to provide unison operation of all blades in the entire assembly.
- C. All dampers shall be provided with appropriate seals along the blade edges and at blade ends to provide tight closure with minimum leakage.
- D. Outside air dampers shall be extruded aluminum low leakage control dampers. Air leakage in the closed position shall be in the range of 6 CFM/sq. ft. at 4 in. w.g. Provide Ruskin RCD-50 or approved equal.
- E. Return and relief air dampers shall be galvanized steel control dampers. Air leakage in the closed position shall be in the range of 10 CFM/sq. ft. at 4 in w.g. Provide Ruskin RCD-45 or approved equal.
- F. Zone Dampers shall be galvanized steel control dampers. Dampers shall have 20 ga. galvanized actuator mounting plate, bronze iolite bearing, ½” solid aluminum extended shaft, and be 1/8” undersized for installation in round duct. Blade seal shall be crosslinked closed cell foam up to 200f. Provide United Enertech model RI or approved equal.

2.5.10.5 Actuators:

- A. Control Damper Actuator shall be 24 VAC spring return rotary damper actuator with a minimum torque of 9 ft. lb. input signal shall be 0-10 VDC. Provide modulating or two position action to meet application requirements.

- B. Terminal Equipment Damper Actuators shall be 24VAC rotary damper actuator with a minimum torque of 35 in. – lb. The actuator shall maintain last position upon power failure.

2.6 GLOBAL CONTROLLER

2.6.1 Global Controller General Description

- A. Global controller (Bti/BCM) shall provide battery-backed real-time (hardware) clock functions. It shall also provide communications via BACnet standard protocols to all field controllers. Global controller shall interface with operator terminal(s) via BACnet protocols for information display.
- B. Global controller shall incorporate as a minimum, the functions of a 3-way BACnet router. Controller shall route BACnet messages between the high-speed LAN (Ethernet and/or ARCNET), master slave token passing (MS/TP), and point-to-point (PTP) or modem ports. GC shall have capability to easily function as a 4-way router with the addition of simple plug-in modules.
- C. Global controller shall be capable of deciding global strategies for the system based on information from any objects in the system regardless if the object is directly monitored by the controller or by another controller. The program that implements these strategies shall be completely flexible and user definable. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site or downloaded via remote communications are not acceptable. Changing global strategies via firmware changes is also unacceptable. Program execution at global controller shall be a minimum of once per second.
- D. Programming shall be object-oriented using control program blocks. Documentation in flowchart form for all programming shall be provided as part of the final system as-built documentation. Samples of flowchart documentation shall be included in submittals. All flowcharts shall be generated and automatically downloaded to controller. No reentry of database information shall be necessary.
- E. Provide means to graphically view inputs and outputs to each program block in real-time as program is executing. This function may be performed via the operator's terminal, field computer, or modem.
- F. Controller shall have a minimum of 4 MB battery-backed static RAM along with 64K of EPROM. Battery shall retain static RAM memory and clock functions for a minimum of 1 year. Battery shall be a field-replaceable (non-rechargeable) lithium type.

2.6.2 Global Controller BACnet Conformance

- A. Global Controller shall as a minimum support Point-to-Point (PTP), MS/TP, Ethernet and ARCNET BACnet LAN types. It shall communicate directly via these BACnet LANs as a native BACnet device and shall support simultaneous routing functions between all supported LAN types. Global controller shall be a BACnet conformance class 3 device and support all BACnet services necessary to provide the following BACnet functional groups:
 - 1. Clock Functional Group
 - 2. COV Event Initiation
 - 3. Files Functional Group
 - 4. Device Communications Functional Group
 - 5. Time Master
- B. Please refer to BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
- C. Standard BACnet object types supported shall include as a minimum: Analog Value, Binary Value, Calendar, Command, Device, File, Group, Notification Class, Program and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

2.6.3 Global Controller Remote Communications

- A. Provide all functions that will allow remote communications via modem to off-site location(s). Include modem along with all cabling necessary for installation.
- B. Owner shall provide standard voice-grade phone line for remote communication function.
- C. For both the local and remote Global controller provide a modem capable of modem-to-modem baud rates of 33.6 Kbps minimum over standard voice-grade phone lines. Lower baud rates shall be selectable for areas where local phone company conditions require them.

2.6.4 Global Controller Schedules

- A. Each global controller shall support a minimum of 100 BACnet Schedule Objects and 100 BACnet Calendar Objects.
- B. Each schedule object (Weekly or Exception) shall be capable of performing an optimum start. Optimum start calculation shall be based on outside air temperature, zone air temperature, deviation from zones, daytime heating and cooling setpoints, and individual zone adaptive heating and cooling coefficients that are adjusted each day based on performance parameters of the individual zone.

2.6.5 Global Controller Logging Capabilities

- A. Each global controller shall log as minimum 150-user selectable object properties. Multiple properties may be logged for each object with a minimum of 100 samples per object property. Any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's terminal. Start of sampling may be by one of the following: Selectable log beginning and ending by using BACnet Calendar and Schedule Objects.

Object change of value (all types of analog objects)

Object change of state (all types of binary objects)

- B. Logs may be viewed both on-site and off-site via remote communication.
- C. Global controller shall periodically upload trended data to operator's terminal for long term archiving if desired.
- D. Archived data stored in database format shall be available for use in third-party spreadsheet or database programs.

2.6.6 Global Controller Alarm Generation

- A. Object change of values and change of states may be identified as alarm conditions. When such conditions exist, the global controller identifies each alarm through BACnet Get Alarm Summary Service. This summary of active alarms (Event State property value not equal to NORMAL) is presented to and displayed at the operator's terminal for system user action.

Alarms may be generated within the system for any object change of value or state either real or calculated. This includes things such as analog object value changes, binary object state changes, and various controller communication failures.

- B. Each alarm may be dialed out as noted in paragraph 2.6.3 above.
- C. Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site via remote communications.

2.6.7 Global Controller Demand Limiting

- A. System shall be capable of monitoring energy demand. Energy demand may be from any type of energy source such as electrical or gas. Provide a demand-limiting routine, which shall shed appropriate system objects to prevent the demand from exceeding preset limits. Demand-limiting routine shall be a priority shed type allowing automatic override of specified object type sheds when assigned analog object (temperature sensor) exceeds limits as set by system user at operator's terminal. Routine shall be able to change between sets of demand limit and restore setpoints based on BACnet Schedule Objects or system user manual commands at operator's terminal.

- B. Zone shed method shall be by either preventing zone heating and cooling operations, or by shifting zone heating and cooling setpoints.
- C. All parameters of the demand limiting routine shall be modifiable from the operator's terminal or via remote communications.

2.7 PACKAGED VENTILATION UNIT & AIR HANDLING UNIT CONTROLLERS

2.7.1 Provide one or more native BACnet logic controllers for the air handling unit and provide native BACnet logic controllers as needed for other mechanical equipment control that adequately cover all objects listed and/or shown on plans. All controllers shall interface to global controller via MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of units. Controllers shall be fully programmable using graphical programming blocks. No auxiliary or non-BACnet controllers shall be used.

2.7.2 BACnet Conformance

- A. Logic controllers shall as a minimum support MS/TP BACnet LAN types. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as native BACnet devices. Logic controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:
 - 1. Files Functional Group
 - 2. Reinitialize Functional Group
 - 3. Device Communications Functional Group
- B. Please refer to BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
- C. Standard BACnet object types supported shall include as a minimum – Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File, Program and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

2.7.3 Logic controllers shall include universal inputs with 10-bit resolution that accept 3K and 10K thermistors, 0-10VDC, 0-5 VDC, 4-20 ma and dry contact signals. Any input on controller may be either analog or digital. Controller shall also include support and modifiable programming for interface to intelligent room sensor with digital display. Controller shall include binary and analog outputs on board. Analog outputs shall be switch selectable as either 0-10VDC or 0-20mA. Software shall include scaling features for analog outputs. Logic controller shall include 24 VDC voltage supply for use as power supply to external sensors.

- 2.7.4 All program sequences shall be stored on board logic controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and capable of multiple PID loops for control of multiple devices. All calculations shall be completed using floating-point math and system shall support display of all information in floating-point nomenclature at operator's terminal.

Programming of logic controller shall be completely modifiable in the field over installed BACnet LANs or remotely via modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and typing blocks together on screen. Logic controller shall be programmed using programming tools as described in operator's terminal section.

All programming tools shall be provided as part of system. Provide documentation in flowchart form of all programming as part of the final system as-built documentation. Include samples of flowchart documentation in submittals.

- 2.7.5 Logic controller shall include software-scheduling functions on board without depending on any external device. Scheduling shall be via a BACnet schedule object for seven day of the week scheduling. Controller shall include interface capability for optional plug-in hardware clock with battery back-up. Provide optional hardware clock as shown on object list given in drawing set.

- 2.7.6 Logic controller shall include support for intelligent field sensor (see section 2.9.B). Display on field sensor shall be programmable at logic controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent field sensor.

2.8 TERMINAL UNIT CONTROLLERS (Split Systems/Heaters/Fans, etc.)

- 2.8.1 Provide one native BACnet logic controller for each piece of unitary mechanical equipment that adequately covers all objects listed in object list for unit. All controllers shall interface to global controller via MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of unit.

2.8.2 BACnet Conformance:

- A. Logic controllers shall as a minimum support MS/TP BACnet LAN types. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as a native BACnet device. Logic controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:

1. Files Functional Group
2. Reinitialize Functional Group
3. Device Communications Functional Group

- B. Please refer to BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
 - C. Standard BACnet object types supported shall include as a minimum-Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File and Program Object Types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
- 2.8.3 Logic controllers shall include universal inputs with 10-bit resolution and that can accept 3K and 10K thermistors, 0-5 VDC, 4-20 ma and dry contact signals. Any input on controller may be either analog or digital. Controller shall also include support and modifiable programming for interface to intelligent room sensor. Controller shall include binary outputs on board.
- 2.8.4 All program sequences shall be stored on board logic controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and shall be capable of multiple PID loops for control of multiple devices.
- 2.8.5 Programming of logic controller shall be completely modifiable in the field over installed BACnet LANs or remotely via modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Logic controller shall be programmed using programming tools as described in operator terminal section.
- 2.8.6 All programming tools shall be provided as part of system. Provide documentation in flowchart form of all programming as part of the final system as-built documentation. Include samples of flowchart documentation in submittals.
- 2.8.7 Logic controller shall include software-scheduling functions on board without depending on any external device. Scheduling shall be via a BACnet schedule object for seven day of the week scheduling. Controller shall include interface capability for optional plug-in hardware clock with battery back up. Provide optional hardware clock as shown on object list given in drawing set.
- 2.8.8 Logic controller shall include support for intelligent field sensor (see Section 2.9.B). Display on field sensor shall be programmable at logic controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent field sensor.
- 2.8.9 Packaged Equipment Controls
- A. Equipment shall be furnished with terminal strip for field mounted DDC control module.

- B. General. The electronic controls packaged with any equipment furnished under this contract shall communicate with the building direct digital control (DDC) system. The DDC system shall communicate with these controls to read the information and change the control setpoints as shown in the points list, sequences of operation, and control schematics. The information to be communicated between the DDC system and these controls shall be in the standard object format as defined in ANSI/ASHRAE Standard 135 (BACnet). Controllers shall communicate with other BACnet objects on the internetwork using the Read (Execute) Property service as defined in Clause 15.5 of Standard 135.
- C. Distributed Processing. The controller shall be capable of stand-alone operation and shall continue to provide control functions if the network connection is lost.
- D. I/O Capacity. The controller shall contain sufficient I/ O capacity to control the target system.
- E. The Controller shall have a physical connection for a laptop computer or a portable operator's tool.
- F. Environment. The hardware shall be suitable for the anticipated ambient conditions.
 - 1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at 40°C to 60°C (40°F to 140°F).
 - 2. Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).
- G. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field removable, modular terminal strips or to a termination card connected by a ribbon cable.
- H. Memory. The Controller shall maintain all BIOS and programming information in the event of a power loss for at least 30 days.
- I. Power. Controller shall be able to operate at 90% to 110% of nominal voltage rating.
- J. Transformer. Power supply for the Controller must be rated at minimum of 125% of ASC power consumption and shall be fused or current limiting type.

PART THREE - SOFTWARE AND PERFORMANCE

3.1 GENERAL

- 3.1.1 The Contractor shall provide a complete software package that meets these specifications and is capable of implementing the specified sequences of control.
- 3.1.2 All software will be turned over to the Owner complete and ready for operation, including all operator entered parameters.

3.2 NETWORK COMMUNICATIONS

- 3.2.1 BAS network communications shall follow the LAN standards set forth by ANSI/ASHRAE Standard 135-2008, BACnet.
- 3.2.2 The network capability shall be implemented by a shielded pair of wires, allowing data exchange between the digital, unitary and VAV controllers and the central IBM-PC type microcomputer, and communicating at a minimum of 156kbps.
- 3.2.3 Each controller in the network shall be assigned a separate I.D. number, capable of knowing the sensor input and override status of all controllers in the network, and able to implement control functions based on this information.
- 3.2.4 Both the central work station computer and remotely located computer(s) shall have the ability to transmit and receive all system programs, data, logged information, and system parameters, and be capable of displaying the system color graphics. Graphics software shall include the ability to display variables in a "real-time" format.
- 3.2.5 The controller shall be able to report alarm conditions based on any predetermined level of analog/digital input values, load run time or actions being performed as result of run time. This alarm shall indicate:
 - A. Analog/Digital input sending alarm.
 - B. Value of the alarm input.
 - C. Time the alarm took place.
 - D. I.D. number of the controller.
 - E. Alarm message.
 - F. Priority of Alarm as indicated by at least three (3) different color backgrounds displayed on the alarm message at a workstation.
 - G. Action being performed as a result of run time.

3.3 ENERGY MANAGEMENT FUNCTIONS:

- 3.3.1 The building automation system (BAS) shall have the capability to perform at a minimum the following basic functions:
 - A. Time of day scheduling.
 - B. Temporary single event programming.
 - C. Self-Learning optimized start-stop scheduling.
 - D. Programmable 365-day holiday programming.
 - E. Programmable daylight savings time switchover dates.

- F. Staggered, varying on and off times based on a value of an input Duty cycling.
- G. User programmable minimum on and off times for each load.
- H. User programmable maximum on and off times for each load.
- I. Variable and analog controlled duty cycling.
- J. Temperature, humidity, ambient light, pressure control.
- K. Control setpoints to be reset from any other sensor.
- L. Scheduled turning on of outputs momentarily in one second increments.
- M. User programmable output status of each load as energized or de-energerized when output is programmed on.
- N. Programmable sequential output turn on and off time delay.
- O. Any Output to generate linear analog output 0-10 VDC voltage signals and control bi-directional actuators.
- P. Programmable analog inputs to utilize any arbitrary multiplier and/or offset values for conversion, calibration, etc.
- Q. Intelligent (global) override of loads and programs via momentary closure of an analog input.
- R. Proportional/Integral (PI) control of analog outputs.
- S. Able to define Virtual Sensors which can be any combination of Network sensors, output states or other virtual sensors and variables.

3.3.2 The BAS shall be provided with the following:

- A. User programmable multiple level access code to prevent unauthorized tampering.
- B. User programmable multiple phone number alarm dial out capabilities to report alarm conditions with an ID number and cause of alarm information.
- C. Automatic self-initialization upon return of power or entry of new time and date, to bring controlled loads to their programmed status based on the time and date entered.
- D. User programmable output status of loads (and time delay to return to normal program control) upon return of power after power failure).
- E. User programmable output status of loads in case of program memory loss due to extensive power outages, accidental erasing or programs, etc.

3.4 SEQUENCE OF OPERATION

- 3.4.1 Refer to the drawings for operational sequence. List all control strategies, alarms conditions, fail safe models of operation, all conditional logic used for the control of Equipment.

END OF SECTION

FABRIC AIR
DISTRIBUTION DEVICES

PART ONE - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of non-metal ductwork is indicated on drawings and by requirements of this section.
- B. Types of non-metal ductwork required for this project include the following:
 - 1. Textile Air Dispersion Products.

1.2 QUALITY ASSURANCE

- A. Building Codes and Standards:
 - 1. Product must be Classified by Underwriter's Laboratories in accordance with the 25/50 flame spread / smoke developed requirements of NFPA 90-A and are also classified in accordance with ICC Evaluation Service AC167 and UL 2518.
 - 2. All product sections must be labeled with the logo and classification marking of Underwriter's Laboratories.
- B. Design & Quality Control
 - 1. Manufacturer must have documented design support information including duct sizing; vent, orifice, and/or nozzle location; vent, orifice, and/or nozzle sizing; length; and suspension. Parameters for design, including maximum air temperature, velocity, pressure and textile permeability, shall be considered and documented.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications on materials and manufactured products used for work of this section.
- B. Building Code Data: Submit UL file number under which product is Classified by Underwriter's Laboratories for both NFPA 90-A, ICC AC167, and UL 2518.
- C. Provide detailed drawings confirming configuration of Fabric Tensioning System (components, support locations, segment lengths) and Textile Dispersion System (diameter, lengths, airflow, pressure, and textile permeability).
- D. Provide detailed installation instructions for components to be installed.
- E. Provide warranty and maintenance documentation.

1.4 WARRANTY

- A. Manufacturer must provide a 10 Year Product Warranty for products supplied for the fabric portion of this system as well as a Design and Performance Warranty.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Protect textile air dispersion system and SkeleCore IHS components from damage during shipping, storage, and handling.
- B. Where possible, store products inside and protect from weather. Where necessary to store outside, store above grade and enclose with a vented waterproof wrapping.

PART TWO – PRODUCTS

2.1 MANUFACTURER

DuctSox[®] Corporation, or Architect approved equal.

2.2 TEXTILE AIR DISPERSION SYSTEM

- A. SkeleCore IHS (Internal Hoop System): Air diffusers shall be constructed with internal retention system.
 - 1. System shall consist of an internal 360 degree hoop system, spaced 5' on center.
 - 2. System shall be installed with a one row suspension system located 1.5" above top-dead-center of the textile system.
 - 3. System attachment to cable shall be made using Gliders spaced 12 inches.
 - 4. Available for diameters from 8" – 60".
 - a. One row suspension options
 - b. Cable suspension hardware to include cable, eye bolts, thimbles, cable clamps, and turnbuckle(s) as required.
 - 1) Cable suspension options(must specify if multiple on same project)
 - (a) Galvanized steel cable
 - (b) Stainless steel cable
 - (c) Impregnated steel cable(required for natatorium applications)
 - 2) Support lengths available in 5'(standard), 10', 15', & 30'.
- B. TEXTILE
 - 1. Verona
 - a. Textile Construction: Filament/filament twill polyester, fire retardant in accordance with UL 2518.
 - b. Air Permeability: 2 (+2/-1) CFM/ft² per ASTM D737, Frazier
 - c. Weight: 6.2 oz. /yd² per ASTM D3776
 - d. Warranty: 10 years with standard inlet velocity.
 - 2. Textile Color
 - a. Standard: blue, white, tan, red, green, silver, black
 - b. Custom

C. TEXTILE SYSTEM FABRICATION REQUIREMENTS

1. Textile system to be constructed in modular lengths (zippered) with proper radial securing clips (inlets, endcaps, and mid-sections) and top access zippers for vertical cable safety attachment.
2. Integrated air dispersion shall be specified and approved by manufacturer. (select only those that apply).
 - a. Linear Vents
 - 1) Air dispersion accomplished by linear vent and permeable fabric. Linear vents must be sized in 1 CFM per linear foot increments (based on .5" SP), starting at 1 CFM through 90 CFM per linear foot. Linear vent is to consist of an array of open orifices rather than a mesh style vent to reduce maintenance requirements of mesh style vents. Linear vents should also be designed to minimize dusting on fabric surface.
 - 2) Size of vent openings and location of linear vents to be specified and approved by manufacturer.
 - 3) Inlet connection to metal duct via fabric draw band with anchor patches as supplied by manufacturer. Anchor patches to be secured to metal duct via zip screw fastener – supplied by contractor.
 - 4) Inlet connection includes zipper for easy removal / maintenance.
 - 5) Lengths to include required intermediate zippers as specified by manufacturer.
 - 6) System to include Adjustable Flow Devices to balance turbulence, airflow and distribution as needed. Flow restriction device shall include ability to adjust the airflow resistance from 0.06 – 0.60 in w.g. static pressure.
 - 7) End cap includes zipper for easy maintenance.
 - 8) Each section of the textile shall include identification labels documenting order number, section diameter, section length, piece number, code certifications and other pertinent information.

D. DESIGN PARAMETERS

1. Textile air diffusers shall be designed from 0.25" water gage minimum to 3.1" maximum, with 0.5" as the standard.
2. Textile air diffusers shall be limited to design temperatures between 0 degrees F and 180 degrees F (-17.8 degrees C and 82 degrees C).
3. System overall design; diameter, length, airflow, operating static pressure and dispersion shall be designed or approved by the manufacturer.
4. Do not use textile diffusers in concealed locations.
5. Use textile air dispersion systems only for positive pressure air distribution components of the mechanical ventilation system.

PART THREE – INSTALLATION

3.1 INSTALLATION OF TEXTILE AIR DISPERSION SYSTEM

- A. Install chosen suspension system in accordance with the requirements of the manufacturer. Instructions for installation shall be provided by the manufacturer with product.

3.2 CLEANING AND PROTECTION

- A. Clean air handling unit and ductwork prior to the fabric duct system unit-by-unit as it is installed. Clean external surfaces of foreign substance which may cause corrosive deterioration of facing.
- B. Temporary Closure: At ends of ducts which are not connected to equipment or distribution devices at time of ductwork installation, cover with polyethylene film or other covering which will keep the system clean until installation is completed.
- C. If fabric duct systems become soiled during installation, they should be removed and cleaned following the manufacturers standard terms of laundry.

END OF SECTION

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 than 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.

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.

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 AHRIS standard 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.

D. Supply Fans

1. Unit shall include direct drive, unhooded, 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, unhooded, 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.

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.

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.

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.

- 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 to 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.
- B. Knockdown curb (with duct support rails) shall be factory furnished for field assembly.
- C. Solid bottom curb shall be factory assembled and fully lined with curb rated 1 inch fiberglass insulation and include a wood nailer strip. (Curb shall be adjustable up to 3/4 inch per foot to allow for sloped roof applications.)

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.

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

The Engineer of Record for East End Elementary, Sheridan School District, Hensley, Arkansas Divisions 26, 27 and 28 of the specifications.

May 18, 2026



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.
- 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.
- 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.

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
- 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.
- 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.
 - 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" reproductions, 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.
- 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.
 - 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.
- 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.
- 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. Main switchboard shall be provided with a heater of type approved by Architect. Heater shall be installed in switchboard, and shall remain as directed by Architect from time of installation until final acceptance.
- I. 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.

- J. 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.

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.

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 than 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.
- 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.
- 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.
- 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.

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.
- 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.

<u>Voltage</u>	<u>Depth (Minimum)</u>
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.

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.

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.
- 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.

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

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.

- 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.

B. Wire:

1. Provide factory-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.

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.

- 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.

- 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 or other designation indicated on Drawings in each junction box and in each panelboard.

3.06 FIELD QUALITY CONTROL:

- A. Perform field inspection and testing.
- B. Inspect wire and cable for physical damage and proper connection.
- C. Measure tightness of bolted connections and compare 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

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 Std Nos. 241 and 242 pertaining to grounding and ground-fault protection of power systems.

- 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.

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.

- 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. The service entry equipment, including switchboard frame and grounding bus and all outgoing feeder and/or motor supply connections shall be permanently and effectively grounded as required per Article 250.50 of the National Electric Code. The grounding electrode system shall consist of the following:
 - 1. 1" metal water pipe with connection within 5'0" of point of entry to building.
 - 2. Concrete encased rebar.
 - 3. Metal frame of the building or structure.
 - 4. 3/4" x 10'0" ground rod.
 - 5. Ground ring consisting of 20'0" of #2 AWG base copper conductor.
- K. 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.
- L. 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

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"

- 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.

- d. Ideal Industries, Inc.
 - e. Joslyn 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.

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

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.

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.

- 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.

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.

- 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.

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.

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.

- 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.

- 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.

- 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.

- 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 locknuttied 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. All bends 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

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.

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.

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

- d. Power transfer equipment
- e. Transformers
- f. Starters
- g. Disconnects
- h. Junction boxes larger than 8" x 8"
- i. Circuit breaker enclosures
- j. Power generating units

2. The following are sample:

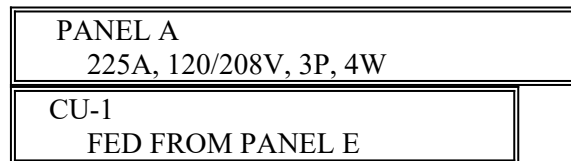
Panel	Panel XXX	XXX AMPS
xxx/xxx Volts	X Phase	X Wire

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. Switchgear and switchboards
 - c. Transfer switches

Samples:



- 8. Provide available fault current stickers/labels as required by NFPA.

END OF SECTION

OCCUPANCY SENSORSPART ONE - GENERAL

1.0 Section Includes

A. Lighting Control Components and Systems:

1. Line Voltage Wall Switches Low Voltage Wall Switches and Sensors
2. Occupancy / Vacancy Sensors Detection
3. Power Interfaces
4. Line Voltage Wall Switches and Sensors

1.1 Related Requirements

- A. Section 26 27 26 - Wiring Devices
- B. Section 26 09 43 – Digital Lighting Controls
- C. Section 26 51 13 - Interior Lighting

1.2 References

A. Underwriters Laboratories (UL):

1. UL 916- Energy Management Equipment
2. UL 924 - Emergency Lighting and Power Equipment
3. UL 1472 – Standard for Safety Solid-State Dimming Controls

B. National Fire Protection Association (NFPA):

1. NFPA 70 - National Electric Code

C. NEMA WD 7-2011: Occupancy Motion Sensors

D. FCC Part 15 and equivalent ISSED / NOM

1.3 Administrative Requirements

A. Coordination

1. Coordinate placement of daylight and occupancy sensors to achieve optimum performance. Proper sensor placement should be coordinated with others to avoid obstructions that would interfere with maintaining prescribed light levels
2. Coordinate the work to provide luminaires that are compatible with the lighting controls to be installed
3. Notify architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work

1.4 Submittals

- A. Submit under provisions of Section 01 33 23 – Shop Drawings, Product Data & Samples
- B. Specification Conformance Document. Clearly define where the equipment submitted for review:
 - 1. Meets specification exactly as specified
 - 2. Meets specification as an alternate with clear definition of compliance
- C. Shop Drawings include
 - 1. System schematic/typical riser diagrams
- D. Product Data Sheets

1.5 Project Closeout Documentation

- A. Provide a factory published manual
 - 1. Warranty
 - 2. Technical support contact
 - 3. Electronic manual on manufacturer's website for free download

1.6 Quality Assurance

- A. Manufacturer Qualifications:
 - 1. Phone Support: Toll-free technical support available from manufacturer through an online tool to schedule a technical support appointment and provide 24/7 emergency support.
 - 2. Remote Support: Manufacturer capable of providing remote support and ability to virtually connect with customers to address issues.
- B. All devices are 100% factory function tested prior to delivery
- C. Compliant with the requirements of NFPA 70
- D. All power components UL listed for required loads

1.7 Project Conditions

- A. Only install equipment after the following site conditions are maintained:
 - 1. Ambient Temperature 14 to 105 degrees F (-10 to 40 degrees C); unless specified extended temperature operation within the product specification sheet.
 - 2. Relative Humidity less than 90% non-condensing
- B. Standard electrical enclosures are permanently installed

C. Equipment is protected from dust, debris and moisture

1.8 Warranty

A. Warranty: Manufacturer and Installer warrant that installed lighting control devices perform in accordance with specified requirements and agree to repair or replace (same device or equivalent), materials, and devices that fail to perform as specified within extended warranty period.

B. Five (5) years from the date of shipment

PART TWO - PRODUCT INFORMATION

2.1 Manufacturers

A. Acceptable: Acuity Brands Lighting, Inc. – System: SensorSwitch Brand

B. Basis of controls design Manufacturer: Acuity Brands, One Lithonia Way, Conyers GA 30012 Steven Downs Manager of Senior Product Markets or Dennis Hoskins, Director of Product Market.

One of the following may be acceptable with approval if compliant with this specification:

1. Sensorswitch
2. Watt-Stopper
Cooper

C. Substitutions: Not Permitted {Under Division 1}:

1. All substitutions must be submitted in writing for approval at least 14 days prior to bid date.
2. Proposed substitute products must be documented with a line by line compliance review

2.1.1 General:

- A. Provide system hardware that is designed, tested, manufactured, warranted by a single manufacturer
- B. Operational Life: At least 10 years expected life while operating within the specified ambient temperature and humidity range
- C. Power Failure Memory: automatically store system settings and recover from a power failure without requiring user input.

Occupancy Detection Technology Requirements:

- D. The occupancy sensor system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.

- E. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions. Ultrasonic or based sensing technologies shall not be accepted.
- F. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional “dual” technology shall be used.
- G. Dual technology sensors shall have one of its two technologies do not require motion to detect occupancy. Acceptable dual technology includes PIR / Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants or approved equal.
- H. Sensors shall offer a settable minimum on timer of at least 15 minutes, to prevent all cycling of lamps before they have burned for the lamp manufacturers minimum recommended time. This timer shall be in addition to the regular occupancy time delay that keeps lights on after last detected occupancy. User shall be able to disable/enable and change the value of this timer.
- I. Sensors shall utilize an occupancy time delay that keeps lights on after last detected occupancy. Factory default setting of the occupancy time delay shall be 10 minutes.
- J. Allow adjustments to the occupancy time delay based on owner preference, fixture life extension or increase energy savings. Should be done in consultation with the building owner and specifying engineer.
- K. Installer, in accordance with manufacturer’s recommendation, shall determine final sensor location. All sensors shall be factory calibrated for optimum performance for its installed PIR lens, and shall not require initial or subsequent field adjustment of detection sensitivity.
- L. All sensor setting adjustments shall be digital; comprising of a one or more user interfaces: Push-button, Visual Light Infrared, RFID or Bluetooth Programming methods
- M. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

2.1.2 Low Voltage Wall Switches

- A. Shall be capable of the following:
 - 1. Accept 12-24VAC/VDC
 - 2. Suitable for installation in a single-gang switch box
 - 3. Support On / Off / Dimming and 3-way Connection
 - 4. single and dual pole options
 - 5. Programmable via push button programming with visual LED visual feedback
- B. Product Series
 - 1. SPODM(A)
 - 2. SWS
 - 3. WSD LV

2.2 Line Voltage Wall Switches

A. Shall be capable of the following:

1. Shall accept Class 1 wiring directly.
2. Devices will operate as On / Off and Dimming (pending model variant)
3. Dimming devices shall be 0-10V sink devices
4. Multi-way switches allow for 3-way, 4-way and up to 9 connections.
5. All Multi-Way devices On / Off loads will operate and respond in unison.
6. Multi-way devices with dimming loads will operate in unison when initiated by a dimming device
7. Multi-way device is a class 1 low voltage data bus and must not be used with a standard toggle switch.
8. Count down timer capabilities
9. Single and dual pole options

B. Product Series

1. PTS(A)
2. SPODMR(A)
3. SPODMRA MWO
4. SPODMR(A) WR
5. WPD
6. ASD

2.3 Line Voltage Wall Switch with Occupancy Sensor

- A. Sensor shall provide wall-to-wall PIR occupant movement supporting small (hand motions) and large (walking motion) detection .
- B. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology (PIR/Microphonics) detection shall be used (as specified in above section 1.1, Occupancy Sensor Technology Requirements).
- C. For applications requiring independent control of two loads, a sensor with two dual relays and dual override switches shall be required. Each relay shall have independent programmable occupancy time delays.
- D. Sensors shall be capable of switching both 120 VAC and 277 VAC (models allowing 120-277 VAC input) and run off of 50/60 Hz power. A version capable of switching 347 VAC shall also be available. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor load.
- E. Light Commercial devices will be designated as 120 VAC and lower load rating compared to commercial based products.
- F. Sensor shall recess into single gang switch box and fit a standard GFI opening.
- G. Sensor shall meet NEC grounding requirements by providing a dedicated ground connection internally and intrinsically through its mounting strap.

- H. Line and load wire connections shall be interchangeable, such that installer cannot make an improper connection to a line/load in a manner that will cause malfunction or damage to the sensor.
- I. Sensor shall not require a neutral connection regardless of number of poles and/or detection technology (only exception is versions with lighted push-buttons).
- J. Sensor shall not allow any leakage of current to pass to the load when sensor is in the unoccupied (off) condition. Sensor shall not require a minimum load to be connected to function.
- K. Sensor shall have optional features for photocell/daylight override, vandal resistant lens, low temperature/high humidity operation.
- L. All sensor settings, including time delay and photocell settings shall be digital and accessible for adjustment via one or more user interfaces push-button, visual light, Bluetooth programming without requiring removal of cover plate or tools of any kind.
- M. Wall Switch sensors shall have field programmable adjustments for selecting operational modes, occupancy time delays, minimum on time, and photocell set-point as applicable.
- N. All models shall be capable of both Auto-On, Manual On, and Partial-On operation.
- O. All models shall be capable of a “Reduced Turn On” operation where the initial PIR turn on level is higher in order to eliminate PIR from reflective surfaces from being detected. PIR shall be returned to normal levels upon initial PIR detection.
- P. All models shall have a “Predictive Off” mode where user can manually turn the lights off when leaving the room and still have them come on automatically when they return to space.
- Q. All models shall be capable of disabling override switch.
- R. Multiple switches controlling the same load (3-way or 4-way applications) shall use multi-way based devices.
- S. The following SensorSwitch models numbers color and optional features like dimming and out-of-box default behaviors are specified within the product datasheets. The list below is subject to change.
- T. Product Series
 - 1. WSRA (PIR)
 - 2. WSRA 2P FAN (PIR, Dual Relay)
 - 3. WSX(A) (PIR)
 - 4. WSX(A) MWO (PIR)
 - 5. WSX(A) 2P (PIR, Dual Relays, Auto On Pole 1/Manual On Pole 2)
 - 6. WSX(A) PDT (PIR/Microphonics)
 - 7. WSX(A) MWO PDT (PIR/Microphonics)
 - 8. WSX(A) PDT 2P (PIR/Microphonics, Dual Relays, On Pole 1/Manual On Pole 2)
 - 9. WSX(A) SA (PIR, Manual On by default; programmable)
 - 10. WSX(A) MWO SA (PIR, Manual On by default; programmable)
 - 11. WSX(A) PDT SA (PIR/Microphonics, Manual On by default; programmable)
 - 12. WSX(A) MWO PDT SA (PIR, Manual On by default; programmable)

13. WSX(A) VA (PIR, Manual On by default)
14. WSX(A) MWO VA (PIR, Manual On by default)
15. WSX(A) PDT VA (PIR/Microphonics Manual On by default)
16. WSX(A) MWO PDT VA (PIR/Microphonics Manual On by default)
17. WSX NL (PIR, lighted push-button, neutral required)
18. WSX PDT NL (PIR/Microphonics, lighted push-button, neutral required)
19. WSD LV (PIR, low voltage, power pack required)
20. WSD PDT LV (PIR/Microphonics, low voltage, power pack required)

2.4 Wall Switch Occupancy Sensors – Large Areas

- A. Sensor shall provide wall-to-wall PIR detection such that small hand motions are detected out to 40 ft (12.19 m).
- B. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology (PIR/Microphonics) detection shall be used (as specified in above section 1.1, Occupancy Sensor Technology Requirements).
- C. For applications requiring independent control of two loads, a sensor with two dual relays and dual override switches shall be required. Each relay shall have independent programmable occupancy time delays.
- D. Sensors shall be capable of switching both 120 VAC and 277 VAC and run off of 50/60 Hz. A version capable of switching 347 VAC shall also be available. Load ratings shall be 13A each pole, ¼ HP motor load.
- E. Sensor shall meet NEC grounding requirements by providing a dedicated ground connection and intrinsically grounding through its mounting strap.
- F. Line and load wire connections shall be interchangeable, such that installer cannot make an improper connection to a line/load in a manner that will cause malfunction or damage to the sensor.
- G. Sensor shall not require a neutral connection regardless of number of poles and/or detection technology.
- H. Sensor shall not allow any leakage of current to pass to the load when sensor is in the unoccupied (Off) condition. Sensor shall not require a minimum load to be connected in order to function.
- I. Sensor shall be the following SensorSwitch model numbers. Device color and optional features as specified.
- J. Product Series
 1. LWS(H) (PIR)
 2. LWS(H) 2P (PIR, Dual Relays)
 3. LWS(H) PDT (PIR/Microphonics)
 4. LWS(H) PDT 2P (PIR/Microphonics, Dual Relays)

2.6. Low Voltage Occupancy Sensors

- A. The installing contractor shall install one or more sensors with PIR coverage areas that cover the entire space and all entrance points. Exact placement and quantity required shall be per manufacturer's best practice recommendations.
- B. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology (PIR/Microphonics) detection shall be used (as specified in above section 2.2, Occupancy Sensor Technology Requirements).
- C. Sensors shall utilize a digital PIR detector (dual element pyro-electric detector) component, to provide a high degree of RF immunity.
- D. Sensors shall interconnect with other sensors and power/relay packs with class 2, three-conductor wire.
- E. Sensors shall operate on 12 to 24 VAC or VDC and consume no more than 5 mA so that up to 14 sensors may be connected to a single power pack.
- F. Upon initial power up, sensors must immediately turn on. Power packs may be wired on the line or load side of local switching and must not exhibit any delays when switch is energized.
- G. Each designated zone shall contain one sensor with a SPDT class 2 auxiliary relay, providing an input to building automation system (BAS). All sensors in designated zone shall communicate to sensor with relay for status to BAS. Sensor relay coil shall energize in the unoccupied state to load share the low voltage current from power pack. Note that power pack must be installed on the Line side of the local toggle switch for auxiliary relay to work properly.
- H. Sensors shall have test mode that temporarily shortens/disable all time delays (e.g., minimum on, occupancy, photocell transition, dimming rates) such that an installer can quickly test operation of sensor. Test mode shall time out and return sensor to normal operation should the installer forget to disable test mode after installation.
- I. Sensors shall have optional features for on/off photocell control, automatic dimming control photocell, high/low occupancy based dimming, and usage in low temperature/high humidity environments.
- J. Sensors with a recessed profile are acceptable substitutes for above ceiling mount sensors (e.g. CM => RM)
- K. Fixture mounted box sensors are acceptable substitutes for above ceiling mount sensors (e.g. CM => CMB)
- L. Sensors shall be the following SensorSwitch model numbers.
 - 1. CM (PIR, Ceiling Mount, Standard Range)
 - 2. CM PDT (PIR/Microphonics, Ceiling Mount, Standard Range)
 - 3. RM (PIR, Ceiling Mount, Extended Range)
 - 4. RM PDT (PIR/Microphonics, Ceiling Mount, Extended Range)
 - 5. WV 16 (PIR, Corner Mount, Wide View)
 - 6. WV PDT 16 (PIR/Microphonics, Corner Mount, Wide View)
 - 7. HW 13(PIR, Wall Mount, Hallway View)

8. HMB 10 (PIR, Box Mount, High Bay Aisle Way)
9. MSD
10. MSOD
11. TLS

2.7 Power Packs

- A. Power packs shall accept and switch 120 or 277 VAC, be plenum rated, and provide class 2 power for up to 14 remote sensors.
- B. Power pack shall securely mount to junction location through a threaded ½ inch chase nipple. Plastic clips into junction box shall not be accepted. All class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
- C. When required by local code, power pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
- D. Power pack shall incorporate a Class 1 relay and an AC electronic switching device. The AC electronic switching device shall make and break the load, while the relay shall carry the current in the on condition. This system shall provide full 20 Amp switching of all load types, and be rated for 400,000 cycles.
- E. Power packs shall be single circuit, or two circuits. Slave packs may be used to control additional circuits. When two circuit power packs, or slave packs are used, the power packs must be wired directly to circuit breaker. Otherwise, power packs may be wired on the line or load side of the local switch.
- F. MP20 used as a dry contact relay to connect BMS, HVAC, Fan, etc....
- G. Power packs shall be the following SensorSwitch model numbers.
 1. PP20 (Single Pole)
 2. SP20 (Secondary Pack)
 3. MP20
 4. PP16 Shunt
 5. PP5LV Shunt
 6. PP5 SSA (wireless)

2.8 Line Voltage Occupancy Sensors

- A. Sensors shall be self-contained and accept Class 1 wiring directly without the use of a power pack.
- B. The installing contractor shall install one or more sensors with PIR coverage areas that cover the entire space and all entrance points. Exact placement and quantity required shall be per manufacturer's best practice recommendations.

- C. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology (PIR/Microphonics) detection shall be used (as specified in above section 2.2, Occupancy Sensor Technology Requirements).
- D. Sensors shall utilize a digital PIR detector (dual element pyro-electric detector) component, so as to provide a high degree of RF immunity.
- E. Line and load wire connections shall be interchangeable, such that installer cannot make an improper connection to a line/load in a manner that will cause malfunction or damage to the sensor.
- F. Multiple sensors controlling the same load shall be wired in parallel.
- G. For applications requiring independent control of two loads, a sensor with two dual relays shall be required. Each relay shall have independent programmable occupancy time delays.
- H. Dual relay sensors shall have an optional operational mode called "Alternating On" where when during unoccupied periods, one relay is always left closed (thus one load is always on). The particular relay that is left closed alternates each cycle so that the aging of the connected lamps is even.
- I. Sensors shall be capable of switching both 120 VAC and 277 VAC and run off 50/60 Hz power. Many devices include intermediate voltage ratings at 220 and 230 VAC. A version capable of switching 347 VAC shall also be available. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor load.
- J. Specific sensors capable of switching 5 Amps of two-phase power (208/240 or 480 VAC) shall be available. These sensors shall always simultaneously switch both phases as per NEC guidelines.
- K. Wall mounted sensors must be installed at 7 to 8 feet above the floor. Single and two circuit units shall be available.
- L. Sensors shall have test mode that temporarily shortens/disable all time delays (e.g., minimum on, occupancy, photocell transition, dimming rates) such that an installer can quickly test operation of sensor. Test mode shall time out and return sensor to normal operation should the installer forget to disable test mode after installation.
- M. Sensors shall have optional features for on/off photocell control, automatic dimming control photocell, high/low occupancy based dimming, and usage in low temperature/high humidity environments.
- N. Sensor settings may be programmed via pushbutton or via mobile application, check the most recent datasheet for more information.
- O. Sensors shall be the following SensorSwitch model families.
 - 1. CMR / CMR 2P (Standard Range 360°, PIR, Ceiling Mount – Single / Two Pole)
 - 2. CMR PDT / CMR PDT 2P (Standard Range 360°, PIR/Microphonics Dual Technology, Ceiling Mount – Single / Two Pole)
 - 3. CMRB / CMRB 12P (Extended Range 360°, PIR, Fixture Mount Box – Single / Two Pole)
 - 4. WVR 16 / WVR 16 2P (Wide View, PIR, Wall Mount – Single / Two Pole)

5. WVR PDT 16 / WVR PDT 2P (Wide View, PIR/Microphonics Dual Technology, Wall Mount – Single / Two Pole)
 6. HMRB 10 (High Bay End-of-Aisle, PIR, Fixture Mount Box)
 7. HWR 13
 8. LSXR
 9. SBGR
 10. SBOR
- P. Sensors with a recessed profile are acceptable substitutes for above ceiling mount or fixture mount sensors (e.g. CMR=> RMR)

PART THREE – EXECUTION

3.1 Installation

- A. Follow manufacturer's instructions for all installation steps
- B. Provide a complete installation per Contract Documents
- C. Where applicable provide FAQs and Quick Start Guides

3.2 Startup and Programming

- A. Provide telephone support via toll free line
- B. Factory trained service available for purchase
- C. Where applicable training video and elearning content

- 3.3 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.

- 3.4 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.

3.5 Maintenance

- A. Factory trained service technicians available within the continental US
- B. Offer integrated help on-screen and via online videos
- C. Factory telephone support via toll free line

END OF SECTION

DIGITAL-NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. System Software Interfaces.
2. System Backbone and Integration Equipment.
3. Wired Networked Devices.

B. Related Requirements:

1. Div. 26: Section 26 05 00 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 26 27 26 "Wiring Devices" for wired switches and dimmers and other Project requirements applicable to Work specified in this Section.

1.2 DEFINITIONS

- A. Data Bus: A wired interface used to communicate with connected devices.
- B. Device: A collective term for bus or wireless connected devices, including fluorescent ballasts, LED drivers, incandescent luminaires, manual switches, switching relays, sensors, and similar.
- C. Global: Communication between devices in otherwise separate spaces using a bridging device or system controller.
- D. Group: A set of devices that communicate together.
- E. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.
- F. Scene: Digital light level associated with a preset.
- G. System Backbone: Devices used to connect and manage otherwise separate spaces, including bridging devices and gateways or system controllers. Used to expose devices to software configuration via TCP/IP.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Bill of Materials necessary to install the networked lighting control system.
2. Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.

3. Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.
4. Other Diagrams and Operational Descriptions - as needed to indicate system operation or interaction with other system(s).

B. Shop Drawings:

1. Riser Diagrams showing device wiring connections of system backbone and typical per room/area type.

1.4 INFORMATIONAL SUBMITTALS

- A. Contractor Startup/Commissioning Worksheet.
- B. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.
- C. Field quality-control reports.
- D. Warranty

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Contracts:
1. Hardware and Software Operation Manuals
 2. Maintenance service agreement.
 3. Software service agreement.

- B. Warranty documentation.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
1. Phone Support: Toll-free technical support available from manufacturer through an online tool to schedule a technical support appointment and provide 24/7 emergency support.
 2. Remote Support: Manufacturer capable of providing remote support and ability to virtually connect with customers to address issues with visual guidance overlaid on images of real-world objects.

1.7 WARRANTY

- A. Warranty: Manufacturer and Installer warrant that installed lighting control devices perform in accordance with specified requirements and agree to repair or replace, including labor, materials, and equipment, devices that fail to perform as specified within extended warranty period.
1. Failures include, but are not limited to, the following:
 - a. Faulty operation of lighting control hardware.
 - b. Faulty operation of lighting control firmware.

2. Minimum Warranty Period: Five years from date of shipment.

PART 2 - PRODUCTS

2.1 SYSTEM COMPLIANCE

- A. System components manufactured in accordance with UL 916 and UL 924 standards where applicable.
- B. System listed as qualified under DesignLights Consortium Networked Lighting Control System Specification v5.0.
- C. Performance Criteria:
 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 SYSTEM PERFORMANCE REQUIREMENTS

- A. System Architecture:
 1. System architecture based upon the following concepts:
 - a. Networkable intelligent lighting control devices.
 - b. Standalone lighting control zones using distributed intelligence.
 2. Intelligent lighting control devices with individually addressable network communication capability and having one or more basic lighting control components including: occupancy sensor, photosensor, relay, dimming output, contact closure input, analog 0-10 V(dc) input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure permissible to minimize overall system device count.
 3. Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices capable of providing automatic control from sensors (occupancy and/or photosensor) and manual control from local wall stations without requiring connection to a higher-level system backbone.
 - a. Lighting control zones (wired and wireless) support at least 128 devices per zone.
 4. System to include one or more system controllers that provide time-based control.
 5. System controller provides means of connecting the lighting control system to a system software interface and building management systems via BACnet/IP or BACnet MS/TP protocol.
 6. System controller supports both low-voltage wired and wireless RF communication within a single controller device.
 7. System devices support firmware update, either remotely or from within the application space, for purposes of upgrading functionality at a later date.
 8. System capable of reporting lighting system events and performance data to management software for display and analysis.

B. Wired Networked Control Zone Characteristics:

1. Connections to devices within a wired networked lighting control zone and to backbone components accomplished with a single type of low-voltage network cable, compliant with CAT6 specifications or higher. Use of mixed types of low-voltage network cables is unacceptable.
2. Devices connected in "daisy-chain" topology. "Hub-and-spoke" topology, requiring all individual networked devices to be connected to a central component, is unacceptable, to reduce the total amount of network cable required for each control zone.
3. Pre-terminated, plenum-rated, low-voltage network cabling supplied with hardware.
4. Following proper installation and provision of power, all networked devices connected with low-voltage network cable must automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g. software application, handheld remote, pushbutton).
 - a. The "out of box" default sequence of operation is intended to provide typical sequence of operation to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.
5. System software capable of automatic discovery of all connected devices without requiring any provisioning of system or zone addresses.
6. Networked devices capable of detecting improper communication wiring and LED notification to alert installation/startup personnel.
7. Networked control devices suitable for control of egress or emergency light sources without additional, externally mounted UL 924 shunting or 0-10 V(dc) disconnect devices, to provide a compliant sequence of operation while reducing the overall installation and wiring costs of the system. Capable of supporting the following sequence of operation:
 - a. Low-Voltage Power Sensing: Devices automatically provide 100 percent light level upon detection of loss of power sensed via low-voltage network cable connection where applicable.
 - b. Line-Voltage Power Sensing: Devices listed as UL 924 emergency relays which automatically close load-control relay and provide 100 percent light output upon detection of loss of power sensed via line voltage connection to normal power.
8. Global Control Zones: Networked luminaires and intelligent lighting control devices located in different areas able to transmit and track information within at least 128 system-wide control zones to support required sequences of operation that may span multiple areas. Occupancy, photosensor inhibit, and switch commands available across multiple controllers.
9. Wired Networked Wall Station Scene-Control Capabilities:
 - a. Preset Scenes that activate a specific combination of light levels across multiple local and global channels.
 - b. Local Profile Support: Profile Scenes that modify the sequence of operation for devices in the area (group) in response to a button press to dynamically optimize occupant experience and lighting energy usage.
 - 1) Wall stations able to manually start and stop local profiles, or local profile capable of ending after a specific duration of time between five minutes and 12 hours.
 - 2) Configurable Parameters:
 - a) Fixture light level.
 - b) Occupancy time delay.
 - c) Response to occupancy sensors (including enabling/disabling response).
 - d) Response to daylight sensors (including enabling/disabling response).

- e) Enabling/disabling wall stations.
- c. Three-Way or Multi-Way Control: Multiple wall stations capable of controlling the same local and global control zones, to support "multi-way" preset scene and profile scene control.

C. System Integration Capabilities:

- 1. Capable of interface with third-party building management systems (BMS) to support two-way communication using BACnet/IP protocol, BACnet MS/TP protocol, and RESTful API.
- 2. Activation of Global Profiles from third-party systems via dry contact closure output signals or digital commands via RS-232 or RS-485.

D. Supported Sequence of Operations:

- 1. Control Zones:
 - a. Local Control Zones: Networked luminaires and intelligent lighting control devices installed in an area (also referred to as a group of devices) capable of transmitting and tracking occupancy sensor, photosensor, and manual switch information within at least 48 unique control zones to support different and reconfigurable sequences of operation within area. These will also be referred to as local control zones.
 - b. Adjacent Control Zones: Networked luminaires and intelligent lighting control devices capable of tracking occupancy broadcasts from adjacent zones. When this feature is enabled, luminaire output for a vacant zone will reduce to a configurable dimmed state if one or more adjacent zones are occupied. Luminaires will turn off when both primary and adjacent zones are vacant.
- 2. Wall Station Capabilities:
 - a. Wall stations support the following capabilities:
 - 1) On/Off of a local or global control zone.
 - 2) Continuous dimming control of light level of a local or global control zone.
 - b. Multi-Way Control: Multiple wall stations capable of controlling the same local or global control zones, to support "multi-way" switching and dimming control.
- 3. Occupancy Sensing Capabilities:
 - a. Occupancy sensors configurable to control a local or global zone.
 - b. Multiple occupancy sensors capable of controlling the same local or global zones. This capability combines occupancy sensing coverage from multiple sensors without consuming multiple control zones.
 - c. Occupancy sensing sequence of operation modes:
 - 1) On/Off Occupancy Sensing.
 - 2) Partial-On Occupancy Sensing.
 - 3) Partial-Off Occupancy Sensing.
 - 4) Vacancy Sensing (Manual-On / Automatic-Off).
 - d. On/Off, Partial-On, and Partial-Off Occupancy Sensing Modes Sequence of Operation:
 - 1) Occupancy automatically turn lights on to a designated level when occupancy is detected. Designated occupied light level support at least 100 dimming levels.
 - 2) Occupancy sensors automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. Designated unoccupied dim level support at least 100 dimming levels.

- 3) System capable of combining Partial-Off and Full-Off operation by dimming lights to a designated level when vacant and turning the lights off completely after an additional time delay.
- 4) Photosensor readings, if enabled in occupancy sensing control zone, automatically adjust light levels during occupied or unoccupied conditions as necessary.
- 5) Wall station activation changes the dimming level or turn lights off as selected by the occupant. Lights optionally remain in this manually specified light level until the zone becomes vacant. Upon vacancy, normal sequence of operation resumes.
- e. Vacancy Sensing or Manual-On/Automatic-Off Mode Sequence of Operation:
 - 1) Activation of a wall station is required turn lights on. System capable of programming the zone to turn on to either a designated light level or previous user-set light level. Initially occupying the space without using a wall station must not result in lights turning on.
 - 2) Occupancy sensors automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. Designated unoccupied dim level support at least 100 dimming levels.
 - 3) System capable of dimming the lights when vacant and then turning the lights off completely after an additional time delay.
 - 4) System capable of an "automatic grace period" immediately following detection of vacancy, during which time any detected occupancy results in the lights reverting to the previous level. After the grace period has expired, the use of a wall station is required to turn lights on.
 - 5) Photosensor readings, if enabled in the Occupancy Sensing control zone, capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary.
 - 6) Wall station interaction changes the dimming level or turn lights off as selected by occupant. Lights remain at manually specified light level until zone becomes vacant; normal sequence of operation resumes upon vacancy.
- f. Occupancy time delays before dimming or shutting off lights separately programmable for all control zones from 15 seconds to 2 hours.
4. Schedule Capabilities:
 - a. System capable of time schedules for time-of-day to override devices including offsets from dusk and dawn.
 - b. System capable of providing a visible "blink warning" five minutes prior to the end of the schedule.
 - c. Wall stations may be programmed to provide timed extensions/overrides that turn the lights on for an additional time period.
 - 1) Timed override/extension duration programmable for each individual device, zone of devices, or customized group of devices, from five minutes to 12 hours.

2.3 SYSTEMS SOFTWARE INTERFACES

A. Management Interface:

1. Web-based management interface for remote system control, live status monitoring, and configuration of lighting control settings and schedules.
2. Compatible with industry-standard web browser clients.
3. Minimum of 100 unique password-protected user accounts.
4. Minimum of three user permission levels: read-only, read and change settings, and full administrative system access.

5. Capable of restricting access for user accounts to specific devices within the system.
6. All system devices capable of being given user-defined names.
7. Device identification information displayed in the Management interface including:
 - a. Model number.
 - b. Model description.
 - c. Serial number or network ID.
 - d. Manufacturing date code.
 - e. Custom label.
 - f. Parent network device.
8. Management interface capable of displaying live status of a networked luminaire or intelligent control device including:
 - a. Luminaire on/off status.
 - b. Dim level.
 - c. Power consumption.
 - d. Device temperature.
 - e. PIR occupancy sensor status.
 - f. Microphonic occupancy sensor status.
 - g. Remaining occupancy time delay.
 - h. Photosensor reading.
 - i. Active Profiles.
9. Management interface capable of displaying and modifying the current active settings of a networked luminaire or intelligent control device including:
 - a. Dimming trim levels.
 - b. Occupancy sensor and photosensor enable/disable.
 - c. Occupancy sensor time delay and light level settings.
 - d. Occupancy sensor response (normal or vacancy).
 - e. Photosensor setpoints and transition time delays.
10. Management interface capable of applying settings changes for a zone of devices or a group of selected devices using a single action that does not require the user to apply settings changes for each individual device.
11. Management interface capable of compiling a printable network inventory report.
12. Management interface capable of compiling a printable report detailing all system profiles.
13. All sensitive information stored encrypted.
14. System software updates available for automatic download and installation via the Internet.

B. Visualization and Programming Interfaces:

1. System provides web-based visualization interface that displays a graphical floorplan.
2. Graphical floorplan will offer the following types of system visualization:
 - a. Full Device Option: Master graphic of entire building, by floor, showing each control device installed with zones outlined including:
 - 1) Controls embedded light fixtures.
 - 2) Controls devices not embedded in light fixtures.
 - 3) Daylight sensors.
 - 4) Occupancy sensors.
 - 5) Wall switches and dimmers.
 - 6) Scene controllers.

- 7) Networked relays.
 - 8) Wired bridges.
 - 9) System Controllers.
 - 10) Wired relay panels.
 - 11) Group outlines.
3. Programming capabilities through the application will include the following:
 - a. Switch, occupancy sensor, and photosensor zone configuration.
 - b. Manual-on or automatic-on modes.
 - c. Turn-on and dim to dimming levels.
 - d. Occupancy sensor time delays and PIR sensitivity.
 - e. Dual technology occupancy sensors sensitivity.
 - f. Photosensor calibration adjustment and auto-setpoint.
 - g. Multiple photosensor zone offset.
 - h. Trim level settings.
 - i. Preset scene creation and copy for scene-capable devices.
 - j. Application of custom device labels to the Bluetooth Low-Energy Programming Devices and individual connected lighting control devices.
 - k. Fade rate settings.

C. Smartphone Programming Interface for Wired and Wireless Devices:

1. Interface provided for both Apple iOS and Android operating systems that allows configuration of lighting control settings.
2. Application supports configuration of wireless networked control devices.
 - a. Application access granted with valid user name and password.
 - b. Access to program information governed by permission system that allows users to share access with other users and restrict access to those who should not be able to reconfigure the equipment.
 - c. Indication of signal strength where multiple Bluetooth Low-Energy Programming Devices are available for configuration.
3. Application supports configuration of wired networked control devices.
 - a. Connected device access granted through user-defined passcode at initial install.
 - b. Indication of signal strength where multiple Bluetooth Low-Energy Programming Devices are available for configuration.
4. Programming Capabilities:
 - a. Switch, occupancy sensor, and photosensor group configuration.
 - b. Manual-on or automatic-on modes.
 - c. Turn-on and dim to dimming levels.
 - d. Occupancy sensor time delays and PIR sensitivity.
 - e. Dual technology occupancy sensors sensitivity.
 - f. Photosensor calibration adjustment and auto-setpoint.
 - g. Multiple photosensor zone offset.
 - h. Trim level settings.
 - i. Preset scene creation.
 - j. Application of custom device labels for individual connected lighting control devices.
 - k. Fade rate settings.

2.4 SYSTEM BACKBONE AND SYSTEM INTEGRATION EQUIPMENT

- A. System Controller: Multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies.
1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nECY or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 2. System Controller Functions:
 - a. Time-based control of downstream wired and wireless network devices.
 - b. Linking into an Ethernet network.
 - c. Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.
 - d. Connection to various software interfaces, including management interface, historical database and analytics interface, and visualization interface.
 3. Integral web server to support system controller configuration and diagnostics.
 4. Minimum of three RJ-45 networked lighting control ports for connection to any of the following:
 - a. Graphical touch screen.
 - b. Wired communication bridges.
 - c. Direct connection to networked wired luminaires and intelligent lighting control devices (up to 128 total devices per port).
 5. Device will automatically detect all network-connected devices.
 6. Capable of managing and operating a minimum of 750 networked devices (wired) per system controller.
 7. Multiple System Controllers capable of connection via LAN for scalability to a minimum of 20,000 networked devices.
 8. Supports BACnet/IP and BACnet MS/TP protocols to directly interface with BMS and HVAC equipment without additional protocol translation gateways.
 9. NEMA 1 enclosure with Class 1 and Class 2 separation.
 - a. Power Supply Voltage: 120 V(ac).
 10. Automatic algorithm to eliminate redundant, networked paths to streamline communication between the system controller and end devices.
 11. System Controller Security Provisions:
 - a. Disallow the use of default passwords and require passwords to be updated prior to use.
 - b. Support user role-based access, such as administrator, user, and viewer.
 - c. Signed firmware to ensure that unmodified, authentic software is always installed.
 - d. IP-based communication protected with strong encryption algorithms such as AES or TLS1.2+.
 - e. Prevent rollback of firmware to firmware versions with known, critical vulnerabilities.
 - f. Valid cybersecurity listing through a third party.

2.5 WIRED NETWORKED DEVICES

A. Wired Networked Wall Switches, Dimmers, Scene Controllers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nPODMA or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
2. Mounting: Suitable for installation in single-gang switch box.

3. Communication and low-voltage power delivered via standard low-voltage network cabling with RJ-45 connectors.
4. All switches detect valid communication and blink a unique LED pattern to visually indicate a potential wiring issue.
5. Devices with mechanical push buttons provide tactile and LED user feedback.
6. Devices with mechanical push buttons manufactured with custom button labeling.
7. Wall switch and dimmer:
 - a. Number of control zones: 4.
 - b. Control Types Supported:
 - 1) On/Off.
 - 2) On/Off/Dimming.
 - 3) On/Off/Dimming/Correlated Color Temperature Control for specific luminaire types.
 - c. Color: Selected by Architect.
8. Scene Controller:
 - a. Number of Scenes: 4.
 - b. Control Types Supported:
 - 1) On/Off.
 - 2) On/Off/Dimming.
 - 3) Preset Level Scene Type.
 - 4) On/Off/Dimming/Preset Level for Correlated Color Temperature.
 - 5) Reprogramming of other devices within daisy-chained zone to implement user-selected lighting scene including manual start/stop from the scene controller, or optionally programmed automatic stop after a user-selectable duration between five minutes and 12 hours.
 - 6) Selecting a lighting profile to be run by device's upstream controller to implement a selected lighting profile across multiple zones including manual start/stop from the scene controller, or optionally programmed automatic stop after a user selectable duration between five minutes and 12 hours.
 - c. Color: Selected by Architect.

B. Networked Graphic Wall Stations:

1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nPOD TOUCH or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
2. Mounting: Suitable for installation in single-gang switch box.
3. Integral 3.5-inch capacitive full-color touch screen.
4. Power via polarity insensitive Class 2 low-voltage 15 to 24V (dc) power supply.
5. Device enables mobile application control of control zones and scenes through Bluetooth.
6. Communication over standard low-voltage network cabling with RJ-45 connectors.
7. User-customizable screen saver utilizing uploaded image file in common file format including jpg, png, gif, bmp, or tif.
8. Capable of configuration of all switches, dimmers, control zones, and lighting preset scenes via password-protected setup screens.
9. Graphic Wall Station Options:
 - a. Number of Control Zones: Up to 16.
 - b. Number of Scenes: Up to 16.

- c. Profile Scene Duration: User configurable from five minutes to 12 hours.
- d. Color: Selected by Architect.

C. Digital Time Clock:

1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nDTC or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
2. Controls a linear bus of lighting devices supplying all time functions without connection to a system controller.
 - a. Programming of the linear bus of lighting devices must not require additional hardware, including computers, specialized dongles, or other connection devices.
 - b. Programming of the linear bus exclusively done through the touch-screen interface.
3. Capable of up to 32 schedules. Each schedule consists of one set of On and Off times per day for each day of the week and for each of two holiday lists. Schedules assignable to any individual relay or group of relays.
4. Operates from non-volatile memory so that all system programming is retained indefinitely.
5. Mounted inside a relay panel to eliminate the necessity for additional enclosures for complete installation.
6. Capacitive 3.5-inch, full-color touch screen.

D. Wired Networked Auxiliary Input / Output (I/O) Devices:

1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nIO series or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
2. Plenum rated.
3. Mounting: Inline wired.
4. Communication and low-voltage power delivered to each device via standard low-voltage network cabling with RJ-45 connectors.
5. Auxiliary Input/Output Devices Options:
 - a. Contact closure or pull-high input.
 - 1) Input programmable to support maintained or momentary inputs that can activate local or global scenes and profiles, activate lights at a preconfigured level, ramp light level up or down, or toggle lights on/off.
 - b. 0-10V analog input.
 - 1) Input supports zero to 10 V dimming output control from a dimmer switch.
 - 2) Input programmable to function as a daylight sensor.
 - c. RS-232/RS-485 digital input.
 - 1) Input supports activation of up to four local or global scenes and profiles, and on/off/dimming control of up to 16 local control zones.
 - 2) Provides relay and dimming level status to external device (e.g. Touchscreen) when polled.

- d. 0-10V dimming control output, capable of sinking up to 20mA.
 - 1) Output programmable to support all standard sequence of operations supported by system.
- e. Digital control output via eidoLED LEDcode communication.
 - 1) Output programmable to support light intensity control, as well as optional correlated color temperature (CCT) control, of the connected luminaire.

E. Wired Networked Occupancy:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nCM nWV or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
- 2. Detect the presence of human activity within space and fully control the on/off function of lights.
- 3. Utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state, thus preventing false on conditions. Ultrasonic and Microwave-based sensing technologies are unacceptable.
- 4. Dual technology sensors used in locations where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions).
- 5. Dual technology sensors must have one sensing technology not motion dependent to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT), which detects both occupant motion and sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) are unacceptable.
- 6. All sensing technologies are acoustically passive, meaning they do not transmit sound waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers and hearing devices). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonic technology. Ultrasonic and Microwave-based sensing technologies are unacceptable.
- 7. Ceiling, fixture, recessed, and corner mounted sensors available, with multiple lens options available customized for specific applications.
- 8. Communication and low-voltage power delivered to each device via standard low-voltage network cabling with RJ-45 connectors.
- 9. All sensors detect valid communication and blink a unique LED pattern to visually indicate a potential wiring issue.
- 10. Sensor programming parameter available and configurable remotely from the software and locally via the device push button.
- 11. Ceiling mount occupancy sensors include one integrated dry contact switching relay, capable of switching 1 A at 24 V, resistive only.
- 12. Sensors available with one or two occupancy "poles," each of which provides a programmable time delay.

F. Wired Networked Wall Switch Sensors:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nWSXA LV or comparable product by one of the following:
 - a. Cooper Industries, Inc.

- b. Leviton Manufacturing Co., Inc.
- 2. Mounting: Suitable for installation in single-gang switch box.
- 3. Communication and low-voltage power delivered via standard low-voltage network cabling with RJ-45 connectors.
- 4. All switches detect valid communication and blink a unique LED pattern to visually indicate a potential wiring issue.
- 5. Devices with mechanical push buttons provide tactile and LED user feedback.
- 6. Wall Switch Sensor Options:
 - a. User Input Control Types: On/Off/Dimming.
 - b. Occupancy Sensing Technology: Dual technology acoustic.
 - c. Color: Selected by Architect.

G. Wired Networked Power Packs:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nPP16 series or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
- 2. Plenum rated.
- 3. Communication will be delivered to each device via standard low-voltage network cabling with RJ-45 connectors.
- 4. Supply Voltage: 120.
- 5. Relay Output: Class 1 relay rated for 16 A and 1/2 HP at 120 V(ac).
- 6. Dimming Output: 0-10 VDC Dimming output.
- 7. Sink Current: 100 mA at 0-10 V(dc).
- 8. Mounting: Integral 1/2-inch chase nipple. Plastic clips into junction box are unacceptable.

H. Wired Networked Relay and Dimming Panel:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; ARP or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
- 2. Outputs: 8 individual relays per panel, with an equal number of individual 0-10 V(dc) dimming outputs.
- 3. Field Configurable Relays (FCR):
 - a. Field configurable to operate in single-, double-, or triple-pole relay groupings.
 - b. Field configurable to operate as normally closed or normally open.
 - c. Provides visual status of current state and manual override control of each relay.
 - d. Minimum Relay Contact Ratings:
 - 1) 40 A at 120-480 V(ac) Ballast.
 - 2) 16 A at 120-277 V(ac) Electronic.
 - 3) 20 A at 120-277 V(ac) Tungsten.
 - 4) 20 A at 48V (dc) Resistive.
 - 5) 2 HP at 120 V(ac).
- 4. Dimming Output Rating: Minimum of 100 mA sink current per dimming output.
- 5. Relay and dimming outputs individually programmable.
- 6. Listing: UL 924 for control of emergency lighting circuits.

7. Power Supply: Integrated 120 V(ac) supply.
8. Low-Voltage Sensor Input:
 - a. Configurable to support any of the following input types:
 - 1) Occupancy Sensor.
 - 2) Contact Closure.
 - b. Low-voltage sensor input provides 24 V(dc) power for sensor so additional auxiliary power supplies are not required.
 - c. Sensor input supports all standard sequence of operations.
9. Integrated Digital Time Clock for local schedule control.
10. Contact Closure Input: One for each group of eight output relays that acts as a panel override to activate the normally configured state of all associated relays (i.e., normally open or normally closed).
11. Panel supplies current limited low-voltage power to other networked devices connected via low-voltage network cable.
12. Enclosure:
 - a. Enclosure Rating: NEMA 1.
 - b. Mounting: Surface mounted.
 - c. Cover: Hinged cover with keyed lock.

I. Wired Networked Bluetooth Low-Energy Programming Device:

1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nIO BT or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
2. Plenum rated, inline wired, and screw mountable.
3. Communication and low-voltage power delivered to device via standard low-voltage network cabling with RJ-45 connectors.
4. Bluetooth communication allows connection from smartphone application for programming device settings within the local daisy-chain zone.
5. Device provides visual indication of remote Bluetooth connection via LED integrated into device enclosure such that it is visible from all angles while the zone is being programmed.

J. Wired Networked Communication Bridge:

1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nBRG or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
2. Suitable for surface mount to a standard 4 by 4-inch square junction box.
3. Communication Ports: Eight RJ-45 ports for connection to lighting control zones (up to 128 devices per port), additional network bridges, and System Controller.
4. Capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to System Controller.
5. Power Input: Class 2 low-voltage supplied locally via a directly wired power supply.
6. Wired Bridge capable of redistributing power from its local supply and connected lighting control zones with excess power to lighting control zones with insufficient local power. Architecture enables loss of power to a particular area to be less impactful on network lighting control system.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING

- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 26 05 23 - "Control-Voltage Electrical Power Cables." Minimum conduit size is 1/2 inch.
 - 1. Comply with requirements for cable thooks as specified on drawings.
 - 2. Comply with requirements for raceways and boxes specified in Section 26 05 33 - "Conduits for Electrical Systems".
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.2 IDENTIFICATION

- A. Identify system components, wiring, cabling, boxes, cabinets, and terminals. Comply with identification requirements specified in Section 260553 "Identification for Electrical Systems."
- B. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with Section 260553 "Identification for Electrical Systems."
- C. Identify all controls with device address.
- D. Label each device cable within 6 inch of connection to bus power supply or termination block.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
 - 1. Test continuity of each circuit.
- B. Field tests and inspections must be witnessed by Architect's representative.
- C. Tests and Inspections: Perform test inspections.
 - 1. Test each zone using local and remote control hardware.

2. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.

D. Nonconforming Work:

1. Lighting controls will be considered defective if they do not pass tests and inspections.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

E. Field Test Reports: Prepare field test reports.

1. Prepare functionality and inspection reports, including a certified report that identifies controls included and describes test results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.
2. Include list of all points created from actual tests of all addressed control points for manual controls and sensors.

3.4 REMOTE ACCESS

A. Digital network lighting control system capable of remote access by manufacturer with the following features:

1. System diagnostics including detection of fault condition in hardware or connected devices.
2. Access to all connected devices for complete programming including scheduling of time-of-day events and device parameters necessary to meet required sequence of operations.
3. Browser-based interface to verify system functionality.
4. On-demand access to manufacturer technical support for remote troubleshooting, diagnostics, configuration, and programming.
5. Owner training on the digital network lighting control system available remotely.

B. Remote access system fully functional over commercial cellular connection or Internet-connected ethernet network.

C. All hardware associated with remote access including cellular modem and cellular antenna are to remain on-site regardless of warranty or cellular contract status.

3.5 SYSTEM STARTUP

A. Perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's published instructions.
2. Activate luminaires and verify that all maximum output levels match output levels detailed in an Owner-approved sequence of operations.
3. Confirm correct communications wiring, initiate communications between control devices and controller/gateways, and program the lighting control system in accordance with approved configuration schedules, time-of-day schedules, and input override assignments.

4. Program network devices to meet required sequence of operations.
5. Program and verify all sequence of operations.
6. Create backup of system programming.
7. Assist in installation of system software on customer-provided workstation or server.

3.6 CLOSEOUT ACTIVITIES

- A. Enhanced Documentation: Engage lighting system manufacturer to provide comprehensive system documentation including detailed programming, sequence of operation data per Project specifications, and related code requirements.
- B. Training: Engage lighting system manufacturer to provide comprehensive system overview, software overview, and documentation relating to system operation and maintenance.

3.7 PROTECTION

- A. After installation, protect digital network lighting controls from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

3.8 WARRANTY

1. Provide full one-year parts/labor warranty.

END OF SECTION

SWITCHBOARDS

PART ONE - GENERAL

1.01 SECTION INCLUDES

- A. Main switchboard.

1.02 RELATED SECTIONS

- A. Section 03 31 00 - Cast-in-Place Concrete: Concrete pads.
- B. Section 09 91 00 - Painting.

1.03 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.
- B. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
- C. NEMA PB 2 - Deadfront Distribution Switchboards.
- D. NEMA PB 2.1 - Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.

1.04 SUBMITTALS

- A. Submit under provisions of Division One and Electrical Division 26.
- B. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground.
- C. Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of all equipment and components.
- D. Test Reports: Indicate results of factory production tests.
- E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.05 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Divisions 1 and Electrical Division 26.
- B. Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum 5 years documented experience.
 - 1. Square D
 - 2. Eaton

1.07 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 1.
- B. Deliver in 48 inch maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.
- C. Accept switchboards on site. Inspect for damage.
- D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- E. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. Conform to NEMA PB 2 service conditions during and after installation of switchboards.

1.10 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

1.11 MAINTENANCE MATERIALS

- A. Provide maintenance materials under provisions of Division 1.
- B. Provide 2 of each key.

PART TWO - PRODUCTS

2.01 SWITCHBOARD

- A. Description: NEMA PB 2 with electrical ratings and configurations as indicated.
- B. Main Section Devices: Individually mounted.
- C. Distribution Section Devices: Panel mounted.
- D. Bus Material: Copper with tin plating, standard size to meet UL Standard 891 on temperature rise.
- E. Bus Connections: Bolted, accessible from front for maintenance.
- F. Ground Bus: Extend length of switchboards.
- G. Insulated Ground Bus: Extend length of switchboard.
- H. 100 Percent Rate Neutral Bus: Extend length of switchboard.
- I. Molded Case Circuit Breakers: NEMA AB 1, integral thermal and instantaneous magnetic trip in each pole.
- J. Line and Load Termination: Accessible from the front only of the switchboard, suitable for the conductor materials and sizes indicated.
- K. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide Continuous current rating as indicated.
- L. Secondary Surge Arrestors: Equal to Joslyn #J9200-10 (three required).
- M. Enclosure: Type 3R - Weather-Proof (outdoor).
 - 1. Align sections at front and rear.
 - 2. Switchboard Height: 90 inches, excluding housekeeping pad.
 - 3. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

PART THREE - EXECUTION

3.01 EXAMINATION

- A. Verify condition.
- B. Verify that surface is suitable for switchboard installation.

3.02 PREPARATION

- A. Provide concrete housekeeping pad under the provisions of Section 03 31 00.

3.03 INSTALLATION

- A. Install switchboard in locations shown on Drawings, in accordance with manufacturer's written instructions and NEMA PB 2.1.
- B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

3.04 FIELD QUALITY CONTROL

- A. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.
- B. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute each, at test voltage of 1000 volts; minimum acceptable value for insulation resistance is 2 megohms.
- C. Check tightness of accessible bolted bus joints using calibrated torque wrench.
- D. Physically test key interlock systems to insure proper function.

3.05 ADJUSTING

- A. Adjust all operating mechanisms for free mechanical movement.
- B. Tighten bolted bus connections in accordance with manufacturer's instructions.

3.06 CLEANING

- A. Touch up scratched or marred surfaces to match original finish.

END OF SECTION

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".

- 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.

- 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

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.

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 Tamper-Resistant 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-SG.
 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, surge suppressor, Leviton 5380-* or 5380IG
Receptacle, commercial grade, tamper-resistant, 5362-SG*
Receptacle, commercial grade, GFCI, tamper Resistant, G5362-WT*
Receptacle, USB Combo, USB20AC5*

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. Refer to drawings for additional information.

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.

- 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

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.

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.

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.

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
 - b. Instantaneous Pickup
 - c. Long Time Delay
 - d. Short Time Pickup
 - e. Short Time Delay
 - f. Ground Fault Pickup – If indicated on the Drawings
 - g. 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.

- 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.

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

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.

- 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.

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

FACILITY LIGHTNING PROTECTION

PART ONE - GENERAL

1.01 DESCRIPTION: This section includes the furnishing and installation of a master labeled lightning protection system, complying with UL 96, UL 96A and NFPA 780.

1.02 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.

1.03 SUBMITTALS

- A. Submit under provisions of Section 01 33 23, furnish the following:
 - 1. Isometric and dimensioned plan views showing layout of the lightning protection system equipment and components (including conductor routing and connections) and connections to the required metal surfaces.
 - 2. Show the methods of mounting the system to the adjacent construction.
- B. Certification: Two weeks prior to final inspection, deliver to the Architect/Engineer four copies of the certification of UL Master "C" Label and that the installed lightning protection system has been inspected by a UL representative and has been approved by UL without variation. Comply with UL 96A, "Master Labeled Lightning Protection Systems".

1.04 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacturer of lightning protection equipment, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years. The firm shall be a member of and certified by the Lightning Protection Institute of America.
- B. Installer: A firm with at least 3 years of successful installation experience on projects with lightning protection work similar to that required for project.
- C. ANSI/NFPA Compliance: Comply with NEC and NFPA No. 78, "Lightning Protection Code", as applicable to materials and installation of lightning protection components, and wiring.
- D. ANSI Compliance: Comply with applicable portions of ANSI C2 and C62.2 pertaining to lightning (surge) arrestors.
- E. UL Compliance: Comply with UL 96, "Lightning Protection Components" pertaining to design, materials, and sizing of lightning protection components. Provide components, which are UL-listed and labeled.

F. Lightning Protection Institute, NFPA, and NEC Compliance.

1.05 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only:

1. NFPA 70 National Electrical Code (NEC)
2. NFPA 780 Lightning Protection Code
3. UL 96 Standard for Lightning Protection Components
4. UL 96A Installation Requirements for Lightning Protection Systems

PART TWO - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering lightning protection components which may be incorporated in the work include, but are not limited to, the following:

1. Conductors and Air Terminals:
Robbins Co.
Independent Protection Co., Inc.
Thompson Lightning Protection, Inc.
A/C Lightning Protection Co., Inc.
2. Protective Devices (Surge Arrestors):
General Electric Co.
TII Industries, Inc.
Atlantic Scientific Corp.

2.02 LIGHTNING PROTECTION SYSTEM COMPONENTS

A. General: Provide lightning protection system components of types, sizes, ratings, for class of service indicated, which comply with manufacturer's standard materials, design, and construction in accordance with published product information, and as required for a complete installation. Where more than one type of component meets requirements, selection is Installer's option. Where type or material is not otherwise indicated comply with NFPA 780 and UL 96 standards.

2.03 CONDUCTORS

A. Class 2 Installations:

1. Conductors: Aluminum cable; strand size 13-gage; 0.190lb./ft.; 192,000 circular mils.

B. Connector: Bronze right-angle thru-roof cable connector; bronze and lead seal flashing washer, 1/2" x 8" threaded stem, to fit 6" roof thickness.

C. Connector: 4" bronze parallel bonding clamp for connecting 1/0 or 2/0 cables.

- D. Splicer: Bronze straight cable splicer for splicing No. 4 and No. 6 cables.
- E. Splicer: Bronze pressure type "T" cable splicer for clamping standard cables through 2/0, with hex bolts and washers.
- F. Splicer: Bimetal straight splicer of cast aluminum and bronze for 2/0 cable with moisture tight sealing capability.
- G. Ground Rod: Solid copper, 5/8" dia. x 10'.
- H. Rod Clamp: 4" bronze ground rod clamp for connecting cable, up to and including 2/0, and 5/8" or 3/4" ground rod.
- I. Ground Plate: Sheet copper plate, 36" x 36" x 20-gage, with 2 cable attachments.
- J. Bonding Plate: 8 sq. in. steel plate with 1" dia. bolt-hole for bonding cable to structural steel, with vice-grip type cable connector with 2" of cable contact.
- K. Surge Arrester: Telephone type arrester with weathertight cover for outdoor mounting.
- L. Surge Arrester: TV type arrester for tubular lead; for indoor/outdoor installation, usage not to unbalance TV line impedance.

2.04 ANCILLARY COMPONENTS

- A. Air Terminal: Bronze beam type, with clamp to fit 4" to 8" beam with 8 sq. in. of surface contact; with 10" x 3/8" solid copper point with polished nickel plated top.

PART THREE - EXECUTION

3.01 INSTALLATION

- A. Install lightning protection systems as indicated, in accordance with equipment manufacturer's written instruction, in compliance with applicable requirements of NFPA No. 70 and 780 codes, and with UL's lightning protection standards, to ensure that lightning protection systems comply with requirements.
- B. Install conductors with direct paths from air terminals to ground connections avoiding sharp bends and narrow loops. Radius of bend on all conductors shall not be less than 8 inches.
- C. Install arresters as close as practical to equipment they are protecting. Install appropriate unit at main electrical service entrance equipment.
- D. Roof conductors shall be coursed along the perimeter of flat roofs, behind or on top of parapets and across large open roof areas. On flat and gently sloping roofs, the conductor shall form a closed loop.
- E. Roof conductors shall interconnect all air terminals including those on building projections and shall afford a two way path to ground from the base of each except as noted in the next paragraph.

- F. Conductor drops from a higher to a lower roof level are permitted without an extra download, provided there are not more than two ridges or more than three flat roof air terminals required on the lower level.
- G. Conductors shall be coursed over flat or gently sloping roofs that exceed 50 feet in width to interconnect the air terminals required in these areas. These cross run conductors shall be connected to the main perimeter cable at intervals not exceeding 150 feet.
- H. Copper lightning protection materials shall not be installed on aluminum roofing or siding material or other aluminum surfaces.
- I. Conductors may be coursed through air without support for a distance of 3 feet or less. With an acceptable support, securely fastened at each end, a conductor may be coursed through air for a distance not to exceed 6 feet.
- J. A 5/8 inch copper clad ground rod or its equivalent is an acceptable support for bridging a conductor through air. Bridging through air is recognized only where another method is not practicable.
- K. No bend of a conductor shall form an angle of less than 90 degrees nor shall have an unsupported radius of bend less than 8 inches.
- L. Roof conductors shall be coursed through or around obstructions (such as cupolas, ventilators, etc.) in a horizontal plane with the main conductor. Properly radiused and secured bends shall be employed.
- M. Conductors shall maintain a horizontal or downward course, free from "U" or "V" (down and up) pockets. Such pockets, often formed at low-positioned chimneys, dormers, or other elevations on the slope of a roof and at coping walls, shall be provided with a down conductor from the base of the pocket to ground, or to a convenient down lead of the main conductor.
- N. Metal roofing and siding, eave troughs, downspouts, or other such metal parts are not acceptable as substitute parts of the lightning protection system.
- O. Air terminal points shall be 3/8 inch minimum diameter, solid copper. Tubular air terminal points shall have a wall thickness of 0.32 inch for copper and shall be at least 5/8 inch in outside diameter.
- P. Air terminals shall extend above the object to be protected not less than 10 inches nor more than 36 inches. Air terminals exceeding 24 inches in height shall be supported with a suitable brace located at a point not less than one-half the height of the air terminal.
- Q. Air terminals shall be placed on ridges of gable, gambrel and hip roofs, around the perimeter of flat roofs and on the corners and edges of gently sloping roofs at intervals not exceeding 20 feet.
- R. Air terminals shall be placed at or within 2 feet of the ends of ridges or edges and corners of flat roofs.

- S. On roofs, the perimeter air terminals shall be spaced at 20' maximum about the perimeter. The center roof area shall be considered flat and shall have air terminals at intervals not exceeding 50 feet.
- T. Down conductors (continuation of roof conductors) shall be as widely separated as practicable, preferable at diagonally opposite corners on square or rectangular structures and diametrically opposite on cylindrical structures or irregularly shaped structures.
- U. Location of down conductors is contingent on location of air terminals, size of structure, most direct coursing, security against displacement, location of metallic bodies (which would require bonding), location of water pipes and ground conditions.
- V. The total number of down conductors on structures having flat or gently sloping roof, and on irregularly shaped structures, shall be of sufficient number so that the average distance between down conductors does not exceed 100 feet.
- W. Down conductors located in driveways, parking areas, public walks, or other similar locations shall be guarded in such a manner as to prevent physical damage or displacement. Guards of plastic (PVC rigid), securely gasketed, are acceptable. If the conductor is run through pipe tubing of iron, steel, copper or other conductive metal, the conductor shall be bonded on the top and bottom of the pipe or tubing. Required guards shall afford full protection of the down conductor for a distance of no less than 6 feet above grade level.
- X. Clamps used to connect down conductors to driven ground rods shall make contact with the ground rod for distance of 1-1/2 inches measured parallel to the axis of the ground rod and with the cable itself for a distance of 1-1/2 inches. Clamps shall be secured with at least two bolts or cap screws. Crimp type fittings are not acceptable for ground connections.
- Y. Where future testing of system may be required, disconnectors should be installed on all but one ground terminal of the building.
- Z. Clamp used for connecting down conductors with driven ground electrodes or ground electrodes are acceptable disconnectors.
- AA. In cases where actual connections are inaccessible, special bolt pressure type disconnects must be used at locations dictated by job conditions.
- BB. Fasteners shall be spaced not more than 3 feet apart on all conductors. Nails, screws, or bolts employed to secure the fasteners shall be of the same material as the fasteners or shall be of a material which is as resistant to corrosion as that of the fasteners. No nails, screws, or bolts shall penetrate the roofing material. All fasteners to the roof shall be adhesive type.
- CC. Galvanized or plated metal steel nails, screws, or bolts are not acceptable.
- DD. Masonry anchors shall have a diameter of not less than 1/4 inch and shall be set with care. Holes to receive the shank of the fastener or fitting shall be correct size, made with proper tools, and preferably made in the brick or stone rather than in the mortar joints. When set, the fit shall be tight against moisture and the effect of frost and cable of withstanding a pull test of 100 pounds. Plastic or fiber anchors with screws meeting the above requirements are acceptable.

- EE. Acceptable connector fittings shall be used on all lightning conductors at "end-to-end", "tee", or "Y" splices. They should be attached so as to withstand a pull test of 200 pounds.
- FF. Fittings for connection to metal tracks, gutters, downspouts, ventilators, chimney extension, or other metal parts about the structure shall be of an acceptable type made tight to the object by compression under bolt heads of the approved type.
- GG. Bolted clamps and splicers of stamper or cast metal of an approved type are acceptable. Crimp type clamps and splicers are unacceptable.
- HH. Metal cupolas, ventilators, air conditioning and handling units, finials, spires, flag poles, radio staffs, television and FM antennas, chimney extensions and caps, or other permanent metal elevations shall be bonded to the main lightning conductor. Air terminals shall be optional on such metal elevation if the metal is of sufficient strength and conductivity to approximate that of a standard air terminal. When bonding metal elevations of this nature, a bonding surface of not less than 3 square inches is required. Provisions shall be made to guard against the corrosive effect introduced by dissimilar metals at points of bonding. Similar elevations of nonconducting material shall be protected with air terminals in the usual fashion.
- II. Metal bodies of conductance as outlined above shall be bonded to the system using an approved clamp and main size conductor. Objects of this type shall be bonded regardless of distance from conductor or location on the building.
- JJ. Cable leads to make these connections shall, wherever possible, maintain a horizontal or downward path to the main conductor. An 8" radius for all unsupported bends shall be observed.
- KK. All connection of this nature shall be made with the use of splicers and fittings of an acceptable type.
- LL. Any metal stack serving furnaces shall be protected regardless of distance from main conductors or location in the building.
- MM. Metal bodies of inductance shall be bonded to the system using proper, approved splicers and fittings and conductors as outlined below.
- NN. All splicers, connectors and bonding devices shall comply with set standards for lightning protection systems and be of an accepted UL inspected and approved type.
- OO. The interconnecting conductor for both exterior and interior bodies of inductance shall be an acceptable Class I in secondary conductor. The interconnection conductor shall terminate in acceptable fittings.
- PP. Radio and television masts of metal, regardless of location on a building, shall be bonded to the main conductor of the lightning protection system with a main-size conductor and acceptable fittings.

- QQ. The connecting cable between the main conductor and a water pipe shall be a main size conductor, and the connections thereto shall be made with fittings accepted for this purpose. The water pipe fittings shall make contact with the water pipe for a distance of 1-1/2 inches, measured along the axis of the water pipe, and having a minimum contact surface of at least 2 square inches.
- RR. If more than one water pipe system serves a structure, all such systems shall be interconnected.
- SS. If electric and/or telephone service employing driven ground electrodes enter a protected structure, the ground electrodes shall be interconnected with the lightning protection system so as to obtain common grounding about the structure. The interconnection shall be made using main size conductors.
- TT. Structures protected by certified lightning protection system shall have all grounding mediums bonded together. This is to include electric and telephone service grounds and other underground metallic piping systems which enter the structure. Such piping systems include water service, gas piping, underground conduits, underground L-P gas piping systems, etc.
- UU. Caution should be exercised to avoid bonding to piping systems which have section of plastic pipe unless such sections are bridged by a length of main-size conductor.

3.02 TESTING

- A. All tests shall be performed in the presence of the Owner and shall be recorded and turned over to the Owner.
- B. Upon completion of installation of lightning protection system, test resistance-to-ground with resistance tester. Where tests show resistance-to-ground is over 25 ohms, take appropriate action to reduce resistance to 25 ohms, or less, by driving additional ground rods and treating soil in proximity to ground rods with sodium chloride, calcium chloride, copper sulphate, or magnesium. Then retest to demonstrate compliance.
- C. Perform resistance-to-ground tests of lightning protection system one year following time of substantial completion and submit written report indicating results. Where resistance is greater than 20 ohms, chemically treat soil to reduce resistance to 25 ohms or less. Then retest to demonstrate compliance.
- D. Upon completion of the installation, the lightning protection installer shall secure and deliver to the Owner the Underwriters Laboratories, Inc. Master Label certification and the Lightning Protection Institute Certified System certification. The system will not be accepted without the UL Master Label plate and the LPI certification certificate.

3.03 PERSONNEL TRAINING

- A. Building Maintenance Personnel Training: Train building maintenance personnel in procedures for testing and determining resistance-to-ground values of lightning protection system. Also instruct maintenance personnel in preparation and application of chemical solution for earth surrounding grounding rods for reducing ohmic resistance to required levels.

END OF SECTION

SURGE PROTECTION FOR
ELECTRICAL POWER CIRCUITS

PART ONE – GENERAL

1.1 SUMMARY

- A. Scope: Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, erection, and installation for surge protection for low voltage electrical power circuits as required for the complete performance of the work, and as shown on the Drawings and as herein specified.
- B. Section Includes: The work specified in this Section includes, but shall not be limited to, the following:
 - 1. Requirements for both field-mounted SPDs (externally mounted), and integrated SPDs (installed from the factory) for low voltage power distribution and control equipment.

1.2 REFERENCES

- A. General: 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. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.
- B. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - 1. ANSI/IEEE C62.41.1, "Guide on the Surges Environment in Low Voltage (1000 V and Less) AC Power Circuits."
 - 2. ANSI/IEEE C62.41.2, "Recommended Practice on Characterization of Surges in Low Voltage (1000 V and Less) AC Power Circuits."
 - 3. ANSI/IEEE C62.45, "Guide on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits."
- C. International Organization for Standardization (ISO):
 - 1. ISO 9001, "Quality Management Systems – Requirements."
- D. National Fire Protection Association (NFPA):
 - 1. NFPA 70, "National Electrical Code," hereinafter referred to as NEC.
- E. Underwriters Laboratories, Inc. (UL):
 - 1. UL 67, "Standard for Panelboards."

2. UL 96A, "Standard for Installation Requirements for Lightning Protection Systems."
3. UL 845, "Motor Control Centers."
4. UL 857, "Busways."
5. UL 891, "Switchboards."
6. UL 1283, "Standard for Safety for Electromagnetic Interference Filters."
7. UL 1449, "Standard for Surge Protective Devices."
8. UL 1558, "Standard for Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear."

1.3 DEFINITIONS

- A. $I_{(n)}$: Nominal discharge current rating.
- B. MCOV: Maximum continuous operating voltage.
- C. Protection Modes: The pair of electrical connections where the VPR applies.
- D. MOV: Metal oxide varistor; an electronic component with a significant non-ohmic current voltage characteristic.
- E. OCPD: Overcurrent protective device.
- F. SCCR: Short circuit current rating.
- G. SPD: Surge protective device.
- H. VPR: Voltage protection rating.

1.4 SYSTEM DESCRIPTION

- A. General SPD Requirements:
 1. SPD with accessories shall be listed and labeled as defined in NEC, by UL, and marked for intended location and application.
 2. Comply with UL 1449.
 3. Comply with UL 1283 (applies to Type 2 SPDs).
 4. Design in accordance with ANSI/IEEE C62.41.1, ANSI/IEEE C62.41.2, and ANSI/IEEE C62.45.
 5. SPDs manufacturer shall be ISO 9001 certified.
 6. MCOV of the SPD shall not be less than 115 percent for 480Y/277V and 125 percent for 208Y/120V nominal RMS system voltages.
 7. SPDs installed internal to the distribution equipment shall be of the same manufacturer as the equipment. The equipment shall be fully tested and certified to the following UL standards:
 - a. Panelboards: UL 67.
 - b. Motor Control Centers: UL 845.
 - c. Busway: UL 857.
 - d. Switchboards: UL 891.
 - e. Switchgear: UL 1558.

1.5 SUBMITTALS

- A. General: See Section 01 33 23 – Shop Drawings, Product Data & Samples
- B. Product Data: Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications.
 - 1. For each type of product indicated include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 2. Provide verification the SPD is listed or recognized through UL to the latest safety standard, UL 1449.
- C. Shop Drawings: Submit shop drawings for each product and accessory required. Include information not fully detailed in manufacturer's standard product data.
- D. Operation and Maintenance Data: Submit operation and maintenance data for surge protection for low voltage electrical power circuits to include in operation and maintenance manuals.
- E. Warranty Data: Submit Sample of special warranties.

1.6 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of surge protection for low voltage electrical power circuits of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of five years.
 - 2. Installer Qualifications: Installer shall be a firm that shall have a minimum of five years of successful installation experience with projects utilizing surge protection for low voltage electrical power circuits similar in type and scope to that required for this Project and shall be approved by the manufacturer.
- B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.
- C. Single Source Responsibility: Obtain surge protection for low voltage electrical power circuits and required accessories from a single source with resources to produce products of consistent quality in appearance and physical properties without delaying the work. Any materials which are not produced by the manufacturer shall be acceptable to and approved by the manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and lot number, if any.

- B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.8 WARRANTY

- A. General: See Section 01 77 19 – Contract Closeout.
- B. Special Warranty: Submit a written warranty executed by the manufacturer, the Installer, and the Contractor, agreeing to repair or replace surge protection for low voltage electrical power circuits that fail in materials or workmanship within the specified warranty period.
 - 1. Warranty Period: Warranty period shall be 10 years from date of Substantial Completion.

PART TWO – PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Product specified is “SurgeLogic Surge Protection” as manufactured by Square D by Schneider Electric. Items specified are to establish a standard of quality for design, function, materials, and appearance. Equivalent products by other specified gear manufacturers are acceptable. The Architect/Engineer will be the sole judge of the basis of what is equivalent.

2.2 SERVICE ENTRANCE SUPPRESSORS

- A. SPDs: Comply with UL 1449.
 - 1. SPDs installed on the line side of the service entrance OCPD shall be Type 1 SPDs. SPDs installed on the load side of the service entrance OCPD shall be either Type 1 or Type 2 SPDs.
 - 2. Type 2 SPDs shall also comply with UL 1283.
- B. Features and Accessories: SPDs shall provide the following features and accessories:
 - 1. Internal fusing design capable of disconnecting the SPD before any damaging external effects to the suppressor or surroundings occur.
 - 2. Indicator light(s) display for power and protection status with push-to-test capabilities.
 - 3. Audible alarm with silencing switch.
 - 4. Form C contacts; one normally open and one normally closed for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 - 5. Surge counter with reset switch.
 - 6. Provide integral disconnect switch for externally mounted SPDs. SPDs integrated into factory supplied equipment shall have an input disconnect switch or circuit breaker unless indicated on the equipment drawings/data sheets.

- C. Surge Current Rating: The surge current rating of the SPD shall be dependent of its category/location, as follows:

Category/Location	Application	Per Phase	Per Mode
C	Service Entrance	240 kA	120 kA
B	Distribution	160 kA	80 kA

- D. Protection Modes:

1. UL 1449 VPR for grounded WYE configured circuits shall not exceed the following:

Modes	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	800 volts	1200 volts	1500 volts
L-L	1200 volts	2000 volts	2500 volts

2. UL 1449 VPR for Delta configured circuits shall not exceed the following:

Modes	240D	480D	600D
L-G; N-G	1200 volts	2000 volts	2500 volts

- E. SCCR: Per NEC 285.6, the short circuit current rating of the SPD shall be equal to or greater than the available short circuit current at the point on the system where installed.
- F. Nominal Discharge Current Rating: 20kA $I_{(n)}$.
1. Surge protective devices located at service entrance locations shall carry a minimum nominal discharge current rating of 20 kA to meet the requirements of UL 96A.

2.3 DISTRIBUTION/ BRANCH PANEL SUPPRESSORS

- A. SPDs: Comply with UL 1449

1. Type 1 or Type 2 SPDs.
2. Type 2 SPDs shall also comply with UL 1283.

- B. Features and Accessories: SPDs shall provide the following features and accessories:

1. Internal fusing design capable of disconnecting the SPD before any damaging external effects to the suppressor or surroundings occur.
2. Indicator light(s) display for power and protection status.

3. Audible alarm with silencing switch.
4. Form C contacts; one normally open and one normally closed for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
5. Surge counter with reset switch.
6. Optional integral disconnect switch for externally mounted SPDs. SPDs integrated into factory supplied equipment shall have an input disconnect switch or circuit breaker unless indicated on the equipment drawings/data sheets.

- C. Surge Current Rating: The surge current rating of the SPD shall be dependent of its category/location, as follows:

Category/Location	Application	Per Phase	Per Mode
B	Distribution	160 kA	80 kA
B	Branch	120 kA	60 kA

- D. Protection Modes:

1. UL 1449 VPR for grounded WYE configured circuits shall not exceed the following:

Modes	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	800 volts	1200 volts	1500 volts
L-L	1200 volts	2000 volts	2500 volts

2. UL 1449 VPR for Delta configured circuits shall not exceed the following:

Modes	240D	480D	600D
L-G; N-G	1200 volts	2000 volts	2500 volts

- E. SCCR: Per NEC 285.6, the short circuit current rating of the SPD shall be equal to or greater than the available short circuit current at the point on the system where installed.
- F. Nominal Discharge Current Rating: 10 kA $I_{(n)}$.

2.4 ENCLOSURES

- A. Enclosure shall meet or exceed the ratings for the environment to be installed as indicated on drawings.
1. Indoor Enclosures for Externally Mounted SPDs: NEMA 250, Type 1R.

2. Outdoor Enclosures for Externally Mounted SPDs: NEMA 250, Type 3R, 4X.

PART THREE – EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Architect, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
 1. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

3.2 INSTALLATION

- A. Install surge protection for low voltage electrical power circuits in accordance with reviewed product data, final shop drawings, manufacturer's written instructions and recommendations, and as indicated on the drawings.
- B. Install SPD devices at the service entrance in accordance with NEC. SPDs installed on the line side of the service entrance OCPD shall be Type 1 SPDs. SPDs installed on the load side of the OCPD shall be either Type 1 or Type 2 SPDs.
- C. Follow manufacturer's recommended installation practices.
 1. Provide a minimum 30 ampere circuit breaker as a dedicated disconnecting means for the SPD unless otherwise indicated.
 2. Install SPDs with properly rated conductors between suppressor and points of attachment as short and straight as possible; adjust circuit breaker positions to achieve shortest and straightest leads.
 3. Do not splice and extend SPD leads unless specifically permitted by manufacturer.
 4. Twist input conductors together to reduce the input inductance.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Compare equipment nameplate data for compliance with the Drawings and the Specifications.
 2. Inspect anchorage, alignment, grounding, and clearances.
 3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- B. A SPD will be considered defective if it does not pass inspections.
- C. Prepare inspection reports.

3.4 DEMONSTRATION

A. Start-Up Service:

1. Complete start-up checks according to manufacturer's written instructions.
2. Do not perform insulation resistance tests of the distribution wiring equipment with SPDs installed. Disconnect all wires, including, but not limited to, neutral of the SPD before conducting insulation resistance tests, and reconnect them immediately after the testing is over.
3. Energize SPDs after power system has been energized, stabilized, and tested.

3.5 PROTECTION

- #### A.
- Provide final protection and maintain conditions in a manner acceptable to the Installer, that shall ensure that the surge protection for low voltage electrical power circuits shall be without damage at time of Substantial Completion.

END OF SECTION

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.

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, L₇₀, or L₇₀%; 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.
- D. Fluorescent T8 lamps and ballasts shall be listed on CEE high-performance qualifying product list and approved by Focus-On-Energy.

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 $\leq 20\%$ 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 $\leq 20\%$ 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.

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.

- 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.

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.

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

EXTERIOR LIGHTING

PART ONE - GENERAL

1.1 SCOPE

- A. The work under this section includes 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, L₇₀, 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.

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.

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 $\leq 20\%$ 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 $\leq 20\%$ 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 FUSES

- A. Furnish and install a fuse holder and fuse in each ungrounded leg of the electrical circuit supplying the outdoor luminaire. If the voltage is 208, 240, or 480 volts, then the fuse holder needs to be a 2-pole fuse holder which simultaneously disconnects both ungrounded conductors. Every luminaire (including bollards) shall be separately fused with a water-resistant fuse holder. Size the fuse for the amperage of the luminaire. Tap the circuit conductors with a minimum #10 AWG conductor to serve the luminaire. The fuse and holder shall be accessible through the handhole. Provide sufficient wire to bring fuse holder outside of handhole.

2.5 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.

2.6 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.

2.7 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.

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

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 service 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.
- B. 4 feet by 8 feet, or size as indicated, by 3/4 inch plywood terminal board painted flat white (where indicated on the plans).
- C. Provide ground bar equivalent to Square D #PK9GTA. Main terminal board ground bar shall be bonded to building steel and to the main electrical service panel by a #6 ground wire. Satellite terminal board ground bars shall be bonded to building steel and to the main terminal board ground bar.

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.)
- 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 work shall be in accordance with the Serving Utility requirements.
- H. All premise cabling shall be punched down at rack-mounted patch panels. Direct connections to switches not allowed.

END OF SECTION

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. Telephone and 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. Fiber optic cables.
 - 6. Fiber optic termination panels.
 - 7. 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)

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.

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 for data, black in color for wireless aps, and yellow for surveillance. Accepted Category 6 manufacturer shall be as listed in Section 1.05.
- B. Fiber optic cable service entrance cable shall be multi-strand single-mode OS2. Provide OCC, Hitachi or equivalent.

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.
- A. Provide self-supporting 4-post floor mounted rack(s) for mounting of computer patch panels, fiber optic termination panels, and Owner's equipment. Unit shall be 84" in height minimum and 19" in width constructed of anodized aluminum. Rails shall be drilled and tapped. Provide equivalent to AMP, Siemon, or Ortronics.

2.4 TELECOM 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.
- B. Multiple ground bus bar kit, equal to Square D #PK9GTA.

- C. Surge protection shall be provided for any telecom service entrance cable. Provide Lucent #189ECT1-100 and modules #4C1-EW or equivalents.

2.5 FIBER OPTIC SUPPORT EQUIPMENT

- A. Fiber optic cable terminations shall be made in a multi-port fiber rack mounted interconnection unit with LC connectors. Provide equivalent to AMP, Siemon, or Ortronics.

2.6 SURGE SUPPRESSION

- A. All copper cabling entering/leaving building shall be protected by Ditek Surge Suppression modules (Vm/Rm Series).

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 three ring binder form and submitted to the Architect; provide three copies 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. Cable 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)								
Frequen cy MHz	Attenuati on, 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 TESTING - FIBER OPTIC CABLES

- A. After the installation of the fiber optic cabling system, each strand shall be tested for discontinuity and for losses with an Optical Power Meter.

3.6 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

INTERCOMMUNICATIONS
AND PROGRAM SYSTEMS

PART ONE – GENERAL

1.1 SYSTEM DESCRIPTION

- A. This section of the specifications includes the furnishing, installation, and connection of an 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.

PART TWO – PRODUCTS

2.1 FUNCTIONAL REQUIREMENTS

- A. The system shall support up to 360 zones of 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.
- B. Provide facilities for up to 7 (seven) call-in priority levels. Each zone call in switch shall be assignable to any one or two of these priority levels. The call button priority levels shall have the capacity to change state on a time of day basis. The priority levels shall be as follows:
 - 1. Normal
 - 2. Security
 - 3. Normal/Emergency
 - 4. Urgent/Emergency
 - 5. Overhead Ring
 - 6. Emergency Only
 - 7. Ignore
- C. Automatically sound an alert tone over any loudspeaker connected for two-way communication to alert the personnel that this two-way call has been established. This is intended to prevent unauthorized monitoring. This tone must repeat every 15 (fifteen) seconds.
- D. Shall provide one way priority override voice paging to all zones from a microphone. The system shall be capable of distributing general announcements from any administrative telephone, staff telephone, or room/office telephone. The system shall be capable of providing all-call, group call, multiple group call, or dial-on-the-fly page groups.

- E. The system shall have 1024 scheduled time events with the built-in master clock. The system must have at a minimum 72 group zones, programmable on a PC using the manufacturer software. The system shall provide pre-alert tone to zones for intercom calls and general announcements. The user shall have the ability to select the tone on an all-call basis from any, or selected, administrative telephones.
- F. The System shall provide the facilities to annunciate incoming intercom calls at multiple phones simultaneously. Calls may be answered from any of the administrative telephones by simply lifting handset, dialing the zone number or pressing a button on the telephone. Once answered, the call will automatically be cancelled for other phones.
- G. Any zone/area loudspeaker must have the flexibility to be programmed as a testing room. A testing room shall be excluded from receiving general announcements, class change tones, group announcements and program material. The testing room must receive emergency tones and announcements. A dial code must be provided that will access these testing rooms at the same time, allowing for an announcement to the testing rooms for applications such as standardized testing and administrative/employee testing. The testing rooms may be reactivated to normal operation at any time by the administration staff as needed. Testing rooms shall automatically be reset to normal operation before start of business the next day.

2.2 EQUIPMENT SPECIFICATIONS

- A. The system shall be rack-mountable in a standard 19" telecommunications rack/cabinet. The system shall be expandable in 24-zone increments or fewer.
- B. The system shall include an RS-232 port, giving the district the ability to monitor operations and functions of the system. The system shall have eight (8) simultaneous communication paths, nine (9) discreet signal tones and four (4) ports for administrative display stations.
- C. Provide 6 (six) software programmable pushbutton inputs that can be used to activate tones, emergency tones, time tones, schedules, set system time, force a holiday schedule, door entry, etc. Provide 8 (eight) software programmable output contact closures which can be activated manually to turn on cameras, unlock doors, emergency lockdown, etc., or automatically via Master Time Control Center.
- D. The system shall have six standard tones: Hi/Low Tone, Warble Tone, High Tone, Low Tone, High Chime, and Low Chime. Additionally, emergency tones must be generated. See Section 2.2-F.
- E. The system shall be have at least one (1) microphone input, three (3) program outputs and two (2) synthesized voice channels. A minimum of four (4) loop-start trunk ports (FXO slots) shall be standard with the system. The system shall have a SMDR serial output for system reporting.
- F. System functionality must include the capability to manually distribute up to 5 (five) emergency alert tones via pushbuttons, contact closure, or dial up tones from any administrative telephone. These tones shall be customizable with respect to cadence, type and duration. Dial up tones must only be accessible by authorized users.

- G. Zone initiated two-way intercom calls must be able to be assigned to ring at specific telephone ports. These telephone ports shall have the flexibility to be forwarded to other administrative ports should a call go unanswered or should the assigned administrative port be busy.
- H. The system shall provide a built in Ethernet port on the CPU for network connectivity over the LAN/WAN for system setup, programming, and system changes. This port shall also be utilized for the administration software as to allow easy and simple access to the system for daily, weekly, monthly, and yearly changes.

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.
- B. The district requires that administrative software be provided at the time of acceptance and applicable training be completed so as to leave the site personnel with a detailed understanding of the system, its design, and the ability to make modifications.
- C. Software shall be capable of running on a Windows 2007 or better platform and shall not require greater than 200MB of storage space.

2.4 CABLING AND TERMINATIONS

2.4.1 Cabling

- A. The Intercom/Paging system shall utilize TIA/EIA 568B.2-1 compliant Category 5e, 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 green in color.

2.4.2 Installation

- A. The Intercom/Paging System shall use a hierarchal star topology design and each IC shall be connected to the MC using 25-pair or multiple 25-pair, CMP Category 5e cables. All 25-pair cables shall be terminated on a 66 block and connected to the manufacturer's equipment using 15-foot, 25-pair, female-female, amphenol connectors. Amphenol cable assemblies shall be manufacturer assembled, never field assembled. All 66-blocks (110 style) shall be terminated in a fashion that allows single zone physical troubleshooting and does not disrupt multiple zones or paging groups.
- B. 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.
- C. 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 3/4" 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 3/4" 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).

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.

- 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 push-button style switch with a 1/2" square Black plastic cap. 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.

2.6 CLOCK INTERFACE

2.6.1 Refer to Section 27 53 13.

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 2000 or later and/or Microsoft Visio. 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.

3.3 Training

- A. The contractor shall provide three separate training classes to the district administrative and instructional staff. The minimum requirements of the training class are outlined below.
 - 1. Class A: The contractor shall provide one (1) 2-hour training class to the districts authorized administrative staff at the local facility. This training class shall include basic operation of the installed system, system programming and modifications as well as emergency response training (in coordination with the districts safety representative).

END OF SECTION

SOUND REINFORCEMENT SYSTEMPART 1 – GENERAL

1.1 OVERALL SYSTEM DESCRIPTION

- A. The system must have specifications and features that are equivalent to the Lightspeed Topcat ceiling-mounted Instructional Audio System including the following:
1. All-in-one, ceiling-mounted audio system with integrated amplifier, speakers and wireless audio receiver/transmitter
 2. Two-way hybrid speaker system with exciter technology sound panel and low frequency cone driver
 3. Cross over technology to deliver high speech intelligibility and full range sound with even distribution throughout the classroom
 4. 2 microphones for whole room instruction, team-teaching or student sharing
 5. Pendant-style Flexmike™ classroom microphone with audio input utilizing Access Technology (1.9 GHz) for transmission. IR not acceptable
 6. PageFirst emergency page priority
 7. Relay closure input to mute all classroom audio when signal is detected
 8. Contact Closure output to trigger alert or other action from teacher microphone
 9. Ceiling-mounted
 10. Suitable for use in air-handling spaces (plenum-rated)
 11. System must have easily accessible audio output to connect with a computer or other recording device for lesson capture.
 12. Wireless Media Connector utilizing Access Technology (1.9 GHz) to integrate with and wirelessly transmit all classroom multimedia to be played through the Topcat
 - a. Includes 4 audio inputs with volume control
 - b. 2 audio outputs for ALD and/or recording with volume control
 - c. Tone control to remotely adjust bass/treble of Topcat
 13. Activate Charging Station with Access Technology, Bluetooth and Wireless Media Connectivity for integration with mobile devices and laptops:
 - a. Includes 2 channels of 2-way Bluetooth Audio
 - b. 4 audio input connections, 2 audio outputs with volume controls
 - c. Cradle charging for 2 pendant microphones, eight (8) 2-way audio Pods
 - d. USB ports to charge up to four (4) additional 2-way audio Pods
 - e. Bluetooth connection with Activate mobile app for control, streaming and audio/video recording of classroom instruction and interaction.
 - f. Mobile device control of system volume levels, Activate Pod selection, and advanced system settings
 - g. Must include a call button allowing students to notify the teacher when they need assistance
- B. The amplifier must contain a 25/70V page mute function (PageFirst™) that passively detects the audio signal of a page coming through the 25/70V PA system without compromising system performance or voiding warranties. As an audio signal is sent to the PA speaker, the PageFirst™ detects that signal and immediately mutes the Topcat audio amplifier.

- C. The amplifier must contain a contact closure input connection to detect a signal from Fire Alarm, IP Paging System or other device and mutes all amplifier audio to ensure emergency alerts from external systems can be heard clearly.
- D. The amplifier must contain a contact closure output to interface with external alert notification system, enabling an alert to be triggered by the teacher microphone with a button press.
- E. The system must produce high speech intelligibility and full-range multimedia quality sound with excellent distribution throughout a classroom.
- F. The system must be capable to be installed in a classroom with no wires installed in or on the walls. The system must be fully operational without speaker wires or sensor cables.
- G. The system must be compatible and expandable to operate with 2-way small group speaker Pods allowing interoperability between both small group and whole group instruction.
- H. The system shall carry a standard warranty equivalent to the Lightspeed 5-year Warranty.

1.2 REGULATORY REQUIREMENTS

- A. Conform to Division 26 building code for requirements applicable to work specified herein.

1.3 QUALITY ASSURANCE

- A. Qualifications
 - 1. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
 - a. Certificate: when requested, submit certificate, indicating qualification.
 - 2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction, approving acceptable installer and approving application method.
- B. Acceptable Manufacturers
 - 1. Basis of Design: Lightspeed Technologies, 11509 SW Herman Road, Tualatin, OR 97062, PH 800-732-8999, FAX 503-684-3197.
 - 2. Substitutions must be in full compliance to specifications as written and approved prior to bid.
- C. Manufacturer Testing: Manufacturer to provide quality assurance certification for each system and all of its components.
- D. Successful third party installation (when needed) will be supplied with necessary training to allow for product installation certification by Manufacturer and will be installed according to Lightspeed recommendations.

1.4 SUBMITTALS

- A. General: Submit listed submittals in accordance with “Conditions of the Contract”.
- B. Manufacturer’s data on all products including but not limited to:
 - 1. Catalog cut sheets
 - 2. Installation instructions
 - 3. Typical wiring diagrams
 - 4. Drawings showing speaker locations
 - 5. User Manual
 - 6. Manufacturer’s warranty documents
 - 7. Manufacturer’s parts lists
 - 8. Product serial numbers
 - 9. Quick Start Guide

1.5 WARRANTY

- A. Warranty: Refer to “Conditions of the Contract” for warranty and repair provisions.
- B. Repair: Manufacturer shall offer repair service on all Classroom Audio components. Owner shall pre-pay shipping for all items returned to manufacturer for repair. The Manufacturer shall repair or replace system components as specified under warranty. Manufacturer shall ship repaired components within five (5) working days of receipt. Items returned to Owner are shipped via the same method in which they were received.
- C. Manufacturer’s Warranty: All the major system components (transmitters, receiver-amplifier and speakers) must be warranted for five years against defects occurring while used in normal classroom instruction. The warranty shall be equivalent to a Lightspeed Technologies' Five-Year Warranty.
 - 1. Submit, for Owner’s acceptance, manufacturer’s standard warranty document executed by authorized company official. Manufacturer’s warranty is in addition to, and not a limitation of, other rights Owner may have under the Contract Documents.
 - 2. Warranty Period: Five years commencing on Date of Substantial Completion.

1.6 OWNER INSTRUCTION

- A. Owner’s Instruction: user training will be performed by the manufacturer’s local representative. The training will include the research and benefits of classroom amplification, system operation, simple troubleshooting guidelines, and incorporating the classroom amplification into teaching styles. The manufacturer will also provide additional training in trouble-shooting techniques and product return procedures to one specified person per campus. This service shall be rendered to the Owner at no additional cost.
- B. A Quick Start Guide is included with system to provide information on how to use the system. In addition, instruction materials and detailed User Manual shall be available on manufacturer’s website to cover complete operational and basic maintenance procedures.

PART 2. PRODUCTS

2.1 CEILING-MOUNTED CLASSROOM AUDIO SYSTEM SPECIFICATIONS

- A. Power output: 20 Watts RMS
- B. Acoustic Frequency response: 60 Hz to 18 kHz -10Db
- C. AC Mains Power Input: 100-240V ~ 50/60Hz 1.5A
- D. DC Power Input: 24V/2.5A
- E. Signal-to-noise: 60 dB
- F. Total Harmonic Distortion: <1%, 10 W
- G. Wireless Communication: Access Technology (1.9 GHz)
- H. Automatic power on when Flexmike is powered on and linked
- I. Dimensions (W x D x H): 24" x 12" x 3.7" (Removable side spacers to fit international ceiling grids; 595mm x 295mm x 94mm)
- J. Weight: 13.5 lbs. (6.1 kg)
- K. Controls:
 - 1. Tone control
 - 2. Audio input volume control
 - 3. PageFirst sensitivity adjustment
- L. Connections:
 - 1. (1) Direct AC mains power input
 - 2. (1) DC Power Input
 - 3. (1) Audio input (Longer cable runs may require a ground loop isolator in order to prevent audio hum caused by a ground loop.)
 - 4. (1) Audio in from another Topcat
 - 5. (1) Audio out to another Topcat
 - 6. 6-pin euro-block system interface with:
 - a. 24/70V page-sensing mute (PageFirst™)
 - b. Contact closure input mute
 - c. Contact closure output trigger
- M. Wireless audio range: up to 200 feet

- N. Integrated 2-Way Hybrid Speaker System:
1. Description: exciter technology sound panel plus low frequency cone driver
 2. Integrated cross-over technology
 3. Panel Size: 13.75" x 6.75"
 4. Cone Driver Size: 5.25"
 5. Overall Frequency Response: 60 Hz to 18 kHz -10dB
 6. Impedance: 8 Ω
 7. Power Handling: 25 W
- O. The ceiling-mounted classroom audio system shall use bi-directional wireless Access Technology to communicate with up to three wireless microphones.
- P. The ceiling-mounted classroom audio system shall use bi-directional wireless Access Technology to integrate with other audio sources in the classroom.
- Q. The ceiling-mounted classroom audio system shall use bi-directional wireless Access Technology to send a mixed audio output to a media connector or Activate Station located at a convenient/student accessible location in the classroom.
- R. The ceiling-mounted classroom audio system shall use bi-directional wireless Access Technology to communicate with up to 12 optional tabletop speaker Pods available to facilitate small group instruction.
- S. The all-in-one system must contain a Page mute function (PageFirst™) that passively detects the audio signal of a page coming through the PA system without compromising system performance or voiding warranties. As an audio signal is sent to the PA speaker, the PageFirst passive sensor clip detects that signal and immediately mutes the Topcat.
- T. The amplifier must contain a contact closure input connection to detect a signal from Fire Alarm, IP Paging System or other device and mutes all amplifier audio to ensure emergency alerts from external systems can be heard clearly.
- U. The amplifier must contain a contact closure output to interface with external alert notification system, enabling an alert to be triggered by the teacher microphone with a button press.

2.2 FLEXMIKE PENDANT-STYLE MICROPHONE / TRANSMITTER

- A. Description: the pendant-style Flexmike transmitter shall contain microphone volume control on the unit allowing users to adjust volume level from anywhere in the classroom. The Flexmike shall be capable of being worn around a teacher's neck as a hands-free microphone via the lavalier cord or to be used as a handheld student pass-around microphone. The Flexmike must be rechargeable via cradle charger or USB power. It must have a user replaceable, snap-in rechargeable battery pack.
- B. Lanyard: adjustable length with magnetic clasp
- C. Wireless communication: Access Technology (1.9 GHz)

- D. Transmission range: up to 200 ft (60m)
- E. Audio distortion: <1%
- F. Integrated microphone type: uni-directional electret
- G. Digital audio interface: USB-C 2-way digital audio interface
- H. Earbud output: 3.5mm (for monitoring optional Activate Pods)
- I. Push button volume control: +/- 6dB (total range = 12 dB)
- J. Power: on/off/mute button
- K. Battery Power: 3.7V Li-Ion battery pack
- L. Battery run time: 8 hours (fully charged)
- M. Charging: via cradle charger or USB-C cable
- N. Cradle Charger: 2-slot drop-in cradle charger capable of charging 2 microphones
- O. Cradle Charger Power: 5V USB-C, charging off AC power or computer USB
- P. Pairing: IR emitter to enable one-button pairing with amplifier
- Q. Dimensions (L x W x H): 2.9" x 1.1" x 0.7" (74 x 28 x 18mm)
- R. Weight: 1.2 oz (34g)
- S. Provide (2) microphones minimum per classroom.

2.3 SHAREMIKE HANDHELD MICROPHONE / TRANSMITTER

- A. Description: handheld wireless microphone for student pass-around use
- B. Wireless communication: Access Technology (1.9 GHz)
- C. Transmission range: up to 200 ft (60m)
- D. Audio distortion: <1%
- E. Integrated microphone type: uni-directional electret
- F. Auxiliary Audio Input: 3.5mm
- G. Digital audio interface: USB-C 2-way digital audio interface
- H. Power: on/off/mute button
- I. Battery Power: 3.7V Li-Ion battery pack

- J. Battery run time: 8 hours (fully charged)
- K. Charging: via cradle charger or USB-C cable
- L. Cradle Charger: 2-slot drop-in cradle charger capable of charging 2 microphones
- M. Cradle Charger Power: 5V USB-C, charging off AC power or computer USB
- N. Pairing: IR emitter to enable one-button pairing with amplifier
- O. Dimensions (L x W x D): 6.0" x 1.1" x 1.1" (153 x 28 x 28mm)
- P. Weight (with batteries): 2.6 oz (73g)
- Q. Provide (1) microphone per classroom.

2.4 ACTIVATE CHARGING STATION WITH ACCESS TECHNOLOGY, BLUETOOTH AND WIRELESS MEDIA CONNECTIVITY

- A. Description: Device charging station with wireless audio and Bluetooth connectivity. Activate utilizes 2-way audio communication to integrate audio sources and mobile devices with Topcat in the ceiling.
 - 1. Integration with Activate mobile app for control, streaming and audio/video recording of classroom instruction and interaction.
 - 2. Mobile device control of system volume levels, Activate Pod selection, and advanced system settings.
- B. Mobile app functionality: Bluetooth interface with companion mobile application with the following functionality:
 - 1. Control and connect to small group 2-way audio Pods
 - 2. Adjust system audio levels and tone control
 - 3. Mobile device audio streaming from audio books, podcasts, music, etc.
 - 4. Audio/video recording synched with microphone and Pod audio
 - 5. Enable advanced system features
- C. Wireless Communication: Access Technology (1.9 GHz + RF4CE), Bluetooth audio (2 channels), Bluetooth LE (2 channels)
- D. Wireless range: Up to 200 ft. (60m) from Topcat, up to 100 ft. (30m) from mobile device.
- E. Audio frequency response: 80 Hz to 7 kHz ± 3 dB
- F. Audio distortion: <1%
- G. Cradle charging: 2 Flexmikes; 8 Pods

- H. USB charging ports: Two (2) 5V/0.3A charging for Pods; Two (2) 5V/1.0A charging for mobile devices or Pods.
- I. DC Power Input: 24V/1.75A
- J. Auxiliary Power Input: 5V USB-C from portable power source (no device charging)
- K. Audio Inputs: (4) 3.5mm stereo jacks with volume control
- L. Bluetooth Audio: (2) independent 2-way Bluetooth audio channels
- M. Audio Outputs: (2) 3.5mm jack with volume control
- N. Volume controls: Audio input, tone, audio output with 10-segment level indicator
- O. Device Pairing: (2) Push buttons for Bluetooth device pairing, (1) push button for Access device registration.
- P. Mounting: table-top
- Q. Dimensions (W x D x H): 13.3"x 5.9"x 1.9" (340 x 150 x 52mm)
- R. Weight: 1.85 lbs. (0.84kg)
- S. Provide one (1) per classroom.

2.5 REGULATORY AND CERTIFICATIONS

- S. The classroom audio system and its components shall be manufactured using lead-free processes and free of other materials harmful to the environment (RoHS and WEEE compliant).
- T. The classroom audio system and its components shall be listed to UL/CUL standards and requirements for electrical safety by Underwriters Laboratories Inc.
- U. The classroom audio system must be suitable for use in air handling spaces and carry appropriate certifications (UL 2043).
- V. The classroom audio system and its components shall be CE Certified and conform with the essential requirements of the following European Union Directives: 2014/30 EU Electromagnetic Compatibility (EMC), 2014/35/EU Low Voltage Directive (LVD) and RED 2014/53/EU.
- W. The classroom audio system and its components shall comply with Part 15 of the FCC rules as a Class B digital device (FCC Certified).

PART 3. EXECUTION

3.1 SYSTEM PERFORMANCE

- A. Install in accordance with Manufacturer's installation instructions.
- B. Final adjustment: Upon completion, the system shall be clean, adjusted and left in perfect operating condition. Transmitters shall be plugged in and charging and Daily Use Guide should be left in a conspicuous place. The full user manual shall be available for download from the manufacturer's website.
- C. Provisions: There shall be no audible components of hum, noise, or distortion.

3.2 INSTALLATION

- A. Provide and install Sound Reinforcement System in the locations shown on drawings as required.
- B. All equipment and enclosures described in this specification shall be permanently attached to the structure and held firmly in place. Supports shall be adequate to support their loads per manufacturers specifications.
- C. The process of testing the Audio Sound System may necessitate moving and adjusting certain component parts (ex. loud speakers). Contractor shall provide at no additional cost to the owner.
- D. Take precautions as necessary to prevent and guard against electromagnetic and electrostatic noise interference. Long cable runs, unshielded and / or poorly shielded cable, multiple ground paths and improper grounding may all contribute to the production of a low frequency hum. In most cases a ground loop isolator (not provided) placed in line will attenuate or possibly eliminate the hum.
- E. Wireless Media Connector or Activate Charging Station shall be located per Owner's request. Contractor to ensure all Media Connectors or Activate Charging Stations have power available, are properly registered, and all volume controls are set properly via a field test in every classroom.

3.3 TOPCAT AUDIO INTEGRATION USING MEDIA CONNECTOR

The wireless Media Connector must have four audio inputs to allow other audio sources to be wirelessly transmitted and played through the Topcat system. Computers, laptops, mobile devices, LCD displays, etc. may be connected into the Media Connector using appropriate patch cords. The Media Connector must also receive audio back from the Topcat to output the mixed audio signal of both microphone channels and multimedia for recording purposes and interface with assistive listening devices. See the systems integration chart below.

3.4 TOPCAT AUDIO INTEGRATION USING ACTIVATE STATION

The wireless Activate Station must have four audio inputs plus 2 Bluetooth audio channels to allow other audio sources to be wirelessly transmitted and played through the Topcat system. Computers, laptops, mobile devices, LCD displays, etc. may be connected into the Activate Station via Bluetooth or using the appropriate patch cable. The Activate Station must also receive audio back from the Topcat to output the mixed audio signal of both microphone channels as well as selected Pods for audio/video recording to the mobile device and interface with assistive listening devices. Activate Station must also communicate with mobile devices via Bluetooth LE for selection and control of small group audio Pods and system volume levels.

END OF SECTION

CLOCK SYSTEMS

PART ONE - GENERAL

1.1 DESCRIPTION OF MASTER TIME CONTROL SYSTEM

- A. Supply and install a complete fully integrated master clock system. All of the clocks in the school shall be synchronized through the Intercom/master clock system. Acceptable manufacturers include:
 - 1. Valcom Inc.
- B. The time control system shall be capable of operating and correcting the clocks as well as controlling class change signals to all speakers and/or bells.
- C. The integrated Master Clock controller shall provide a 10-year battery back-up real time clock to ensure for correct timekeeping of the internal master clock during power failure. Once power is restored, the clock driver shall update the clocks as follows:
 - 1. Digital clocks shall receive an instantaneously update with the correct time.
- D. The system shall provide for automatic clock correction for Daylight Savings Time, Spring Ahead/Fall Back. Daylight savings shall not require the use of any user input at the time of daylight savings.
- E. The IP Digital Clock, model VIP-D425A/VIP-D440A, shall enable time indication, synchronization, and correction over an IP-based LAN/WAN allowing locating a clock display anywhere on the network. The VIP-D425A/VIP-D440A clock synchronization shall be programmed to sync with any NTP (Network Time Protocol) server. In addition to the IP address, the clock shall be capable of acquiring all of the information needed to synchronize time from the DHCP scope without further programming. If the DHCP is not available, the clock will revert to the static IP address of 192.168.6.207 after 3 minutes. DHCP Scope Options shall be Option 42, NTP Server IP Address, Option 100, POSIX Time Zone, example: "EST5EDT4,M3.2.0/02:00,M11.1.0/2:00". This is the preferred option, and works for any area of the world. Option 101, Time Zone Name, example: "America/New York". This option is only supported for North American time zones. Power shall be provided to the VIP-D425A/VIP-D440A via a Power over Ethernet (PoE) switch meeting the 802.3af specification. Setup of the VIP-D425A/VIP-D440A shall be via the Valcom IP Solutions Setup Tool. The VIP-D425A/VIP-D440A Digital Clock enclosure case shall be constructed of steel with a durable black powder coated black finish. The VIP-D425A/VIP-D440A shall be suitable for indoor applications. VIP-D425A maximum dimensions shall be: 10.65in L x 3.00in W x 4.90in H (27.05cm x 7.62cm x 12.45cm). Weight shall be approximately 2.88lbs (1.31kg). VIP-D440A maximum dimensions shall be: 17.00in L x 3.00in W x 6.75in H (43.18cm x 7.62cm x 17.14cm). Weight shall be approximately 5.10lbs (2.31kg). Warranty information may be found on our website at www.valcom.com/warranty.

- F. Clocks shall integrate into Section 27 51 23 – School Intercom System.

PART TWO – PRODUCTS

- 2.1 Clocks – Provide 4” digital POE clocks as shown on plans. Model VIP-D425A/VIP-D440A.

- 2.2 Cabling – refer to Section 27 10 00 – CAT6 Premise Cable.

PART THREE - EXECUTION

3.1 INSTALLATION

- A. Install the system in accordance with the manufacturer's printed instructions and recommended cable types.
- B. Provide Point to point wiring diagrams showing location of all wire pulls. Mark all cables corresponding to point to point wiring diagrams.
- C. System Acceptance Test
 - 1. Have the company field adviser adjust the completed system to desired volume levels of customer.
 - 2. The system shall operate for at least two weeks with no failures or changes required.
 - 3. Test every circuit in the system to ensure proper using making sure staff is knowledgeable in the operation of the system.
- D. The Contractor shall provide a one-year warranty of the installed system against defects in material and workmanship. All labor and materials shall be provided at no expense to the Owner during normal hours. The warranty period shall begin on the date of acceptance by the Owner.
- E. The Contractor shall, at the Owner's request, make available a service contract offering continuing factory authorized service of this system after the initial warranty period.
- F. The system manufacturer shall maintain engineering and service departments capable of rendering advice regarding installation and final adjustment of the system.

END OF SECTION

PUBLIC SAFETY BDA SYSTEM

PART 1 - GENERAL

1. SUMMARY

- A. This specification describes technical and performance criteria for deploying a Public Safety Radio Distributed Antenna System (DAS), designed to provide in-building, 2-way radio coverage for all frequencies used by local first responder agencies. The DAS components specified in this document include: Bi-Directional Amplifiers (BDA), Donor Antennas, Coverage Antennas, Coax Cable, Coax Connectors, Splitters, Combiners and Couplers. These devices shall be used as part of a system, to be designed by a DAS integrator, experienced with design-build projects for in-building, public safety, amplification systems. Quantities and locations of antennas shall be as determined by the equipment selected and the DAS integrator's design.

1.1 DESIGN-BUILD PROJECT - GENERAL DESCRIPTION

- A. Services: The design-build DAS integrator shall meet the required qualifications, experience and expertise in the design and installation of Public Safety Radio DAS's.
- B. Areas requiring coverage include stairwells corridors, hallways, fire pump room, fire command center and other areas designated as critical by the 2018 NFPA 72, Section 24, NFPA 1221, IFC 510 and other information necessary to deploy a complete and fully operational PSR DAS At this location.
- C. The DAS shall have expansion capabilities and the flexibility to support the addition or changes of radio frequencies and future building expansions and renovations.
- D. The BDA shall include alarms in accordance with NFPA 72, to be connected to an indicating light in the fire alarm panel. The DAS integrator shall coordinate the installation of this alarm light with the fire alarm contractor.
- E. The DAS Integrator, as part of his design, will be responsible for selecting locations for the BDA, coverage and donor antenna as required to provide the required coverage. The BDA shall be mounted in a Telco room, IDF closet or similar low voltage electronic control room which is not equipped with a wet sprinkler system. The BDA shall be enclosed in a NEMA 4 enclosure.

1.2 ALTERNATIVES

- A. No alternates shall be accepted as equal, unless the Contractor provides satisfactory proof demonstrating the proposed alternate is equal or superior to the specified integrator or product, in experience, value, and quality, and that the proposed alternates have successfully performed or have been used in projects of similar size and complexity for no less than 5-years. The following information shall be required to be submitted for approval for each alternative component. The owner's decision to accept or reject the alternate products shall be final.
 - 1. DAS Integrator:
 - a. Years of experience with Design-Build, In-Building 2-way radio Public Safety Systems, (3-years minimum, requirement may be met by subcontractor).
 - b. Certifications of factory training from proposed equipment manufacturers.
 - c. Personnel qualifications and experience to include industry certification in BDA /DAS (requirements may be met by subcontractor)
 - d. Detailed product specifications.
 - e. Written documentation from the manufacturer guaranteeing that the alternative component(s) shall remain available for purchase for a period of 5- years from the date of system acceptance.
 - 2. Active Components:
 - a. Hardware and software manuals.
 - b. Detailed product specifications.
 - c. Written documentation from the manufacturer guaranteeing that the alternative component(s) shall be supported for a period of 5-years from the date of system acceptance.

1.3 CODES, STANDARDS AND CERTIFICATIONS

- A. All work, including but not limited to: cabling, pathways, support structures, wiring, equipment, installation, workmanship, maintenance and testing shall comply with the latest editions of the National Fire Protection Association (NFPA72), National Electrical Code, and National Electrical Safety Code, as adopted by the county or municipality where the project is located, including all applicable local codes, rules and regulations. In case of discrepancy or disagreement between the documents noted above, the contractor shall satisfy the most stringent of the requirements. B. Requirements set forth by first-responder code, ordinance, or the AHJ shall supersede the requirements described herein and shall be met in their entirety. It is the Contractor's responsibility to ensure that the DAS complies with local code, ordinances or requirements established by the PSN AHJ.
- B. Abbreviations and Acronyms
 - 1. ACG: Automatic Gain Control.
 - 2. AHJ: Authority Having Jurisdiction.
 - 3. ATP: Acceptance Test Plan.
 - 4. BDA: Bi-Directional Amplifier.
 - 5. BOM: Bill-of-Material.
 - 6. DAS: Distributed Antenna System.
 - 7. LMR: Land Mobile Radio.
 - 8. MTBF: Mean Time Between Failure.

9. NFPA: National Fire Protection Association.
10. PSN: Public Safety Network.
11. RSL: Received Signal Level.
12. SMR: Specialized Mobile Radio.
13. SMS: Short Message Service.
14. SNIR: Signal-to-Noise Interference Ratio.
15. SOW: Statement of Work.
16. VSWR: Voltage Standing Wave Ratio.

1.4 DEFINITIONS

- A. Acceptance: Expressed approval by the AHJ and owner's representative.
- B. Active: DAS components that require AC/DC power for operation and/or require RF to optics conversion.
- C. DAS Integrator: The sub-contractor with the required qualifications and experience in the design installation and commissioning of 2-way Public Safety Radio, in-Building Amplification Systems, also known as Distributed Antenna Systems (DAS).
- D. Passive: DAS components that do not require AC/DC power for operation or transmission and systems not requiring RF to optics conversion.

1.5 PERFORMANCE REQUIREMENTS

- A. DAS:
 1. Prior to making submittals, the DAS integrator shall confirm the correct Agency frequencies used first responders at time of submission and shall guarantee coverage for these frequencies per DAQ 3.4 criteria.
 2. The DAS shall deliver coverage throughout 95 percent of the building, and 100 percent of areas designated as critical. Coverage areas shall include stairwells, elevators, fire pump room, underground spaces and other areas as listed in NFPA72 and required by the AHJ.
 3. The BDA shall have a common alarm output which is to be connected to an alarm light in the Fire Alarm Annunciator panel.
 4. The DAS shall be connected to the buildings emergency power and equipped with a 12-hour Battery Backup System, or more, if required by the AHJ, capable of providing the following alarms to be monitored by the fire alarm system.
 5. Loss of Normal AC power.
 6. Battery Charger Failure.
 7. Low Battery Capacity
 8. The DAS shall be capable of modifications and upgrades, without the need to replace the proposed hardware or software. Frequency changes and additions within the Public Safety Radio frequency band, shall be accomplished without the need to replace the existing hardware. The DAS design shall allow future expandability to cover additional public safety radio frequencies.
 9. Equipment Shall be available in Class A or Class B versions, preferred to be Listed to the UL2524 Standard, include Intelligent Oscillation Management, have alarm annunciation readily visible on the unit, and contain adjustable Uplink squelch circuitry.

1.6 SUBMITTALS

A. Submittal Requirements.

1. The DAS integrator is required to submit, for approval by the owner's technical representative, a complete list of the proposed equipment with a system diagram showing how the various components are interconnected and their function. Included in the submittal shall be:
2. Product Data: Submit manufacturer datasheets for the following components:
 - a. Bi-Directional Amplifiers (BDA).
 - b. Uninterruptible Power Supply.
 - c. Donor and Coverage Antennas.
 - d. Lightning Suppressor.
 - e. Coaxial Cable and Connectors.
 - f. Splitters, Combiners and Couplers.
 - g. Fiber-Optic Master Unit (if required).
 - h. Fiber-Optic Remote Units (if required).
 - i. Shop Drawings: Submit the following items.
 - j. RF site survey results.
 - k. System riser diagram.
 - l. Overlay of antennas and other system components on the architectural floor plans.
 - m. Donor Antenna lightning suppression and grounding details.
3. Acceptance Test Plan (ATP): Submit a proposed ATP including cable testing reports. At a minimum, testing requirements shall be designed to satisfy requirements of the local AHJ and NFPA 72.
4. Warranty Documents:
 - a. Submit for all manufactured Components specified in this Section.
 - b. Submit DAS Integrator System Warranty.

B. Submittal Requirements at Close Out:

1. Drawings: Submit as-built drawings indicating:
 - a. A final, signed copy of all previously submitted documents reflecting the final, as-built representation, equipment used and details.
 - b. Cable routing, splitters, couplers and coverage antenna final locations.
 - c. Active component locations, layout, configuration and programmed parameters.
2. Test Reports.
 - a. Submit Accepted ATP reports confirming the requirements of Section 1.5 have been met.
 - b. Submit a Certificate of Radio Coverage Compliance signed by a local Fire Marshall, certifying that the system has been installed in accordance with the requirements listed, successfully tested and found to meet local code requirements and the requirements of this specifications.
3. Field Reports: Submit sweep-testing results for all coaxial cable runs.
4. Technical Data Sheets: Submit hardware and software manuals for all Active Components.
5. Warranty Documents:
 - a. Submit for all manufactured components specified in this Section.
 - b. Submit Contractor's System Warranty.

1.7 QUALITY ASSURANCE

- A. Qualifications: The DAS Integrator shall have a minimum of 3-years full-time, in-building, public safety radio experience executing work of similar scope and complexity, and have, as full-time employee, at least one industry Certified BDA / DAS employee.
- B. Certifications:
 - 1. Passive Components: The DAS Integrator shall provide manufacturer certification that their personnel have been trained on the installation of the components being installed.
 - 2. Active Components: The DAS integrator shall provide manufacturer certification that their personnel have been trained on the installation of the components being installed.
 - 3. Personnel: Personnel involved in the installation and maintenance of the DAS / BDA must Possess manufacturer's certification as to equipment training. A Certificate of such certification will be made available upon request.

1.8 WARRANTY

- A. Manufacturer Warranty:
 - 1. Splitters, Couplers and Coverage Antennas: 1-year limited warranty from date of system acceptance.
 - 2. Coaxial Cable and Connectors: 10-year limited warranty from date of system acceptance.
 - 3. Fiber-Optic Cable: 20-year limited warranty from date of system acceptance.
 - 4. Active Components: The earliest of 1-year limited warranty from date of system acceptance.
- B. Contractor Warranty: Contractor shall warrant the system performance as specified in Article 1.5 for 1-year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified BDA Manufacturers:
 - 1. Westell Inc. / Simplex
 - 2. Alternate Manufacturers: To be approved as equal, as permitted in Article 1.1.

2.2 COMPONENTS

- A. LMR Yagi Donor Antennas:
 - 1. Electrical:
 - a. Frequency band, as required by the County owning the PSR System.
 - b. Bandwidth > 1.5 VSWR: 20
 - c. Gain: > 10 dB or as required by the requirements of the DAS.
 - d. Maximum input power: 250 watts.

- e. Front-to-back ratio: 16 dB.
- f. Impedance: 50 Ohm
- g. Azimuth Pattern: As proposed by the manufacturer to meet the performance specifications in this Section.
- 2. Mechanical:
 - a. Connector: 50 Ohm N Type Female.
 - b. Mounting: Pole.
- 3. Environmental:
 - a. Temperature: -40 °C to +60 °C.
 - b. Lighting protection: Direct ground.
 - c. Waterproof level: IP 66.
 - d. Wind Speed, maximum: 125 mph.
 - e. Wind Load: 0.45 sq. ft.
- 4. Approved Manufacturer: Andrew/Commscope, Laird Technologies, Westell or as approved in accordance with Article 1.1.

B. Bi-Directional Amplifier (BDA):

- 1. Characteristics
 - a. Frequency: As required by the local municipality or County's PSR System.
 - b. Gain: Adjustable by software 55 dB to 90 dB as required by the DAS Integrator Design.
 - c. Maximum Output Power is determined by the system design.
 - d. Operating Temperature Range: -30 °C to +50 °C.
 - e. Chassis: Shall be capable of rack or wall mounting as required by the DAS integrators design and be housed in a NEMA 4 enclosure.
 - f. Filtering: Digital.
 - g. Alarming: Dry contacts for remote alarm.
- 2. Compliance:
 - a. NFPA: The BDA shall comply with NFPA 72, 2018 edition. In-Building Public Safety Radio Enhancement Systems.
 - b. FCC: Shall be FCC type certified.

C. Air Dielectric, Plenum Rated Cable:

- 1. Material Characteristics:
 - a. Jacket: Halogenated, Fire-Retardant, Plenum rated.
 - b. Outer Conductor Material: Corrugated Aluminum or Corrugated Copper.
 - c. Inner Conductor Material: Copper-Clad Aluminum Wire.
- 2. Electrical Characteristics:
 - a. Impedance: 50 ± 1.0 Ohm
 - b. Frequency Band: 1 - 8800 MHz.
 - c. Peak Power Rating: > 40.0 kW.
- 3. Mechanical Characteristics:
 - a. Diameter Over Jacket: 5 .627-inch.
 - b. Minimum Bending Radius: < 5-inches.
 - c. One Time Minimum Bending Radius: 3-inches.
- 4. Attenuation Characteristics:
 - a. Standard Conditions: VSWR 1.0, ambient temperature 20 °C (68 °F).
- 5. Approved Manufacturer: Andrew HL4RP-50A, Eupen equivalent or other equivalent, in accordance with Article 1.1.

- D. Foam Dielectric Cable: To be used for donor antenna and outdoors.
1. Material Characteristics:
 - a. Jacket: Non-halogenated, Fire-Retardant Polyolefin.
 - b. Outer Conductor Material: Corrugated Copper.
 - c. Inner Conductor Material: Copper-Clad Aluminum Wire or Copper Tube.
 2. Electrical Characteristics:
 - a. Impedance: 50 + 1.0 Ohm.
 - b. Frequency Band: 1/2" Nominal: 1 - 8800 MHz, 7/8" Nominal: 1 - 5000 MHz.
 - c. Peak Power Rating: 40.0 kW.
 3. Mechanical Characteristics:
 - a. Diameter Over Jacket: 1/2" Nominal: s .630 in, 7/8-inch Nominal: < 1.1-inches.
 - b. Minimum Bending Radius: 1/2-inch Nominal: < 5 inches, 7/8-inch Nominal: < 10-inches.
 - c. One Time Minimum Bending Radius: 1/2-inch Nominal: < 2-inches, 7/8-inch Nominal: 5-inches.
 - d. Standard Conditions: VSWR 1.0, ambient temperature 20 °C (68 °F).
 4. Approved Manufacturer: Andrew LDF4-50A, Eupen equivalent or other equivalent, in accordance with Article 1.1.
- E. Splitters, Combiners, Couplers, Coax Jumpers and Connectors:
1. All passive equipment shall have a 698 to 2500 MHz range.
 2. Approved Manufacturer: Andrew, Westell, or equivalent, in accordance with Article 1.1.

Part 3 - EXECUTION

3.1 INSTALLATION

- A. The contractor shall design, install, commission and test the DAS in accordance with the manufacturer's instructions and recommendations
- B. Cable and Equipment:
- C. Installation shall include the delivery, unloading, setting in place, fastening to walls, floors, ceiling, or other structures and where required, penetration fire-stop, interconnecting wiring of the system components, equipment alignment and adjustments, and all other work whether or not expressly required herein which is necessary to result in complete operational DAS system.
- D. During the installation, and up to the date of final acceptance, the integrator shall be under obligation to protect his finished and unfinished work against damage and loss. In the event of such damage or loss, he shall replace or repair such work at no cost to the owner.
- E. All equipment shall be properly mounted on equipment racks or walls and secured in place. Wall mounted equipment shall be mounted over a 1/2-inch fire rated plywood, securely attached to the wall.

- F. Cables shall be properly supported with dedicated hangers or brackets. Cable trays shall be used only if they are dedicated low voltage trays and only with approval from the owner.
- G. Fastenings and supports shall be adequate to support their loads with a safety factor of at least three.
- H. All boxes, equipment, etc shall be secured plumb, level and square.
- I. In the installation of equipment and cable, consideration shall be given to operational efficiency and overall aesthetic factors. Antennas shall be centered and in-line with other ceiling mounted devices.
- J. All cables, regardless of length, shall be marked with cable markers reading "Public Safety Radio", at regular intervals but not less than every 50 ft. There shall be no unmarked cables at any place in the system. In addition, markings codes at each end of the cables and patch panels shall correspond to codes shown on drawings and/or run sheets.
- K. All coax cables must be handled in accordance with the manufacturer's guidelines. Transmission line cables have minimum bending radius specifications that shall be followed. In the event a cable is kinked or bent excessively during installation that section of cable cannot be used, even if subsequently straightened. The damaged area of the cable shall be removed, and a new section installed using correct splice methods. Ultimately the cable must pass the testing and meet the manufacturers' requirements.
 - L. Radio communications cabling shall not be grouped with electrical cabling. It can only share sleeves and raceways with other low voltage data and communications cables.
- 1. Connection between cables and other antenna components shall use N-Type premium connectors. No coax cable splicing is permitted.
 - 2. All power dividers shall be securely mounted in place by bolting the mount to a solid surface or securing each by suspension on the cables within 4 inches of each connector termination at the power divider. The transmission lines connecting to the device shall be routed in the shortest possible path.
- M. Grounding:
 - 1. In order to minimize problems resulting from improper grounding, and to achieve maximum signal-to-noise ratios, the following grounding procedures shall be adhered to:
 - a. System Ground: A signal primary "system ground" shall be established for the system. All grounding conductors in that area shall connect to this primary system ground. The system ground shall consist of a copper bar of sufficient size to accommodate all secondary ground conductors. An extension of the ground shall connect to the buildings lightning protection system per the direction of the on-site electrical engineer.
 - b. A copper conductor, having a maximum of 0.1 Ohms total resistance, shall connect the primary system ground bar to the primary system ground ring.
 - c. Secondary system grounding conductors shall be provided from all racks, radio consoles, and under grounded radio equipment in each area, to the primary system grounding point for the area. Each of these grounding conductors shall have a maximum of 0.1 Ohms total resistance.

- d. Under no conditions shall the AC neutral conductor, either in the power panel or in receptacle outlets, be used for a DAS system ground.
- e. General: Because of the great number of possible variations in grounding systems, it shall be the responsibility of the integrator to follow good engineering practice, as outlined above, and to deviate from these practices only when necessary to minimize crosstalk and to maximize signal-to-noise ratios and reduce interference in the radio systems. R-56 Industry standard is preferred for the communication community. Certified R-56 installers should be used in this process.

3.2 ACCEPTANCE TESTING

- A. The contractor shall complete the acceptance testing as prescribed in the approved Acceptance Test Plan (ATP) submittal.
- B. Acceptance Test Procedure: Upon completion of installation, the building owner shall have the option to participate in the radio system tested to ensure that two-way radio coverage on each floor of the building is a minimum of 90 percent and be tested to meet DAQ 3.4 guidelines. The test procedure shall be conducted as follows:
 - 1. Each floor of the building shall be divided into a grid of 20 or more, approximately equal areas. No two test locations shall be greater than 50 ft apart
 - 2. The test shall be conducted using a calibrated portable radio of the latest brand and model used by the agency talking through the agency's radio communications system.
 - 3. No area designated as critical and no two adjacent areas shall be allowed to fail the test.
 - 4. In the event that any three non-adjacent, non-critical areas fail the test, in order to be more statistically accurate, the floor may be divided into smaller areas. In the event that three non-critical, non-adjacent areas still fail the test, the contractor shall reconfigure the system to meet the 90-percent coverage requirement with no three adjacent areas failing.
 - 5. A test location approximately in the center of each grid area shall be selected for the test by the public safety or owner's representative, then the radio shall be enabled to verify two-way communications to and from the outside of the building through the public agency's radio communications system. Once the test location has been selected, that location shall represent the entire area. If the test fails in the selected test location, that grid area shall fail, and prospecting for a better spot within the grid area shall not be allowed.
 - 6. The gain values of all amplifiers shall be measured and the test measurement results shall be noted on the as-built drawings and the O&M manuals so that the measurements can be verified during annual tests.
 - 7. As part of the installation a spectrum analyzer or other suitable test equipment shall be utilized to insure spurious oscillations are not being generated by the subject signal booster.

8. When the DAS system is commissioned, the DAS integrator shall coordinate with the local Public Safety radio office and give them the opportunity to check the noise level generated by the DAS on the county system, and verify it is within an acceptable level as determined by the regulatory agency.

END OF SECTION

FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Section apply to this section.
- B. The work covered by this section is to be coordinated with related work as specified elsewhere in the specifications. Requirements of the following sections apply:
 - 1. Division 16: "Basic Electrical Materials and Methods."
 - 2. Division 16: "Wiring Methods."
 - 3. Division 13: "Fire Suppression".
 - 4. Division 15: "Fire Protection".
 - 5. Division 15: "HVAC Systems".
 - 6. Division 13: "Building Automation and Control".
- C. The system and all associated operations shall be in accordance with the following:
 - 1. Requirements of the following Model Building Code: IBC
 - 2. Requirements of the following Model Fire Code: IFC, NFPA, Arkansas Fire Prevention Code
 - 3. Requirements of the following Model Mechanical Code: IMC
 - 4. NFPA 72, National Fire Alarm Code, Latest Edition
 - 5. NFPA 70, National Electrical Code, Latest Edition
 - 6. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems, Latest Edition
 - 7. ANSI/ASME A17.1 / CSA B44, Safety Code for Elevators and Escalators, Latest Edition
 - 8. ICC/ANSI A117.1 Accessible and Useable Buildings and Facilities, Latest Edition
 - 9. Local Jurisdictional Adopted Codes and Standards
 - 10. ADA Accessibility Guidelines

1.2 SUMMARY

- A. This Section covers fire alarm systems, including initiating devices, notification appliances, controls, and supervisory devices.
- B. Work covered by this section includes the furnishing of labor, equipment, and materials for installation of the fire alarm system as indicated on the drawings and specifications.
- C. The Fire Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions:
 - 1. Fire alarm system detection and notification operations.

2. Control and monitoring of elevators, door hold-open devices, fire suppression systems, emergency power systems, and other equipment as indicated in the drawings and specifications.
 3. One-way supervised automatic voice alarm operations.
- D. Network fire alarm control units shall include all features as described in this specification for stand-alone FACUs and shall have network communication capabilities as described herein.
1. All points monitored and controlled by a single node shall be capable of being programmed as "Public". Each point made public to the network may be programmed to be operated by any other node connected to the network.
 2. Network communications shall be capable of supporting "point lists" that can be handled as though they were a single point.
 3. The network shall provide a means to log into any node on the system via a laptop computer and have complete network access (Set Host) for diagnostics, maintenance reporting, and information gathering of all nodes in the system. The means shall include the capability to log into any node on the system via TCP/IP Ethernet network communications protocol compatible with IEEE Standard 802.3. Ethernet access to a fire alarm panel via a customers's LAN/WAN connection shall be capable of providing access only to authenticated users through a cryptographically authenticated and secure SSL tunnel. Provisions for a standard RJ-45 Ethernet connection to the owner's Ethernet network must be provided at each node as part of the contract. Systems not meeting this requirement must provide all diagnostic tools required to support this function from selected points on the network. This Section covers fire alarm systems, including initiating devices, notification appliances, controls, and supervisory devices.

1.3 DEFINITIONS

- A. ADA: Americans with Disabilities Act
- B. AHJ: Authority Having Jurisdiction
- C. ANSI: American National Standards Institute
- D. ASME: American Society of Mechanical Engineers
- E. FACU: Fire Alarm Control Unit
- F. FM: Factory Mutual
- G. IBC: International Building Code
- H. ICC: International Code Council
- I. IDC: Initiating Device Circuit
- J. IEEE: Institute of Electrical and Electronic Engineers
- K. IFC: International Fire Code
- L. IMC: International Mechanical Code
- M. IRI: Industrial Risk Insurers
- N. LED: Light-emitting diode.
- O. NAC: Notification Appliance Circuit

- P. NFPA: National Fire Protection Association
- Q. NICET: National Institute for Certification in Engineering Technologies.
- R. RAC: Releasing Appliance Circuit
- S. SLC: Signaling Line Circuit
- T. UL: Underwriters Laboratories
- U. ULC: Underwriters Laboratories, Canada

1.4 SCOPE OF WORK

- A. Provide a complete and fully integrated District Wide Fire alarm System.

1.5 SYSTEM DESCRIPTION

- A. General: Provide a complete, non-coded addressable, microprocessor-based fire alarm system with initiating devices, notification appliances, and monitoring and control devices as indicated on the drawings and as specified herein.
- B. Power Requirements
 1. The control unit shall receive AC power via a dedicated fused disconnect circuit.
 2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 15 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic.
 3. All circuits requiring system-operating power shall be 24 VDC nominal voltage and shall be individually fused at the control unit.
 4. The incoming power to the system shall be supervised so that any power failure will be indicated at the control unit. A green "power on" LED shall be displayed continuously at the user interface while incoming power is present.
 5. The system batteries shall be supervised so that a low battery or a depleted battery condition, or disconnection of the battery shall be indicated at the control unit and displayed for the specific fault type.
 6. The system shall support NAC Lockout feature to prevent subsequent activation of Notification Appliance Circuits after a Depleted Battery condition occurs in order to make use of battery reserve for front panel annunciation and control.
 7. The system shall support 100% of addressable initiating devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions.
 8. Loss of primary power shall sound a trouble signal at the FACU. FACU shall indicate when the system is operating on an alternate power supply.
- C. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary.
 1. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation.

2. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory.
 3. Panels shall be capable of full system operation during new site specific configuration download, master exec downloads, and slave exec downloads.
 4. Remote panel site-specific software and executive firmware downloads shall be capable of being performed over proprietary fire alarm network communications, and via TCP/IP Ethernet network communications. Ethernet access to a fire alarm panel via a customer's LAN/WAN connection shall be capable of providing access only to authenticated users through a cryptographically authenticated and secure SSL tunnel.
 5. Panels shall automatically store all program changes to the panel's non-volatile memory each time a new program is downloaded. Panels shall be capable of storing the active site-specific configuration program and no less than 9 previous revisions in reserve. A compare utility program shall also be available to authorized users to compare any two of the saved programs. The compare utility shall provide a deviation report highlighting the changes between the two compared programs.
 6. Panels shall provide electronic file storage with a means to retrieve a record copy of the site-specific software and up to 9 previous revisions. Sufficient file storage shall be provided for other related system documentation such as record drawings, record of completion, owner's manuals, testing and maintenance records, etc.
 7. The media used to store the record copy of site-specific software and other related system documentation shall be electrically supervised. If the media is removed a trouble shall be reported on the fire alarm control unit.
- D. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.
- E. Recording of Events: The system shall be capable of recording all alarm, supervisory, and trouble events by means of system printer. The printout shall include the type of signal (alarm, supervisory, or trouble) the device identification, date and time of the occurrence. The printout shall differentiate alarm signals from all other printed indications.
- F. Wiring/Signal Transmission:
1. Transmission shall be hard-wired using separate individual circuits for each zone of alarm operation, as required or addressable signal transmission, dedicated to fire alarm service only.
 2. System connections for initiating device circuits shall be Class B, Style D, signaling line circuits shall be Class B, Style 4 and notification appliance circuits shall be Class B, Style Y.
 3. Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the FACU. Provide a distinctive indicating audible tone and alphanumeric annunciation.
 4. Constant Supervision Audio: When provided, audio notification appliance circuits shall be supervised during standby by monitoring for DC continuity to end-of-line resistors.

G. Required Functions: The following are required system functions and operating features:

1. Priority of Signals: Fire alarm events have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Priority Two, Supervisory and Trouble events have second-, third-, and fourth-level priority, respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.
2. Noninterfering: An event on one zone does not prevent the receipt of signals from any other zone. All zones are manually resettable from the FACU after the initiating device or devices are restored to normal. The activation of an addressable device does not prevent the receipt of signals from subsequent addressable device activations.
3. Transmission to an approved Supervising Station: Automatically route alarm, supervisory, and trouble signals to an approved supervising station service provider, under another contract.
4. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACU and the remote annunciator, indicating the type of device, the operational state of the device (i.e. alarm, trouble or supervisory) and shall display the custom label associated with the device.
5. Selective Alarm: A system alarm shall include:
 - a) Indication of alarm condition at the FACU and the annunciator(s).
 - b) Identification of the device /zone that is the source of the alarm at the FACU and the annunciator(s).
 - c) Operation of audible and visible notification appliances until silenced at FACU.
 - d) Closing doors normally held open by magnetic door holders.
 - e) Unlocking designated doors.
 - f) Shutting down supply and return fans serving zone where alarm is initiated.
 - g) Initiation of smoke control sequence.
 - h) Transmission of signal to the supervising station.
 - i) Initiation of elevator Phase I functions (recall, shunt trip, illumination of indicator in cab, etc.) in accordance with ANSI/ASME A17.1 / CSA B44, Safety Code for Elevators and Escalators, when specified detectors or sensors are activated, as appropriate.
6. Supervisory Operations: Upon activation of a supervisory device such as a fire pump power failure, and tamper switch, the system shall operate as follows:
 - a) Activate the system supervisory service audible signal and illuminate the LED at the control unit and the remote annunciator.
 - b) Pressing the Supervisory Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.
 - c) Record the event in the FACU historical log.
 - d) Transmission of supervisory signal to the supervising station.
 - e) Restoring the condition shall cause the Supervisory LED to clear and restore the system to normal.

7. Alarm Silencing: If the "Alarm Silence" button is pressed, all audible alarm signals shall cease operation.
8. Priority Two Operations: Upon activation of a priority two condition such as leak detection, intrusion alert, weather alert, the system shall operate as follows:
 - a) Activate the system priority two audible signal and illuminate the LED at the control unit and the remote annunciator.
 - b) Pressing the Priority 2 Acknowledge Key will silence the audible signal while maintaining the Priority 2 LED "on" indicating off-normal condition.
 - c) Record the event in the FACU historical log.
 - d) Transmission of priority two signal to the supervising station.
 - e) Restoring the condition shall cause the Priority 2 LED to clear and restore the system to normal.
9. System Reset
 - a) The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-arming the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."
 - b) Should an alarm condition continue, the system will remain in an alarmed state.
10. A manual evacuation (drill) switch shall be provided to operate the notification appliances without causing other control circuits to be activated.
11. WALKTEST: The system shall have the capacity of 8 programmable passcode protected one person testing groups, such that only a portion of the system need be disabled during testing. The actuation of the "enable one person test" program at the control unit shall activate the "One Person Testing" mode of the system as follows:
 - a) The city circuit connection and any suppression release circuits shall be bypassed for the testing group.
 - b) Control relay functions associated with one of the 8 testing groups shall be bypassed.
 - c) The control unit shall indicate a trouble condition.
 - d) The alarm activation of any initiating device in the testing group shall cause the audible notification appliances assigned only to that group to sound a code to identify the device or zone.
 - e) The unit shall automatically reset itself after signaling is complete.
 - f) Any opening of an initiating device or notification appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating the trouble condition.
 - (a) Any device which is activated during the time that Walktest is enabled, but is not within the group under test shall immediately cause a normal alarm sequence to commence as if the system was not under any testing sequence.
12. Install Mode: The system shall provide the capability to group all non-commissioned points and devices into a single "Install Mode" trouble condition allowing an operator to clearly identify event activations from commissioned points and devices in occupied areas.

- a) It shall be possible to individually remove points from Install Mode as required for phased system commissioning.
- b) It shall be possible to retrieve an Install Mode report listing that includes a list of all points assigned to the Install Mode. Panels not having an install mode shall be reprogrammed to remove any non-commissioned points and devices.

13. Module Distribution:

- a) The fire alarm control unit shall be capable of allowing remote location of the following modules; interface of such modules shall be through a Class B supervised serial communications channel (SLC):
 - (a) Initiating Device Circuits
 - (b) Notification Appliance Circuits
 - (c) Auxiliary Control Circuits
 - (d) Graphic Annunciator LED/Switch Control Modules
 - (1) In systems with two or more Annunciators and/or Command Centers, each Annunciator/Command Center shall be programmable to allow multiple Annunciators/Command Centers to have equal operation priority or to allow hierarchal priority control to be assigned to individual Annunciator/Command Center locations.
 - (e) Initiating Device Signaling Line Circuits
 - (f) Notification Appliance Signaling Line Circuits
 - (g) Power Supplies
 - (h) Voice System Amplifiers

- 14. Service Gateway: A Service Gateway software application shall be provided that allows an authorized service person to remotely query panel status during testing, commissioning, and service without the need to return to the panel using standard email or instant messaging tools. For systems without a service gateway application the service provider shall provide a minimum of two technicians for any system testing or commissioning.

H. Integrated Automation

1. Security Integration

- a) The FA System shall provide the means to be integrated directly to a Software House C•Cure 9000 Security Management System (SMS) or a Kantech Corporate and Global EntraPass system via a software interface for the purpose of communicating fire alarm events directly to the security system.
- b) Communication between the FA System and security system shall be accomplished using Computer Port Protocol (CPP).
 - (a) The FA and the security system shall be connected via a local or network serial port server based RS-232 serial port connection.
- c) The CPP shall consist of a bi-directional serial protocol capable of accessing most of the Fire Alarm Control Unit (FACU) diagnostic features.
- d) The interface shall provide the means to communicate the following information to the security system:
 - (a) Device/Point status changes (e.g., Fire, Trouble, Disabled)
 - (b) Panel event status (e.g. Number of Unacknowledged Fire Alarms, Card Failure Troubles, etc.)
 - (c) Panel health status (e.g., AC power, battery status)

- e) Interface software shall include a data acquisition function that provides the following:
 - (a) Establishes and maintains a supervised serial link
 - (b) Extraction of the point database from the FACU
 - (c) Merges the FACU database into the C•Cure SMS database
- f) The software interface shall not allow system control functionality from the security system to the FA System.
- g) The installation, programming and maintenance of the FA/security integration software interface shall be conducted by factory trained certified technicians.

2. Building Automation and Control Network (BACnet) Integration

- a) The fire alarm control unit shall be capable of providing a one-way communications interface between the fire alarm control unit and an industry-standard Building Automation and Control Network (BACnet) using ASHRAE® BACnet® IP (internet protocol) compliant with ANSI/ASHRAE Standard 135.
- b) The BACnet communications module shall be agency listed to UL Standard 864.
- c) The fire alarm control unit shall be capable of communicating status changes of up to 15,000 devices and system points to the building automation system. This shall include the capability to discretely identify and report the status of each notification appliance and initiating device.
- d) Status of addressable initiating and notification devices shall be accomplished via multi-state BACnet objects, and each point shall include detailed custom descriptions matching those provided in the fire alarm control panel site specific programming.
- e) Programming of the BACnet interface shall be accomplished using the current version of the manufacturer's approved fire alarm panel programming software.
- f) MS/TP Master and MS/TP Slave data link layer options communicating at baud rates up to 76,800 bps shall be supported.
- g) The interface shall be capable of supporting ANSI X3.4, ISO 10656 (ICS-4), ISO 10656 (UCS-2), ISO 8859-1, or IBM/Microsoft DBCS character sets.
- h) A standard RJ-45 Ethernet connection to the Building Automation System Ethernet network shall be provided at the fire alarm control unit as part of the contract.
- i) Systems using relay interfaces shall not be accepted.

3. Refer to section: 25.00 Integrated Automation

I. Analog Smoke Sensors:

- 1. Monitoring: FACU shall individually monitor sensors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The control unit shall determine the condition of each sensor by comparing the sensor value to the stored values.
- 2. Environmental Compensation: The FACU shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.

3. Programmable Sensitivity: Photoelectric Smoke Sensors shall have 7 selectable sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACU.
 4. Sensitivity Testing Reports: The FACU shall provide sensor reports that meet NFPA 72 calibrated test method requirements.
 - a) Reports shall be capable of being printed for annual recording and logging of the calibration maintenance schedule.
 - b) Where required, reports shall be accessible remotely through:
 - (a) A Fire Panel Internet Interface using Ethernet and TCP/IP communications protocol compatible with IEEE Standard 802.3. The Fire Panel Internet Interface shall be capable of automatically scheduling email reports to individual user accounts on a weekly, bi-weekly, or monthly schedule
 5. The FACU shall automatically indicate when an individual sensor needs cleaning. The system shall provide a means to automatically indicate when a sensor requires cleaning. When a sensor's average value reaches a predetermined value, (3) progressive levels of reporting are provided. The first level shall indicate if a sensor is close to a trouble reporting condition and will be indicated on the FACU as "ALMOST DIRTY." This condition provides a means to alert maintenance staff of a sensor approaching dirty without creating a trouble in the system. If this indicator is ignored and the second level is reached, a "DIRTY SENSOR" condition shall be indicated at the FACU and subsequently a system trouble is reported to the Supervising Station. The sensor base LED shall glow steady giving a visible indication at the sensor location. The "DIRTY SENSOR" condition shall not affect the sensitivity level required to alarm the sensor. If a "DIRTY SENSOR" is left unattended, and its average value increases to a third predetermined value, an "EXCESSIVELY DIRTY SENSOR" trouble condition shall be indicated at the control unit.
 6. The FACU shall continuously perform an automatic self-test on each sensor that will check sensor electronics and ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a "SELF TEST ABNORMAL" trouble condition.
 7. Multi-Sensors shall combine photoelectric smoke sensing and heat sensing technologies. An alarm shall be determined by either smoke detection, with selectable sensitivity from 0.2 to 3.7 %/ft obscuration; or heat detection, selectable as fixed temperature or fixed with selectable rate-of-rise; or based on an analysis of the combination of smoke and heat activity.
 8. Programmable bases. It shall be possible to program relay and sounder bases to operate independently of their associated sensor.
 9. Magnet test activation of smoke sensors shall be distinguished by its label and history log entry as being activated by a magnet.
- J. Fire Suppression Monitoring:
1. Water flow: Activation of a water flow switch shall initiate general alarm operations.
 2. Sprinkler valve tamper switch: The activation of any valve tamper switch shall activate system supervisory operations.

3. Water flow switch and sprinkler valve tamper switch shall be capable of existing on the same initiating zone. Activation of either device shall distinctly report which device has been activated on the initiating zone.

K. Audible Alarm Notification: By voice evacuation and tone signals on loudspeakers in areas as indicated on drawings.

1. Automatic Voice Evacuation Sequence:

- a) The audio alarm signal shall consist of an alarm tone for a maximum of five seconds followed by an automatic digital voice message. At the end of the voice message, the alarm tone shall resume. This sequence shall sound continuously until the "Alarm Silence" switch is activated.
- b) All audio operations shall be activated by the system software so that any required future changes can be facilitated by authorized personnel without any component rewiring or hardware additions.

L. Speaker: Speaker notification appliances shall be listed to UL 1480.

1. The speaker shall operate on a standard 25VRMS or 70.7VRMS NAC using twisted/shielded wire.
2. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.
3. The speaker shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for general signaling.

M. Manual Voice Paging

1. The system shall be configured to allow voice paging. Upon activation of any speaker manual control switch, the alarm tone shall be sounded over all speakers in that group.
2. The control unit operator shall be able to make announcements via the push-to-talk paging microphone over the pre-selected speakers.
3. Total building paging shall be accomplished by the means of an "All Call" switch.

N. Constant Supervision of Non-Alarm Audio Functions

1. When required, the system shall be configured to allow Non-Alarm Audio (NAA) functions such as background music or general/public address paging.
2. During NAA operation, the speaker circuit shall be electrically supervised to provide continuous monitoring of the speaker circuit.
3. During an alarm condition, supervision shall be disabled and alarm signals delivered to speakers.

O. Network Communication:

1. A single open, ground or short on the network communication pathway shall not degrade network communications. At the same time the fault condition status of the communication link shall be reported.
2. If a group of nodes becomes isolated from the rest of the network due to multiple fault conditions, that group shall automatically form a sub-network with all common interaction of monitoring and control remaining intact. The network shall be notified with the exact details of the lost communications.

3. Fiber optics communication shall be provided as an option via a fiber optics media module. All fire alarm network fiber optic communication is to be via full duplex transmission over a single fiber optic cable, either single mode or multi mode.

P. Addressable Notification Appliances (Applies only where addressable notification is provided):

1. Monitoring: The FACU shall monitor individual addressable notification appliances for status, condition, type of appliance, and configured appliance settings. A fault in any individual appliance shall automatically report a trouble condition on the FACU.
2. Individual Appliance Custom Label: Each addressable appliance shall have its own 40 character custom label to identify the location of the appliance and to aid in troubleshooting fault conditions.
3. Individual Appliance Information Display:
 - a) The FACU shall be capable of calling up detailed information for each addressable appliance including the appliance location, status, condition, type of appliance, and configured appliance settings.
 - b) Notification appliances that are not capable of communicating and reporting their individual location, status, condition, type of appliance, and configured appliance settings to the FACU shall not be accepted.
4. Programmable Appliance Settings:
 - a) The selectable operation of each addressable notification appliance shall be capable of being configured by the FACU without having to replace or remove the appliance from the wall or ceiling.
 - (a) Programmable appliance settings for applicable addressable notification appliances shall include:
 - (1) Operation:
 - ((a)) General Evac
 - ((b)) Alert
 - ((c)) User Defined
 - (2) Style:
 - ((a)) Indoor
 - ((b)) UL Weatherproof
 - ((c)) ULC Weatherproof
 - (3) Candela Selections:
 - ((a)) Indoor: 15, 30, 75, 110, 135, or 185 cd (per UL1971)
 - ((b)) UL Weatherproof: 15 or 75 cd (per UL1971), and 75 or 185 cd (per UL1638)
 - ((c)) ULC Weatherproof: 20, 30 or 75 cd (per ULCS526)
 - (4) Horn Volume:
 - ((a)) Hi
 - ((b)) Low
 - (5) Horn Cadence:
 - ((a)) Temporal 3
 - ((b)) Temporal 4
 - ((c)) March Time 20 bpm
 - ((d)) March Time 60 bpm
 - ((e)) March Time 120 bpm

- ((f)) Steady
- (6) Horn Tone:
 - ((a)) 520 HZ
 - ((b)) Bell
 - ((c)) Slow Whoop
 - ((d)) Siren
 - ((e)) Hi / Lo

b) Systems that require replacement or removal of the appliances from the wall or ceiling to change their applicable operation or settings shall not be accepted.

5. Programmable Notification Zones:

- a) Changing the notification zone assigned to a notification appliance shall be configurable by the FACU and shall not require additional circuits or wiring.
- b) Systems that require additional circuits and wiring to change the notification zone assigned to a notification appliance shall not be accepted.

6. Other Emergency and Non Emergency Notification:

- a) Where required, notification appliances for purposes not related to fire alarm shall be capable of:
 - (a) being connected to the same circuit as the fire alarm appliances, and
 - (b) being individually configured for their intended use without requiring additional circuits or wiring.
- b) Systems that require separate circuits and wiring for other Emergency and Non Emergency notification shall not be accepted.

7. Addressable Notification Appliance Automated Self-Test:

- a) The fire alarm control unit shall be capable of performing an automated functional self-test of all self-test notification appliances and meet the requirements in NFPA 72, 14.2.8 Automated Testing and Table 14.4.3.2 testing requirements.
- b) Test results for each self-test notification appliance shall be stored in non-volatile memory at the fire alarm control unit.
- c) The fire alarm control unit shall be capable of running a functional automated test for all self-test notification appliances in a general alarm group or for all self-test appliances within a specific notification zone.
- d) The duration required to complete the automated functional test for all self-test notification appliances shall be accomplished in 2 minutes or less.
- e) The automated test results for all self-test notification appliances shall be available from the fire alarm control unit within 4 minutes from the start of the test.
- f) If any notification appliance fails its automated functional self-test an audible and visual trouble signal shall be annunciated at the fire alarm control unit.
 - (a) The self-test trouble signal shall be a latching trouble signal which requires manual restoration to normal.

8. Addressable Notification Appliance Reports:

- a) The fire alarm control unit shall maintain configuration and test data for each self-test addressable notification appliance.
- b) The fire alarm control unit shall be capable of generating configuration, self-test, and deficiency reports, that can be viewed through the fire alarm control unit user interface or printed via the fire alarm control unit service port.

- (a) At minimum, the configuration report shall include the following information applicable for each addressable notification appliance:
 - (1) Point ID
 - (2) Custom Label
 - (3) Device Type
 - (4) Candela Setting
 - (b) At minimum, the self-test report shall include the following information applicable for each self-test notification appliance:
 - (1) Point ID
 - (2) Custom Label
 - (3) Time and Date of last test
 - (4) Pass / Fail results of last visual test
 - (5) Pass / Fail results of last audible test
 - c) The fire alarm control unit shall also be capable of providing a deficiency report that includes a list of all self-test notification appliances that have failed self-test.
9. Magnet test: When the control unit is in diagnostic mode, the appliances shall be capable of being tested with a magnet. The magnet diagnostics shall:
- a) Pulse the appliance LED to indicate appliance address

1.6 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.
 - 1. Product data sheets for system components highlighted to indicate the specific products, features, or functions required to meet this specification. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.
 - 2. Wiring diagrams from manufacturer.
 - 3. Shop drawings showing system details including location of FACU, all devices, circuiting and details of graphic annunciator.
 - 4. System power and battery charts with performance graphs and voltage drop calculations to assure that the system will operate in accordance with the prescribed backup time periods and under all voltage conditions per UL and NFPA standards.
 - 5. System operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. A list of all input and output points in the system shall be provided with a label indicating location or use of IDC, SLC, NAC, relay, sensor, and auxiliary control circuits.
 - 6. Operating instructions for FACU.
 - 7. Operation and maintenance data for inclusion in Operating and Maintenance Manual. Include data for each type product, including all features and operating sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organizations.

8. Product certification signed by a certified representative of the manufacturer of the fire alarm system components certifying that their products comply with indicated requirements.

9. Record of field tests of system.

B. Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of shop drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, make resubmissions, if required, to make clarifications or revisions to obtain approval.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A factory authorized installer is to perform the work of this section.

B. Each and every item of the Fire Alarm System shall be listed under the appropriate category by a Nationally Recognized Testing Laboratory and shall bear the respective "NRTL" label.

1.8 PROJECT CONDITIONS

A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of fire-alarm service.

2. Do not proceed with interruption of fire-alarm service without Architect's written permission.

1.9 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

PART 2 - PRODUCTS

2.1 ACCEPTABLE EQUIPMENT AND SERVICE PROVIDERS

A. Manufacturers: The equipment and service described in this specification are those supplied and supported by Johnson Controls and represent the base bid for the equipment.

1. Subject to compliance with the requirements of this specification, provide products by the following:

a) Simplex, a Johnson Controls Company

- B. Alternate products must be submitted to the Engineer and Owner two weeks prior to bid for approval. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Verified automatic alarm operation of smoke detectors.
6. Automatic sprinkler system water flow.
7. Heat detectors in elevator shaft and pit.
8. Fire-extinguishing system operation.
9. Fire standpipe system.

- B. Fire-alarm signal shall initiate the following actions as required:

1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Activate voice/alarm communication system.
7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
8. Activate smoke-control system (smoke management) at firefighter smoke-control system panel.
9. Activate stairwell and elevator-shaft pressurization systems.
10. Close smoke dampers in air ducts of designated air-conditioning duct systems.
11. Recall elevators to primary or alternate recall floors.
12. Activate emergency lighting control.
13. Activate emergency shutoffs for gas and fuel supplies.
14. Record events in the system memory.
15. Record events by the system printer.

- C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal AC voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer where provided.

2.3 FIRE ALARM CONTROL UNIT (FACU)

A. The following FACU hardware shall be provided:

1. Power Limited base panel with platinum cabinet and door, 120 VAC input power.
2. 3,000 point capacity where (1) point equals (1) monitor (input) or (1) control (output).
3. 2000 points of annunciation where one (1) point of annunciation equals:
 - a) 1 LED driver output on a graphic driver or 1 switch input on a graphic switch input module.
 - b) 1 LED on panel or 1 switch on panel.
4. 9.5 Amp Power Supply minimum with temperature compensated, dual-rate battery charger capable of charging up to 110 Ah batteries without a separate external battery charger. Battery charger voltage and amperage values shall be accessible on the FACU LCD display. Optional cooling fan shall be available to increase base power supply from 9.5 to 12.7 Amps. Optional expansion and back-up power supplies shall be available.
5. One Auxiliary electronically resettable fused 2A @24VDC Output, with programmable disconnect operation for 4-wire detector reset.
6. One Auxiliary Relay, SPDT 2A @32VDC, programmable as a trouble relay, either as normally energized or de-energized, or as an auxiliary control.
7. Three circuit Class B Addressable Notification Appliance Signaling Line Circuits SLCs module.
 - a) Each Addressable Notification Appliance SLC shall be rated at 3A and capable of supporting up to 127 Notification Appliances per channel.
 - b) Wiring shall be 18 AWG to 12 AWG unshielded twisted pair wire. Systems that require shielded wire for Notification Appliances shall not be accepted.
 - c) A constant voltage under both primary and secondary power conditions shall be maintained at the notification appliance field wiring terminal connections in

- the FACU to ensure the voltage drop on the circuit is consistent under both primary and secondary power conditions.
- d) For systems that do not provide a constant voltage source at the FACU notification appliance field wiring terminal connections, the fire alarm contractor shall:
 - (a) Provide separate point-to-point voltage drop calculations for all notification appliances under worst case secondary power specifications, and
 - (b) Perform a complete functional test of all notification appliances under worst case secondary power conditions.
8. Three circuit Class B Notification Appliance Circuits module. The NAC end-of-line resistor value shall be programmable and selected from a wide range of resistance values.
 - a) NAC's shall be conventional reverse polarity operation and shall be for synchronized strobes and independent horn/strobe operation over two wires.
 - b) NACs shall be selectable as auxiliary power outputs derated to 2 A for continuous duty.
 - c) Strobe synchronization and audible cadence synchronization shall be across all panel NAC circuits. Systems that cannot provide listed synchronization across all panel NAC's shall not be acceptable.
 9. Where required provide Intelligent Remote Battery Charger for charging up to 50Ah batteries.
 10. The FACU shall support up to (5) RS-232-C ports and one service port. All RS-232 Ports shall be capable of two-way communications.
 11. Remote Unit Interface: supervised Class B (Style 4) or Class X (Style 7) serial communication channel for control and monitoring of remotely located annunciators and I/O panels.
 12. Universal Communicator supporting POTS, Internet, and Cellular communications. Shall have multiple connectivity options and be configurable with a primary and secondary path. Paths can use any of the external connections; telephone line, cellular, or LAN Ethernet. Cellular shall be minimum 3G with 2G fallback. Cellular antenna extension kits shall be available for poor reception areas. IP based transmission; cellular or Ethernet shall be based on ADEMCO Contact ID Alarm Communication Protocol and Programmable DACT for either Common Event Reporting or per Point Reporting.
 13. Fire Panel Internet Interface to provide supplemental notification and remote user access to the FACU using Ethernet and TCP/IP communications protocol compatible with IEEE Standard 802.3.
 14. Modular Network Communications Card.
- B. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control unit, provide exactly matching modular unit enclosures.

C. Alphanumeric Display and System Controls: Panel shall include an 854 character, expanded content multi-line QVG LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.

1. The system shall include the necessary hardware to provide expanded content, multi-line, operator interface displays as indicated on the drawings and specifications. The expanded content multi-line displays shall be Quarter-VGA QVGA or larger and be capable of supporting a minimum of 854 standard ASCII characters to minimize or eliminate the levels of navigation required for access to information when responding to critical emergencies and abnormal system conditions. The QVGA operator interface shall provide operator prompts and six context sensitive soft-keys for intuitive operation.

a) Expanded content, multi-line operator interfaces shall be capable of providing the following functions:

(a) Dual language operation with Instant-Switch language selection during runtime.

(b) Activity display choices for:

(1) First 8 Events.

(2) First 5 Events and Most Recent Event (with first and most recent event time and date stamps).

(3) First Event and Most Recent Event (with first and most recent event time and date stamps).

(4) Scrollable List Display displays a scrollable list of active points for the event category (alarm, priority 2, supervisory, or trouble) selected. The position in this list will be the last acknowledged point (not flashing) at the top followed by the next 7 unacknowledged points (flashing)

(5) General Event Status (alarm, priority 2, supervisory, or trouble in system)

(6) Site Plan

(c) Equal or hierarchal priority assignment. In systems with two or more operator interfaces, each operator interface shall be programmable to allow multiple operator interfaces to have equal operation priority or to allow hierarchal priority control to be assigned to individual operator interfaces (locations).

(d) Up to 50 custom point detail messages for providing additional point specific information in detailed point status screens.

(e) Bitmap file import for operator interface display of site plan and background watermark images. Site plan status icons shall indicate area status for highest priority active events.

b) Expanded content, multi-line displays shall have the capability to provide Dual-Language operation.

(a) Language selection shall be via a switch on the operator interface panel. Operator interface panels shall support instant-language-switchover during runtime to allow the operator to toggle between languages each time the language selection switch is operated, without requiring complicated multi-step processes.

(b) Both one-byte and two-byte characters shall be supported.

- D. Distributed Module Operation: FACU shall be capable of allowing remote location of the following modules; interface of such modules shall be through a Style 4 (Class B) supervised serial communications channel (SLC):
1. Addressable Signaling Line Circuits
 2. Initiating Device Circuits
 3. Notification Appliance Circuits
 4. Auxiliary Control Circuits
 5. Amplifiers, voice and telephone control circuits
- E. Voice Alarm: Provide an emergency communication system, integral with the FACU, including voice alarm system components, microphones, amplifiers, and tone generators. Features include:
1. Amplifiers comply with UL 1711, "Amplifiers for Fire Protective Signaling Systems." Amplifiers shall provide an onboard local mode temporal coded horn tone as a default backup tone. Test switches on the amplifier shall be provided to test and observe amplifier backup switchover. Each amplifier shall communicate to the host panel amplifier and NAC circuit voltage and current levels for display on the user interface. Each amplifier shall be capable of performing constant supervision for non-alarm audio functions such as background music and general paging.
 2. Dual alarm channels permit simultaneous transmission of different announcements to different zones or floors automatically or by use of the central control microphone. All announcements are made over dedicated, supervised communication lines. All risers shall support Class A wiring for each audio channel.
 3. Eight channel digitally multiplexed audio for systems that require more than two channels of simultaneous audio. Up to 8 channels of audio shall be multiplexed on either a style 4 or style 7 twisted pair.
 4. Emergency voice communication audio controller module shall provide up to 32 minutes of message memory for digitally stored messages. Provide supervised connections for master microphone and up to 5 remote microphones. Optional Microphone Multiplex modules shall support a total of 40 remote microphones.
 5. Status annunciator indicating the status of the various voice alarm speaker zones and the status of fire fighter telephone two-way communication zones.
 6. When required, Redundant Voice Command Centers shall be capable of generating voice paging from more than one node in a network audio system.
- F. Evacuation System - Non-Alarm Audio
1. The fire alarm control unit shall provide non-alarm audio from an owner supplied paging and/or music source over the fire alarm evacuation speakers. This feature shall be an integral part of the fire alarm system, and shall use some or all of the audio components from the fire alarm evacuation system.
 2. The fire alarm system and the non-alarm audio operation shall comply with NFPA 72 requirements for non-emergency purposes at a fire command center that is not constantly attended by a trained operator.

3. All fire alarm system hardware and software shall be U.L. listed for non-alarm audio use. The fire alarm system shall supervise for system hardware and field wiring faults while playing non-alarm audio over the evacuation speakers. Any hardware failure or speaker circuit fault detected when the system is playing non-alarm audio shall report a trouble on the fire alarm control unit. All audio components used for both the non-alarm audio and the fire alarm evacuation system shall be manufactured by the same supplier.
4. The non-alarm audio shall have two dedicated audio inputs to the fire alarm control unit. Terminal strip connections and an industry standard RCA receptacle shall be provided at the fire alarm control unit for terminating the owner's audio source. The fire alarm input shall be 600-Ohm impedance. The inputs on the fire alarm control unit shall be electrically isolated via an isolation transformer.
5. The fire alarm control unit shall accept industry standard "line level audio input" from the owner's non-alarm audio source. The fire alarm system hardware and software shall distribute the audio over the fire alarm evacuation speakers. The selection of which speaker zones to distribute the non-alarm audio to the building occupants shall be coordinated with the owner's representative.
6. The fire alarm control unit shall be able to make audio input level adjustments from the owner's non-alarm audio source. This adjustment will match the non-alarm audio source to the fire alarm input. After the audio levels are adjusted, the owner shall control the volume level from the non-alarm audio source.
7. The fire alarm system will have the capability to provide operator "keys" that will adjust the volume level of pre-assigned non-alarm audio zones. The volume level of non-alarm audio that is being broadcast to any audio zone will also be individually adjustable by time of day via a pre-specified schedule.
8. The non-alarm audio shall be the lowest priority audio on the fire alarm system. The non-alarm audio shall not interfere with any of the fire alarm emergency signals that may include live voice, pre-recorded emergency voice messages, or any alert tones. Switches shall be located on the fire alarm control unit to turn on or off the non-alarm audio system feature. The fire alarm control unit shall have LED lamps to indicate the ON vs. OFF status of the non-alarm audio feature. Speaker circuits that are actively broadcasting non-alarm audio will also be indicated by LEDs.
9. The non-alarm audio shall be synchronized throughout the fire alarm life safety system amplifiers and speaker circuits. Any remote amplifier panels located on the fire alarm system network shall also be synchronized. The system shall be capable of accepting a system-wide non-alarm audio input at the main fire alarm control or another local non-alarm audio input at a remote amplifier panel to serve only the areas served by that remote panel.
10. Multiple non-alarm audio sources must be accessible by the fire alarm non-alarm audio system. Each separate non-alarm audio source will have the ability to be broadcast into a distinct fire zone, depending on occupant preference. Any system restricted to a limited number of non-audio sources will not be accepted. The system must have the capability of broadcasting an unlimited number of non-alarm sources, except as determined by the number of individual fire zones served by the fire alarm system.

11. Non-alarm audio shall be automatically turned off in the event of primary power failure to the fire alarm control unit or any of the remote amplifier panels controlled by the main fire alarm control unit.

2.4 ADDRESSABLE INITIATING

A. ADDRESSABLE MANUAL PULL STATIONS

1. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
2. Description: Addressable double action type, red LEXAN. Station shall mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units. Station shall be pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit. Where double-action stations are provided, the mechanism shall require two actions push top activation door to initiate an alarm.
3. Provide with a front showing red LED showing that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the station LED shall be on steady.
4. Indoor Protective Shield: Where required, or as indicated on the drawings, provide a factory-fabricated, tamperproof, clear LEXAN enclosure shield and red frame that easily fits over manual pull stations which shall be hinged at the top to permit lifting for access to initiate a local alarm. Unit shall be NRTL listed. Lifting the cover shall actuate an integral battery-powered audible horn intended to discourage false-alarm operation. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85dB at 10 feet and shall be powered by a 9 VDC battery.
5. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

B. ADDRESSABLE ANALOG SMOKE SENSORS

1. General Requirements for System Smoke Detectors:
 - a) Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:
 - b) Factory Nameplate: Serial number and type identification.
 - c) Operating Voltage: 24 VDC, nominal and shall be two-wire type.
 - d) Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.
 - e) Photoelectric sensor and electronics in a single piece construction which shall twist-lock onto a mounting base that attaches to a standard electrical box. Provide terminals in the fixed base for connection to building wiring. Sensors shall include an internal communication transmitter and receiver in the sensor having a unique identification and capability for status reporting to the FACU. Integral Addressable Module shall be arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit. Each sensor shall contain an integral visual-indicating LED that will flash to provide power-on status

each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor LED shall be on steady. Sensor and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base.

- f) Each sensor base shall contain a magnetically actuated test switch to provide for easy pre-certification alarm testing at the sensor location.
- g) Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.
- h) Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit. Provide multiple levels of detection sensitivity for each sensor.
- i) Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct smoke sensor shall be provided by the FACU.
- j) The sensor's electronics shall be immune from nuisance alarms caused by EMI and RFI. Removal of the sensor head for cleaning shall not require the setting of addresses.
- k) Bases: CO Sensor, relay output, sounder and isolator bases shall be supported alternatives to the standard base.

2. Addressable Sensor Bases

- a) Standard base - Twist lock addressable base with address selection DIP switch accessible from front with sensor removed. Integral red LED for power-on (pulsing), or alarm or trouble (steady on). Locking anti-tamper design mounts on standard outlet box.
- b) Sensor Base with remote device connection - All standard base features with wired connection for either a Remote LED alarm indicator or remote relay (relay is unsupervised and requires separate 24VDC)
- c) Supervised Relay Bases - All standard base features and shall be available in either a 4-Wire Sensor Base to use with remote or locally mounted relay; requires separate 24 VDC, or as a 2-Wire Sensor Base to use with remote or locally mounted relay; no separate power required. Supervised relay operation shall be programmable and shall be manually operated from control panel.
- d) Sensor base with built-in electronic alarm sounder - All standard base features and piezoelectric sounder shall provide high output (88 dBA) with low current requirements (20 mA). Sounder shall be synchronized via SLC communications or by the NAC if NAC powered, sounder shall operation shall be programmable and shall be manually operated from control panel.
- e) 520 Hz Sensor base with built-in electronic low frequency sounder - All standard base features and piezoelectric sounder shall provide a low frequency 520 Hz Square Wave (85 dBA) with nominal current requirements (115 mA). Sounder shall be synchronized via SLC communications or by the NAC if NAC powered, sounder operation shall be programmable and shall be manually operated from control panel.
 - (a) Emitted tone shall be a 520Hz Square Wave signal in compliance with the requirements of the 2010 edition of NFPA 72 for sleeping areas.

- (b) The 520Hz Sounder base shall be listed to UL 268 and UL464, Audible Signal Appliances.

C. ADDRESSABLE DUCT SMOKE SENSOR

1. Standard Addressable Duct Smoke Sensor Unit. Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Duct housing shall include relay or relay driver as required for fan shutdown.
 - a) Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct smoke sensor shall be provided by the FACU.
 - b) The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable independent of the sensor head for activation by other alarm initiating devices within the fire alarm system. Relay shall be mounted within 3 feet of HVAC control circuit.
 - c) Duct Housing shall provide a magnetic test area and Red sensor status LED and Duct Housing shall provide a relay control Yellow LED trouble indicator.
 - d) Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
 - e) Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
 - f) For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
 - g) Each duct smoke sensor shall be provided with a Remote Test Station with an alarm LED and test switch.
 - h) Where indicated provide a NEMA 4X weatherproof duct housing enclosure that shall provide for the circulation of conditioned air around the internally mounted addressable duct sensor housing to maintain the sensor housing at its rated temperature range. The housing shall be UL Listed to Standard 268A.
2. Addressable In-Duct Mounted Smoke Sensors. Photoelectric type, for applications with controlled dust and humidity providing HVAC duct smoke sensing where sampling tube designs are not appropriate. In-Duct housing shall include relay or relay driver as required for fan shutdown.
 - a) Shall accommodate duct airflow from 0 to 4000 ft/min (0 to 1220 m/min), and provide environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct smoke sensor by the FACU.
 - b) The In-Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable independent of the sensor head for activation by other alarm initiating devices within the fire alarm system. Relay shall be mounted within 3 feet of HVAC control circuit.

- c) Standard models shall be for rectangular ducts from 6" (152 mm) square to 36" (914 mm) square with optional adapters available to allow use with round ducts of 6", 8" (203 mm), 10" (254 mm) or 12" (305 mm) in diameter.
 - d) In-Duct Housing shall provide a magnetic test area and Red sensor status LED and In-Duct Housing shall provide a relay control Yellow LED trouble indicator.
 - e) Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
 - f) Each duct smoke sensor shall be provided with a Remote Test Station with an alarm LED and test switch.
3. Addressable Air Aspirating Duct Smoke Sensors. Photoelectric type smoke detection with an aspirating system shall provide remote sensor location for ducts with difficult service access. Detectors shall support remote housing up to 82ft with 1.05" OD rigid pipe; detectors shall support remote housing up to 50ft with 3/4" OD flexible tubing. Sampling tubes shall be provided per design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Duct Detection system shall be UL listed to Standards 268A, and ULC listed to Standard S529.
- a) Environmental compensation, programmable sensitivity settings, status testing and monitoring of sensor dirt accumulation for the duct smoke sensor shall be provided by the FACU.
 - b) The Air Aspirating duct detection system shall supervise air flow through the duct housing and shall communicate trouble to the fire alarm control unit on a high or low air flow condition.
 - c) The Air Aspirating Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single Form C contact rated at 7A@ 28VDC and 120VAC. This auxiliary relay output shall be fully programmable. Relay shall be mounted within 3 feet of HVAC control circuit.
 - d) Air Aspirating Duct Housing shall provide a magnetic test area and Red sensor status LED.
 - e) Each duct smoke sensor shall have a Remote Test Station with an alarm LED and test switch.
 - f) Each duct housing shall have remote functional smoke testing capability.
 - g) Each duct housing shall be supplied with a replacement air inlet filter.
 - h) Each duct housing shall have an optional water trap with a ball valve for draining to eliminate moisture buildup.
 - i) The Air Aspirating Detection system shall have an operating air velocity range of 0 to 4000 linear ft/minute) 0 to 1220 meters/minute.
 - j) The Addressable Air Aspirating Detection system shall be capable of use in other areas as open area detection where point type detectors are not practical, such as; prison cells in correctional facilities, transformer vaults, cable tunnels and MRI rooms.

D. ADDRESSABLE HEAT SENSORS

1. General Requirements for Heat Detectors: Comply with UL 521.

2. Thermal Sensor Combination type: Fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; Actuated by either a selected fixed temperature or a rate of rise that exceeds a preset amount per minute unless otherwise indicated.
3. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall not be affected by thermal lag. Selectable rate compensated, fixed temperature sensing with or without rate-of-rise operation.
4. Mounting: Twist-lock base interchangeable with smoke-sensor heads.
5. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
6. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACU for either 15-deg F or 20-deg F per minute.
7. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F.
8. Unless otherwise indicated, sensors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for temperature by fire-alarm control unit.
 - a) Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
 - b) Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.

E. ADDRESSABLE CO SENSOR

1. Addressable CO Sensor
 - a) The CO Sensor shall be an addressable carbon monoxide (CO) sensing module providing both CO toxic gas detection and enhanced fire detection, and shall be listed to UL 268, Smoke Detectors for Fire Alarm Signaling Systems and UL 2075, Gas and Vapor Detectors and Sensors; allowing systems to be listed to UL 2034, Single and Multiple Station Carbon Monoxide Alarms.
 - b) The CO Sensor shall include CO sensor element mounted in the sensor base which can be easily replaced without replacing the complete sensor base assembly.
 - c) The CO Sensor base shall provide address selection in the base allowing the address to remain with its location when the sensor is removed for service or type change.
 - d) The CO Sensor base shall include an integral red LED to indicate the power-on, trouble, test mode or alarm status.
 - e) CO sensor shall provide enhanced fire detection with the addition of two selectable modes of operation: Nuisance Alarm Reduction Mode and Faster Fire Detection.
 - f) The CO Sensor shall provide a 10 year life expectancy before replacement is necessary or required.

- g) The CO Sensor base shall report the following CO Sensor troubles: Communication loss, Disabled, Almost Expired 12 Months, Almost Expired 6 Months, Expired (End of Life), and Sensor Missing/Failed.

F. ADDRESSABLE MULTI-POINT/MULTI-SENSOR/MULTI-CRITERIA SENSOR

1. Smoke and heat sensing shall be available to be combined in a single housing to provide smoke activity accurately monitored by photoelectric sensing technology and thermal activity accurately monitored by thermistor sensing technology.
2. A correlation algorithm of smoke activity and thermal activity shall be provided for intelligent fire detection earlier than with either technology activity alone but shall provide software and programming capabilities to help reduce nuisance alarms.
3. Individual sensor information shall be processed by the host fire alarm control unit to determine sensor status and to determine whether conditions are normal, off-normal, or alarm.
4. Analog information from each sensor type shall be digitally communicated to the control panel where it is to be analyzed. Photoelectric sensor input is to be stored and tracked as an average value with an alarm or abnormal condition being determined by comparing the sensor's present value against its average value. Thermal data is to be processed to look for absolute or rate-of-rise temperature as desired.
5. Monitoring each photoelectric sensor's average value shall provide a software filtering process that compensates for environmental factors (dust, dirt, etc.) and component aging, which shall provide an accurate reference for evaluating new activity. The intent of this process is to be a significant reduction in the probability of false or nuisance alarms caused by shifts in sensitivity, either up or down. Status indications of dirty and excessively dirty shall be automatically generated allowing maintenance to be performed on a per device basis.
6. Peak activity per sensor shall be stored by the host fire alarm control unit to assist in evaluating specific locations where the alarm set point for each sensor shall be capable of being determined at the control panel, and selectable as more or less sensitive as the individual application requires.
7. Alarm set points shall be programmed for timed automatic sensitivity selection (such as more sensitive at night, less sensitive during day). Control panel programming shall also provide multi-stage operation per sensor, for example a 0.2% level may cause a warning to prompt investigation while a 2.5% level may initiate an alarm.
8. Combination smoke and heat sensors Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute. The fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
9. Bases: CO Sensor, relay output, sounder, 520 Hz Sounder, and isolator bases shall be supported alternatives to the standard base.

G. ADDRESSABLE CIRCUIT INTERFACE MODULES

1. Addressable Circuit Interface Modules: Arrange to monitor or control one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable devices, and for control of AHU systems.
2. Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box or be cabinet mounted using appropriate mounting to allow quick replacement. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line circuit or a separate two wire pair running from an appropriate power supply, as required.
3. There shall be the following types of modules:
 - a) Type 1: Monitor Circuit Interface Module:
 - (a) For conventional 2-wire smoke detector and/or contact device monitoring with Class B or Class A wiring supervision. This module will communicate status (normal, alarm, trouble) to the FACU.
 - (b) For conventional 4-wire smoke detector with Class B wiring supervision. The module will provide detector reset capability and over-current power protection for the 4-wire detector. This module will communicate status (normal, alarm, trouble) to the FACU.
 - b) Type 2: Line Powered Monitor Circuit Interface Module
 - (a) This type of module is an individually addressable module that has both its power and its communications supplied by the two wire signaling line circuit. It provides location specific addressability to an initiating device by monitoring normally open dry contacts. This module shall have the capability of communicating four zone status conditions (normal, alarm, current limited, trouble) to the FACU.
 - (b) This module shall provide location specific addressability for up to five initiating devices by monitoring normally closed or normally open dry contact security devices. The module shall communicate four zone status conditions (open, normal, abnormal, and short). The two-wire signaling line circuit shall supply power and communications to the module.
 - c) Type 3: Single Address Multi-Point Interface Modules
 - (a) This multipoint module shall provide location specific addressability for four initiating circuits and control two output relays from a single address. Inputs shall provide supervised monitoring of normally open, dry contacts and be capable of communicating four zone status conditions (normal, open, current limited, and short). The input circuits and output relay operation shall be controlled independently and disabled separately.
 - (b) This dual point module shall provide a supervised multi-state input and a relay output, using a single address. The input shall provide supervised monitoring of two normally open, dry contacts with a single point and be capable of communicating four zone status conditions (normal, open, current limited, and short). The two-wire signaling line circuit shall supply power and communications to the module.
 - (c) This dual point module shall monitor an unsupervised normally open, dry contact with one point and control an output relay with the other point, using a single address. The two-wire signaling line circuit shall supply power and communications to the module.

- d) Type 4: Line Powered Control Circuit Interface Module
 - (a) This module shall provide control and status tracking of a Form "C" contact. The two-wire signaling line circuit shall supply power and communications to the module.
 - e) Type 5: 4-20 mA Analog Monitor Circuit Interface Module
 - (a) This module shall communicate the status of a compatible 4-20 mA sensor to the FACU. The FACU shall annunciate up to three threshold levels, each with custom action message; display and archive actual sensor analog levels; and permit sensor calibration date recording.
4. All Circuit Interface Modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACU. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

2.5 ADDRESSABLE NOTIFICATION

A. ADDRESSABLE ALARM NOTIFICATION APPLIANCES

1. Addressable Notification Appliances: The Contractor shall furnish and install Addressable Notification Appliances and accessories to operate on compatible signaling line circuits (SLC).
- a) Addressable Notification appliance operation shall provide power, supervision and separate control of horns and strobes over a single pair of wires. The controlling channel (SLC) digitally communicates with each appliance and receives a response to verify the appliance's presence on the channel. The channel provides a digital command to control appliance operation. SLC channel wiring shall be unshielded twisted pair (UTP), with a capacitance rating of less than 60pf/ft and a minimum 3 twists (turns) per foot.
 - b) All Notification Appliances shall operate as a completely independent device allowing for specific location alerting of both fire alarm and Mass Notification functions. Each visible device (both clear fire alarm and amber mass notification) shall be capable of operating on multiple notification zones or completely separate from all other notification devices, this allows "On the fly" program operation changes for Mass Notification alerting and fire alarm notification.
 - c) All Notification Appliances shall operate as a completely independent device allowing for appliances in handicap accessible rooms and other locations to operate on the same SLC and to activate individually based on an alarm condition in a room or as part of a general alarm condition where all appliances activate together.
 - d) Individual Notification Appliances shall be able to be grouped into zones (or operational groups) by central programming at the main fire alarm control unit.
 - e) Notification Appliances shall provide for "unobtrusive" testing. Each Notification Appliance shall be tested for audible and visible operation on an individual basis at the device or from the main fire alarm control unit, allowing for minimal invasive impact.
 - f) Class B (Style 4) notification appliances shall be wired without requiring traditional in/out wiring methods; addressable "T" Tapping shall be permitted. Up to 127 addresses can be supported on a single channel.

- g) Each Addressable notification appliance shall contain an electronic module and a selectable address setting to allow it to occupy a unique location on the channel. This on-board module shall also allow the channel to perform appliance diagnostics that assist with installation and subsequent test operations. A visible LED on each appliance shall provide verification of communications and shall flash with the appliances address setting when locally requested using a magnetic test tool.
 - h) Each addressable notification appliance shall have electrical test point access without removing the device cover.
 - i) Both wall mount and ceiling mount devices shall be available along with weatherproof devices.
2. Addressable Visible/Only: Addressable strobe shall be listed to UL 1971. The V/O device shall consist of a xenon flash tube and associated lens/reflector system, cover and mounting plate. For ease of installation the mounting plate shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. When the appliance is connected to an active circuit, the front cover of the appliance shall be removable without causing a trouble indication on the fire alarm control unit. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot. The V/O appliance shall be provided with multiple minimum flash intensities of 15cd, 30cd, 75cd, 110cd, 135cd and 185cd. The Candela levels shall be settable from the fire alarm control unit or by using a hardware selector on the appliance.
3. Addressable Audible/Visible: Addressable combination Audible/Visible (A/V) Notification Appliances shall be listed to UL 1971 and UL 464. The strobe device shall consist of a xenon flash tube and associated lens/reflector system, cover and mounting plate. For ease of installation audible/visible mounting plate shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. The strobe shall provide multiple minimum flash intensities of 15cd, 30cd, 75cd, 110cd, 135cd and 185cd. The Candela levels shall be settable from the fire alarm control unit or using a hardware selector on the appliance. The Horn shall support Temporal Code 3, March Time (20, 60, or 120 BPM), Continuous, and Temporal Code 4 coding patterns. The horn shall have a minimum sound pressure level of 83 or 89 dBA for steady or 79 or 85 dBA for coded operation. When the appliance is connected to an active circuit, the front cover of the appliance shall be removable without causing a trouble indication on the fire alarm control unit. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot. The appliance shall be capable of two-wire synchronization with one of the following options:
- a) Synchronized Strobe with Horn on steady.
 - b) Synchronized Strobe with Temporal Code Pattern on Horn.
 - c) Synchronized Strobe with March Time cadence on Horn.
 - d) Synchronized Strobe firing to NAC sync signal with Horn silenced.

4. Addressable Multi-Tone Audible Only: Addressable multi-tone appliance shall be listed to UL 464. Per appliance tone selection of 520 Hz Horn, Broadband Horn, Bell, and Chime tones shall be controlled as Temporal Code 3, Temporal Code 4, March Time (selectable as 20, 60, or 120 bpm), or Continuous shall be programmable from the control panel, or selected using an on-board DIP Switch. Slow Whoop, Siren, and High/Low tone selections shall be controlled as synchronized continuous operation. Appliances shall have a High/Low Setting, programmable by channel from the addressable controller or by appliance from the host FACU. 520 Hz tone shall be compliant with NFPA 72 Low Frequency Signal Requirements for Sleeping Areas. The appliance shall consist of three pieces; appliance, cover and mounting plate. For ease of installation the mounting plate shall mount directly to a standard single gang, double gang or 4" square electrical box, without the use of special adapter or trim rings. When the appliance is connected to an active circuit, the front cover of the appliance shall be removable without causing a trouble indication on the fire alarm control unit.
5. Addressable Multi-Tone Audible/Visible: Addressable combination Multi-Tone Audible/Visible (A/V) Notification Appliances shall be listed to UL 1971 and UL 464. The strobe device shall consist of a xenon flash tube and associated lens/reflector system, cover and mounting plate. For ease of installation audible/visible mounting plate shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. The strobe shall provide multiple minimum flash intensities of 15cd, 30cd, 75cd, 110cd, 135cd and 185cd. The Candela levels shall be settable from the fire alarm control unit or using a hardware selector on the appliance. Per appliance tone selection of 520 Hz Horn, Broadband Horn, Bell, and Chime tones shall be controlled as Temporal Code 3, Temporal Code 4, March Time (selectable as 20, 60, or 120 bpm), or Continuous shall be programmable from the control panel, or selected using an on-board DIP Switch. Slow Whoop, Siren, and High/Low tone selections shall be controlled as synchronized continuous operation. Appliances shall have a High/Low Setting, programmable by channel from the addressable controller or by appliance from the host FACU. 520 Hz tone shall be compliant with NFPA 72 Low Frequency Signal Requirements for Sleeping Areas.
6. Addressable Weatherproof Visible Only: Addressable weatherproof strobe shall be UL 1971 listed for indoor applications with strobe intensity selectable as 15 or 75 cd or UL 1638 listed for outdoor applications with strobe rated at 75 cd (WP75) or 185 cd (WP185). The appliances shall be acceptable for indoor and outdoor, extended temperature and extended humidity applications. The V/O device shall consist of a xenon flash tube and associated lens/reflector system, weatherproof cover and weatherproof mounting box. The V/O appliance shall be provided with multiple minimum flash intensities of 15, 75, WP 75, or WP 185 candela. The Candela levels shall be settable from the fire alarm control unit or by using a hardware selector on the appliance.

7. Addressable Weatherproof Audible/Visible: Addressable weatherproof horn/strobe shall be UL 464 and UL 1971 listed for indoor applications with strobe intensity selectable as 15 or 75 cd or UL 1638 listed for outdoor applications with strobe rated at 75 cd (WP75) or 185 cd (WP185).. The appliances shall be acceptable for indoor and outdoor, extended temperature and extended humidity applications. The A/V device shall consist of a xenon flash tube and associated lens/reflector system, weatherproof cover and weatherproof mounting box. The strobe appliance shall be provided with multiple minimum flash intensities of 15, 75, WP 75, or WP 185 candela. The Candela levels shall be settable from the fire alarm control unit or by using a hardware selector on the appliance. The Horn shall support Temporal Code 3, March Time (20, 60, or 120 BPM), Continuous, and Temporal Code 4 coding patterns. The horn shall have a minimum sound pressure level of 81 or 87 dBA for steady or 80 or 87 dBA for coded operation.
8. Addressable Mini-Horn Audible Only: Addressable mini-horn shall be listed to UL 464. Horn shall support Temporal Code 3, March Time (20, 60, or 120 BPM), Continuous, and Temporal Code 4 coding patterns. Mini-horn appliances shall have a High/Low Setting, selectable at the appliance or programmable from the addressable controller by appliance from the host FACU. The horn shall have a minimum sound pressure level of 85 or 87 dBA for steady) or of 81 or 83 dBA for coded operation. The horn device shall consist of two pieces; cover and appliance/mounting plate. For ease of installation the appliance/mounting plate shall mount directly to a standard single gang electrical box, without the use of special adapter or trim rings. When the appliance is connected to an active circuit, the front cover of the appliance shall be removable without causing a trouble indication on the fire alarm control unit. Weatherproof model shall mount to provided single gang weatherproof electrical box.
9. Addressable LED Visible Only: Addressable LED visible strobe (V/O) shall be listed to UL 1971. The multi-candela LED V/O strobe device shall be available in low (15, 30, 75 cd) and high (110, 135, 185 cd) range candela. Models shall provide a small compact design with low current draw due to efficient strobe LED's. LED strobe device shall consist of two pieces; cover and appliance/mounting plate. For ease of installation the appliance/mounting plate shall mount directly to a standard single gang electrical box, without the use of special adapter or trim rings. Synchronized LED strobe operation shall be provided with other LED or Xenon strobe devices on the same circuit or the same panel on different circuits. LED strobe device shall meet the 20ms pulse width requirement in the 2016 Edition of NFPA 72. When the appliance is connected to an active circuit, the front cover of the appliance shall be removable without causing a trouble indication on the fire alarm control unit. The Candela levels shall be settable from the fire alarm control unit or by using a hardware selector on the appliance. Weatherproof model shall mount to provided single gang weatherproof electrical box.

10. Addressable LED Audible/Visible: Addressable combination LED Audible/Visible (A/V) Notification Appliances shall be listed to UL 1971 and UL 464. Horn shall support Temporal Code 3, March Time (20, 60, or 120 BPM), Continuous, and Temporal Code 4 coding patterns. Horn shall have a High/Low Setting, selectable at the appliance or programmable from the addressable controller by appliance from the host FACU. The horn shall have a minimum sound pressure level of 85 or 87 dBA for steady) or of 81 or 83 dBA for coded operation. The multi-candela LED V/O strobe device shall be available in low (15, 30, 75 cd) and high (110, 135, 185 cd) range candela. Models shall provide a small compact design with low current draw due to efficient strobe LED's. Synchronized LED strobe operation shall be provided with other LED or Xenon strobe devices on the same circuit or the same panel on different circuits. LED strobe device shall meet the 20ms pulse width requirement in the 2016 Edition of NFPA 72. The A/V device shall consist of two pieces; cover and appliance/mounting plate. For ease of installation the appliance/mounting plate shall mount directly to a standard single gang electrical box, without the use of special adapter or trim rings. When the appliance is connected to an active circuit, the front cover of the appliance shall be removable without causing a trouble indication on the fire alarm control unit. Weatherproof model shall mount to provided single gang weatherproof electrical box.
11. Standard Speaker: Speaker notification appliances shall be listed to UL 1480.
- a) The speaker shall operate on a standard 25VRMS or 70.7VRMS NAC using twisted / shielded wire.
 - b) The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.
 - c) The speaker shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for general signaling.
 - d) The speaker shall install directly to a 4" square, 1 ½" deep electrical box with 1 ½" extension.
12. Hybrid Speaker/Visible: Combination Speaker/Visible (S/V) units combine the speaker and visible functions into a common housing. The S/V shall be listed to UL 1971 and UL 1480. Addressable functionality controls visible operation, while the speaker operates on a 25VRMS or 70.7VRMS NAC.
- a) Twisted/shielded wire is required for speaker connections on a standard 25VRMS or 70.7VRMS NAC and UTP conductors, having a minimum of 3 twists per foot is required for addressable strobe connections.
 - b) The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 82 dBA at 10 feet.
 - c) The S/V shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for general signaling.
 - d) The S/V installs directly to a 4" square, 1 ½" deep electrical box with 1 ½" extension.
13. Addressable Speaker: Addressable Speaker notification appliances shall be listed to UL 1480. Individual device level supervision and activation control shall be provided by the fire alarm control unit.

- a) Speakers shall be individually powered, addressed, and controlled from a compatible fire alarm control unit Signaling Line Circuit (SLC) using Unshielded Twisted Pair (UTP) cable and T-taps shall be allowed for Class B installation reducing wiring costs and wiring distances. Shielded cable shall not be required.
 - b) Speakers shall provide for Fire Alarm and General Signaling functionality in a single unit, eliminating additional devices. Device "Self-Test" shall be supported by a compatible fire alarm control unit and shall be UL listed and NFPA 72 compliant. Speakers shall be UL listed to provide a 520Hz audio tone in compliance with NFPA 72 for sleeping areas.
 - c) The speaker audio shall be provided by a standard 25VRMS or 70.7VRMS audio circuit using Unshielded Twisted Pair (UTP) cable and T-taps shall be allowed for Class B installation reducing wiring costs and wiring distances. Supervision of this circuit shall be provided by the addressable speaker. Shielded cable shall not be required.
 - d) Speaker power taps shall be at a minimum of 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker shall have a minimum UL rated sound pressure level of 86dBA at 10 feet for the Standard Output version and 84dBA at 10 feet for the High Fidelity version.
 - e) Speakers shall be available in either "Standard Output" with a minimum frequency response of 400 to 4000 Hz or in "High Fidelity Output" with a minimum frequency response of 200 to 10,000 Hz. Standard Output speakers shall use a multi-tapped speaker for audio/tone notification.
 - f) Wall mount appliances shall be available in White and Red and ceiling mount appliances shall be available in White, Red, and Black. Labeling shall be available as either "FIRE", "ALERT" or no labeling.
 - g) The speaker shall install directly to a 4" square, 2 1/8" deep electrical box. Extensions for these boxes shall not be required. Units shall be modular in design to allow for easy installation and for easy changing of device color and labeling.
14. Addressable Speaker/Visible: Combination Speaker/Visible (S/V) units combine the speaker and visible functions into a common housing. The S/V shall be listed to UL 1971 and UL 1480. Addressable functionality controls visible operation, while the speaker shall operate on a 25VRMS or 70.7VRMS NAC.
- a) Operational functions and features of Addressable Speaker above shall apply to this section. Operational functions and features of Addressable Strobe above shall apply to this section.
 - b) Wall mount appliances shall be available in White and Red and ceiling mount appliances shall be available in White, Red, and Black. Labeling shall be available as either "FIRE", "ALERT" or no labeling.
 - c) The speaker shall install directly to a 4" square, 2 1/8" deep electrical box. Extensions for these boxes shall not be required. Units shall be modular in design to allow for easy installation and for easy changing of device color and labeling

15. Isolator Module: Isolator module provides short circuit isolation for addressable notification appliance SLC wiring. Isolator shall be listed to UL 864. The Isolator shall mount directly to a minimum 2 1/8" deep, standard 4" square electrical box, without the use of special adapter or trim rings. Power and communications shall be supplied by the Addressable Controller channel SLC; dual port design shall accept communications and power from either port and shall automatically isolate one port from the other when a short circuit occurs. The following functionality shall be included in the Isolator module:
 - a) Report faults to the host FACU.
 - b) On-board Yellow LED provides module status.
 - c) After the wiring fault is repaired, the Isolator modules shall test the lines and automatically restore the connection.
16. Addressable Textual Notification Appliance: Textual Notification Appliance is to operate on a compatible Signaling Line Circuit (SLC) and is to provide a high visibility, multi-color LED text message display.
 - a) Textual Notification Appliance shall be Listed to UL 1638 Visual Signaling Appliances.
 - b) Appliance shall be capable of up to thirty two (32) pre-programmed message selections that can be activated in response to pre-defined emergency situations or linked to specific system point status conditions. It shall be possible for new messages to be created or factory pre-programmed messages shall be modified if needed.
 - c) Textual Notification Appliance shall be capable of displaying dual or single line emergency instructions. Instructions can show as static, flashing, or scrolling with a variety of appearance/transition options. Instructions shall be capable of displaying using multi-colors to emphasize instructions content.
 - d) Textual Notification Appliance shall be capable of providing non-emergency information during non-emergency conditions. Emergency conditions will override non-emergency message/instructions and display emergency instructions.
 - e) Textual Notification Appliance shall be capable of scrolling alarm messages of at least 1024 characters in length.
 - f) Textual Notification Appliance shall be viewable from a distance of 100 feet.
 - g) Textual Notification Appliance shall be powered by a listed fire alarm power supply providing 24VDC with battery back-up.
 - h) Textual Notification Appliance shall be capable of wall or ceiling mounting options.
17. Accessories: The contractor shall furnish the necessary accessories.

B. ADDRESSABLE APPLIANCE SLC REPEATER

1. Addressable Repeater shall supervise channel (SLC) wiring and communicate with and control addressable notification appliances. The Repeater shall be a stand-alone panel capable of powering one (1) NAC SLC. The channel (SLC) shall be rated for 3 amps and support up to 127 addresses. Power and communication for the notification appliances shall be provided on the same pair of wires. It shall be possible to program the High/Low setting of the audible (horn) appliances by channel from the addressable controller.

- a) The Repeater shall provide a constant voltage output to ensure NAC current and voltage do not vary whether the panel is operating on AC or battery. The output voltage during alarm conditions shall be 29 VRMS.
- b) Addressable SLC notification appliance circuits shall be Class B, Style 4.
- c) For Class B circuits, the Repeater shall support up to 4 Class B branches directly at its output terminals for one SLC.
- d) The internal power supply and battery charger shall be capable of charging up two 12.7 Ah batteries internally mounted or 25Ah batteries mounted in an external cabinet.
- e) The Repeater panel can be mounted close to the host fire alarm control unit or remotely.
- f) The Repeater status shall be communicated to the host fire alarm control unit and locally indicated.
- g) A 200mA auxiliary output shall be available
- h) The Repeater shall be listed to UL 864

2.6 MAGNETIC DOOR HOLDERS

- A. Description: Units shall be listed to UL 228. Units are equipped for wall or floor mounting as indicated and are complete with matching door plate. Unit shall operate from a 120VAC, a 24VAC or a 24VDC source, and develop a minimum of 25 lbs. holding force.
- B. Material and Finish: Match door hardware.

2.7 REMOTE LCD ANNUNCIATOR

- A. Provide a remote LCD Annunciator, where required/shown, with the same "look and feel" as the FACU operator interface. The Remote LCD Annunciator shall use the same Primary Acknowledge, Silence, and Reset Keys; Status LEDs and LCD Display as the FACU.
- B. Annunciator shall have super-twist LCD display with two lines of 40 characters each. Annunciator shall be provided with four (4) programmable control switches and associated LEDs.
- C. Under normal conditions the LCD shall display a "SYSTEM IS NORMAL" message and the current time and date.
- D. Should an abnormal condition be detected the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The unit audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.
- E. The LCD shall display the following information relative to the abnormal condition of a point in the system:
 - 1. 40 character custom location label.
 - 2. Type of device (e.g., smoke, pull station, waterflow).
 - 3. Point status (e.g., alarm, trouble).
- F. Operator keys shall be key switch enabled to prevent unauthorized use. The key shall only be removable in the disabled position. Acknowledge, Silence and Reset operation shall be the same as the FACU.

2.8 NETWORK ANNUNCIATORS

A. Network Display Unit (NDU) shall contain the following features:

1. 854 character, expanded content multi-line QVGA LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.
2. Capacity to annunciate 12,000 network points and/or point lists.
3. Historical event logs shall maintain separate 1,250 Alarm and 1,250 Trouble events.
4. The network shall provide a means to log into any node on the system via a laptop computer and have complete network access (Set Host) for diagnostics, maintenance reporting, and information gathering of all nodes in the system. Systems not meeting this requirement must provide all diagnostic tools required to support this function from selected points on the network.
5. A DACT with partitioning capability shall be provided that shall receive an alarm, supervisory, or trouble signal from any network connected fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station.
 - a) When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, DACT shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line.
 - b) DACT shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
 - c) Digital data transmission shall include the following:
 - (a) Address and node information of the alarm-initiating device.
 - (b) Address and node information of the supervisory signal.
 - (c) Address and node information for trouble condition.
 - (d) Abnormal test signal.
 - (e) Communication failure.
 - d) Self-Test: Conducted automatically every 24 hours with report transmitted to central station.
6. The Network Display Unit shall support up to (5) RS-232-C ports and one service port. All (5) RS-232 Ports shall be capable of two-way communications. RS-232-C printer ports shall provide activity log and on demand report print-outs for all network activity.
7. A Remote Unit Interface shall be available to provide supervised serial communication channel for control and monitoring of remotely located annunciators and I/O panels.
8. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control unit, provide exactly matching modular unit enclosures.

9. Supplemental Notification and Remote User Access (Fire Panel Internet Interface).

- a) The Network Display Unit shall provide the necessary hardware to provide supplemental notification and remote user access to the FACU using Ethernet and TCP/IP communications protocol compatible with IEEE Standard 802.3.
- b) A standard RJ-45 Ethernet connection shall connect to the owner's Ethernet network. Provisions for that connection must be provided at each fire alarm control unit as part of the contract.
- c) Operation shall be as described under Section 1.5 SYSTEM OPERATION; Supplemental Notification and Remote User Access (Fire Panel Internet Interface).

B. Network Voice Command Center

- 1. A Network Voice Command Center shall be provided as part of the Network Display Unit and shall be a network level annunciator and manual system/point controller with network voice control equipment. Unit shall include all necessary voice alarm system components required to integrate fully with the individual network node voice alarm panels.
- 2. All network Emergency Voice/Alarm Communications functions shall operate in association with other voice system nodes to allow network wide operation of live emergency voice communications or pre-recorded messages.
- 3. A single alarm channel for manual live microphone announcements. All multi-channel pre-recorded messages and tone signals shall be generated at each individual voice system node panel.
- 4. Dual alarm channels permit simultaneous transmission of different announcements to different buildings automatically or by use of the central control microphone..
- 5. Eight channel digitally multiplexed audio for systems that require more than two channels of simultaneous audio. Up to 8 channels of audio shall be multiplexed on either a style 4 or style 7 twisted pair.
- 6. All announcements shall be made over dedicated, supervised communication lines. All risers shall support Class A wiring for each audio channel. Communication over fiber-optic cable shall be provided for the one-way voice communication system.
- 7. Emergency voice communication audio controller module shall provide up to 32 minutes of message memory for digitally stored messages. Provide supervised connections for master microphone and up to 5 remote microphones. Up to 40 remote microphones shall be capable of being directly connected to the audio controller.
- 8. LED and switch modules shall be provided as part of the Network Voice Command Center to provide individual manual control of each local or remote speaker circuit. LED's shall show which circuits are presently active and the switches shall provide a circuit on/off activation. A network master microphone shall be provided as part of the Network Voice Command Center.

9. Evacuation System - Non-Alarm Audio

- a) The Network Voice Command Center shall provide non-alarm audio from an owner supplied paging and/or music source over the fire alarm evacuation speakers. This feature shall be an integral part of the Network Voice Command Center, and shall use some or all of the audio components from the fire alarm evacuation system.
- b) The Network Voice Command Center and the non-alarm audio operation shall comply with NFPA 72 requirements for non-emergency purposes at a fire command center that is not constantly attended by a trained operator.
- c) The Network Voice Command Center unit shall accept industry standard "line level audio input" from the owner's non-alarm audio source. Terminal strip connections and an industry standard RCA receptacle shall be provided at the Network Voice Command Center for terminating the owner's audio source.
- d) Operation shall be as described under Section 2.3 SYSTEM OPERATION; Evacuation System - Non-Alarm Audio, but on a network basis.

2.9 DACT/IP/CELLULAR COMMUNICATOR TRANSMITTER

- A. DACT/IP/Cellular communicator transmitter shall be listed to UL 864 for Central Station Service and be acceptable for use by the remote or central station.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for, or connected via TCP/IP or Cellular to a remote or central station. When contact is made with the remote or central station, signals shall be transmitted. If connecting by POTS and service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the remote or central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal. If service is by TCP/IP or Cellular and connection is lost, transmitter shall initiate the local trouble signal and a loss of connection shall be indicated at the central station.
- C. Local functions of the DACT/IP/Cellular communicator transmitter shall include the following:
 1. Configurable with a primary and secondary path.
 2. Paths can use any of the external connections, telephone line, cellular, or LAN Ethernet connections.
 3. 3G with 2G fall back cellular connection through the cellular module. Antenna extension kits for areas of poor connectivity.
 4. Communications failure with the remote or central station or fire-alarm control unit.
- D. Digital data transmission shall include the following:
 1. Address of the alarm-initiating device.
 2. Address of the supervisory signal.
 3. Address or loss of power.
 4. Low battery.
 5. Abnormal test signal.

- 6. Communication bus failure.
- E. Secondary Power: Integral rechargeable battery and automatic charger.
- F. Constant connection supervision and detects failures within 90 seconds for IP/Cellular connection.

2.10 RADIO ALARM TRANSMITTER

- A. Transmitter shall comply with NFPA 1221 and shall be listed and labeled by an NRTL.
- B. Comply with 47 CFR 90.
- C. Description: Manufacturer's standard commercial product; factory assembled, wired, tested, and ready for installation and operation.
 - 1. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
 - 2. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
 - 3. Normal Power Input: 120-V ac.
 - 4. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.
 - 5. Antenna: Omnidirectional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of antenna and mounting hardware and supports shall withstand 100 mph (160 km/h) with a gust factor of 1.3 without failure.
 - 6. Antenna Cable: Coaxial cable with impedance matched to the transmitter output impedance.
 - 7. Antenna-Cable Connectors: Weatherproof.
 - 8. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire-alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.
- D. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions:
 - 1. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
 - 2. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.

3. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
4. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
5. Local Fire-Alarm-System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.
6. Local Fire-Alarm-System Supervisory-Alarm Message: Actuated when the building alarm system indicates a supervisory alarm.

2.11 NETWORK SYSTEM INTEGRATOR

- A. The Network System Integrator shall provide Agency Listed integration capable of communicating the status information from multiple brands and/or vintages of control units onto the fire alarm network for reporting at a central command center location and at other network nodes (panels).
 1. Protocol communication interfaces for systems integration that require ongoing protocol development necessary to maintain compatibility and agency listings with new versions of software releases shall not be substituted.
- B. The Network System Integrator shall receive primary and secondary power from a 120VAC/240VAC source and cabinet contained standby batteries.
- C. The Network System Integrator shall provide 8 I/O points expandable to 32, each programmable as a monitor input or relay output for status communication onto the network
 1. Inputs shall be rated to monitor dry contacts on the host control panel
 2. Dry contact relay outputs from the Network System Integrator shall be available to provide status conditions from this unit or other network nodes to the local building control panel
- D. The Network System Integrator shall provide the following additional features:
 1. 6 Amp power supply for auxiliary power with integral battery charger for secondary power requirements
 2. Intuitive user interface behind locked solid door to provide for unit status reporting, testing, diagnostics, and historical log access
 3. Dual language selection, including unicode character languages
 4. User interface is to be a 4.3" or greater diagonal color touchscreen LCD with separate status LED's
- E. The Network System Integrator shall be capable of maintaining Fire Alarm Network communications with other network nodes (panels) when the monitored interface panel is powered down for service

2.12 EMERGENCY POWER SUPPLY

- A. General: Components include battery, charger, and an automatic transfer switch.
- B. Battery: Sealed lead-acid or nickel cadmium type. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all alarm notification devices in alarm mode for a period of 15 minutes.

2.13 DEVICE GUARDS

- A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
 - 1. Factory fabricated and furnished by manufacturer of device.
 - 2. Finish: Paint of color to match the protected device.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install system components and all associated devices in accordance with applicable NFPA Standards and manufacturer's recommendations.
- B. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:
 - 1. Factory trained and certified personnel.
 - 2. National Institute of Certification in Engineering Technologies (NICET) fire alarm level II certified personnel.
 - 3. Personnel licensed or certified by state or local authority.

3.2 EQUIPMENT INSTALLATION

- A. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, Ethernet drops, and all other necessary material for a complete operating system.
- B. Existing Fire Alarm Equipment shall be maintained fully operational until the new equipment has been tested and accepted.
- C. Equipment Removal: After acceptance of the new fire alarm system, disconnect and remove the existing fire alarm equipment and restore damaged surfaces. Package operational fire alarm and detection equipment that has been removed and deliver to the Owner. Remove from the site and legally dispose of the remainder of the existing material.
- D. Water-Flow and Valve Supervisory Switches: Connect for each sprinkler valve required to be supervised.
- E. Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.

- F. Install manual station with operating handle 48 inches (1.22 m) above floor. Install wall mounted audible and visual notification appliances not less than 80 inches (2.03 m) above floor to bottom of lens and not greater than 96 inches (2.44 m) above floor to bottom of lens.
- G. Mount outlet box for electric door holder to withstand 80 pounds pulling force.
- H. Make conduit and wiring connections to all door release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control units, duct smoke detectors .
- I. Automatic Detector Installation: Conform to NFPA 72.
- J. Ethernet Drop: A standard RJ-45 Ethernet connection to the owner's Ethernet network shall be provided at each fire alarm control unit as part of the contract.

3.3 PREPARATION

- A. Coordinate work of this Section with other affected work and construction schedule.

3.4 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire-alarm system.
 - 1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - 1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
 - 2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
 - 3. Smoke dampers in air ducts of designated air-conditioning duct systems.
 - 4. Alarm-initiating connection to elevator recall system and components.
 - 5. Alarm-initiating connection to activate emergency lighting control.
 - 6. Supervisory connections at valve supervisory switches.

3.5 WIRING INSTALLATION

- A. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electric Code (NEC).
- B. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.

- C. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.
- D. Terminate circuit in control unit for Class "A" supervision. Mount end-of-line device in box with last device or separate box adjacent to last device for Class "B" supervision.
- E. Ethernet Circuits:
 - 1. Ethernet circuits shall be provided to the Fire Alarm Control Unit as shown on the plans.
 - 2. Where a dedicated Fire Alarm Ethernet LAN is specified only Agency Listed Fire Alarm Ethernet hardware shall be installed.
 - 3. The electrical contractor shall coordinate and ensure proper Ethernet connections occur at the fire alarm control unit and other designated equipment locations prior to system turnover.

3.6 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.7 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.8 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.
- B. Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:
 - 1. Factory trained and certified.
 - 2. National Institute for Certification in Engineering Technologies (NICET) fire alarm certified.
 - 3. International Municipal Signal Association (IMSA) fire alarm certified.
 - 4. Certified by a state or local authority.
 - 5. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.
- C. Pretesting: Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.

D. Inspection:

1. Inspect equipment installation, interconnection with system devices, mounting locations, and mounting methods.
2. Verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.

E. Acceptance Operational Tests:

1. Perform operational system tests to verify conformance with specifications:
 - a) Each alarm initiating device installed shall be operationally tested. Each device shall be tested for alarm and trouble conditions. Contractor shall submit a written certification that the Fire Alarm System installation is complete including all punch-list items. Test battery operated emergency power supply. Test emergency power supply to minimum durations specified. Test Supervising Station Signal Transmitter. Coordinate testing with Supervising Station monitoring firm/entity.
 - b) Test each Notification Appliance installed for proper operation. Submit written report indicating sound pressure levels at specified distances.
 - c) Test Fire Alarm Control Unit and Remote Annunciator.
2. Provide minimum 10 days notice of acceptance test performance schedule to Owner, and local Authority Having Jurisdiction.

F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Use NFPA 72 Forms for documentation.

H. Final Test, Record of Completion, and Certificate of Occupancy:

1. Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy. Provide completed NFPA 72 Record of Completion form to Owner and AHJ.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

3.10 CLEANING AND ADJUSTING

A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Clean unit internally using methods and materials recommended by manufacturer.

B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound pressure levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.11 TRAINING

- A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.
 - 1. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 8 hours' training.
 - 2. Schedule training with the Owner at least seven days in advance.

END OF SECTION

CLEARING AND GRUBBING

PART ONE - GENERAL

1.1 WORK INCLUDED

1. Removing and disposing of existing trees, vegetation, fencing, asphalt, concrete, 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.

- 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

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).

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.

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 outpart 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 subgrade 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.

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

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.

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.

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.

- 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

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.

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 out 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

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.

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

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.

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. Recompect 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.

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

SYNTHETIC GRASS SURFACING

PART ONE – GENERAL

1.1 SUMMARY

- A. This Section Includes all labor, materials and services required to the Artificial Turf Contractor (ATC) to install the proposed artificial turf surfacing system with resilient infill, including game lines and event markings, as per the drawings and specifications herein and as per the recommendations for installation of the proposed artificial turf product issued by the Artificial Turf Manufacturer (ATM).

1.2 REFERENCE STANDARDS

- A. ASTM – American Society for Testing and Materials.
 - D1577 - Standard Test Method for Linear Density of Textile Fiber
 - D5848 - Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Covering
 - D1338 - Standard Test Method for Tuft Bind of Pile Yarn Floor Covering
 - D1682 - Standard Method of Test for Breaking Load and Elongation of Textile Fabrics
 - D5034 - Standard Test Method of Breaking Strength and Elongation of Textile Fabrics (Grab Test)
 - F1015 - Standard Test Method for Relative Abrasiveness of Synthetic Turf Playing Surfaces
 - D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity
 - D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials
 - F355 - Standard Test Method for Shock-Absorbing Properties of Playing Surfaces.
 - F1936 - Standard Test Method for Shock-Absorbing Properties of North American Football Field Playing Systems as Measured in the Field
 - D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
 - ASTM F355-10, Procedure A: Testing Services Inc test number TSI 1202

1.3 SUBMITTALS

- A. Comply with Section 01 33 23, Shop Drawings, Product Data and Submittals. Submit for approval prior to fabrication.
- B. Shop Drawings:
 - 1. Indicate field layout; field marking plan and details for the specified sports; i.e., High School Football; roll/seaming layout; methods of attachment, field openings and perimeter conditions.
 - 2. Show installation methods and construction indicating field verified conditions, clearances, measurements, terminations, drainage.
 - 3. Provide joint submission with related trades when requested by Architect.

C. Product Data:

1. Submit manufacturer's catalog cuts, brochures, specifications; preparation and installation instructions and recommendations; storage, handling requirements and recommendations.
2. Submit fiber manufacturer's name, type of fiber and composition of fiber.
3. Submit data in sufficient detail to indicate compliance with the contract documents.
4. Submit manufacturer's instructions for installation.
5. Submit manufacturer's instructions for maintenance for the proper care and preventative maintenance of the synthetic turf system, including painting and markings.

D. Samples: Submit samples, 6 x 6 inches, illustrating details of finished product in amounts as required by General Requirements, or as requested by Architect.

E. Product Certification:

1. Submit manufacturer's certification that products and materials comply with requirements of the specifications.
2. Submit test results indicating compliance with Reference Standards.

F. List of existing installations: Submit list including respective Owner's representative and telephone number.

G. Warranties: Submit warranty and ensure that forms have been completed in Owner's name and registered with approved manufacturer.

H. Testing data to the Owner to substantiate that the finished field meets the required shock attenuation, as per ASTM F1936.

I. Testing Certification: Submit certified copies of independent (third-party) laboratory reports on ASTM testing:

1. Pile Height, Face Weight & Total Fabric Weight, ASTM D5848.
2. Primary & Secondary Backing Weights, ASTM D5848.
3. Tuft Bind, ASTM D1335.
4. Grab Tear Strength, ASTM D1682 or D5034.
5. Shock Attenuation, ASTM F1936.
6. Water Permeability, ASTM D4491

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section. The turf contractor and/or the turf manufacturer:

1. Turf Contractor must manufacture its own fiber and synthetic turf, two-step distribution is not acceptable. Turf Contractors who do not manufacture their own fiber and synthetic turf shall be disqualified.

2. Shall be experienced in the manufacture and installation of infilled synthetic grass system for a minimum of five (5) years. This includes a fiber, backing, the backing coating, and the installation method.
 3. Shall have 20 fields in play for at least two years. Fields shall be 65,000 ft² or more
 4. Shall have a minimum of 50 fields that are at least 8 years old, which is equal to the respective warranty period, with the same infill system.
- B. Installer: Company shall specialize in performing the work of this section. The Contractor shall provide competent workmen skilled in this specific type of synthetic grass installation.
1. The designated Supervisory Personnel on the project shall be certified, in writing by the turf manufacturer, as competent in the installation of material, including sewing seams and proper installation of the infill mixture.
 2. Installer shall be certified by the manufacturer and licensed.
 3. The installer supervisor shall have a minimum of 5 years experience as either a construction manager or a supervisor of synthetic turf installations, and at least ten (10) acceptable installations of infilled synthetic turfs over the past three (3) years.
- C. Pre-Installation Conference: Conduct conference at project site at time to be determined by Architect. Review methods and procedures related to installation including, but not limited to, the following:
1. Inspect and discuss existing conditions and preparatory work performed under other contracts.
 2. In addition to the Contractor and the installer, arrange for the attendance of installers affected by the Work, The Owner's representative, and the Architect.
- D. The Contractor shall verify special conditions required for the installation of the system.
- E. The Contractor shall notify the Architect of any discrepancies.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in the original, manufacturer's packaging with the labels intact.
- B. Store products in a location and position that protects them from damage from any cause. The environmental condition in the storage area must be such that no physical changes occur in the products.
- C. Handle products in a manner that protects them from damage from any cause.

1.7 WARRANTY

- A. The ATM shall provide a company warranty covering products and installation that shall endure for eight (8) years from the date of substantial completion of the installation of the artificial turf system or from the date of Owner's occupancy.
 1. The warranty submitted must have the following characteristics:
 - a. Must provide coverage for eight (8) years from the date of Substantial Completion.
 - b. Must warrant materials and workmanship.

- c. Must verify through a third party that the materials installed meet or exceed the product specifications.
 - d. Must have a provision to either make a cash refund or repair or replace such portions of the installed materials that are no longer serviceable to maintain a serviceable and playable surface.
 - e. Must be a manufacturer's warranty from a single source covering workmanship and all self-manufactured or procured materials.
 - f. Turf Contractor must provide a full eight year third party insured warranty on the synthetic turf with an aggregate coverage of \$10,000,000.
 - B. The warranty shall state coverage of: workmanship, defects in material, excessive color change, non-uniform color change, excessive loss of porosity, excessive wear , ability to meet the ASTM F355 procedure A requirements over the warranty period, and any other feature that is deemed to not be ordinary wear and tear on artificial turf playing field surfaces as specified in these specifications and in the ATM's current standard product information literature and specifications.
- 1.8 MAINTENANCE PROGRAM (Refer to Section 01 23 00 – Alternates)
- A. Term of Duration:
 - 1. One (1) annual visit starting in year two (2) for the duration of the warranty period – total of seven (7) visits.
 - B. Scope of Services Per Visit:
 - 1. De-compact fill.
 - 2. Remove debris from playing surface.
 - 3. Level and smooth out infill.
 - 4. Rejuvenate fibers.
 - 5. GMAX testing with annual visit.
 - 5. Capture dust with integrated vacuum system.
 - 6. Treat playing surface with antimicrobial treatment.
 - 7. Repair of any line markings and small seam issues found.

1.9 EXISTING CONDITIONS

- A. The Turf Contractor shall be responsible for any damage to the existing base and/or concrete curb during removal/installation of the synthetic turf system.

PART TWO – PRODUCTS

2.1 ACCEPTABLE TURF MANUFACTURERS

- A. AstroTurf Corporation - AstroTurf® Rootzone 3D3 Blend 60, Dalton, Georgia, (517)902-4453
- B. Alternate provider is acceptable and must meet and/or be equivalent to all listed requirements, qualifications and specifications prior to bid and with written approval given by the Architect.

2.2 MATERIALS AND PRODUCTS

A. Artificial surfacing system materials shall consist of the following:

1. A complete synthetic turf system consisting of a combination of high micron thickness monofilament polyethylene fibers and 10,000 denier parallel slit film fibers along with an in-house factory extruded monofilament nylon thatch. Pile height shall be nominal 2.0". Fibers shall be tufted to a primary backing and a mechanically applied adhesive secondary backing.
2. Infill: Controlled mixture of graded sand and rubber crumb that partially covers the carpet.
3. Glue, thread, paint, seaming fabric and other materials used to install and mark the artificial grass surface.

B. The installed artificial grass surface shall have the following properties:

Standard	Property	Specification
ASTM D1577	Fiber Denier	10,800
ASTM D5823	Pile Height	2.00"
ASTM D5793	Stitch Gauge	3/8" to 1/2"
ASTM D5848	Pile Weight	60 oz/square yard
ASTM D5848	Primary Backing	8 oz/square yard
ASTM D5848	Secondary Backing	20 oz/square yard
ASTM D5848	Total Weight	88 oz/square yard
ASTM D1335	Tuft Bind (Without Infill)	>8+ lbs
ASTM D5034	Grab Tear (Width)	200 lbs/force
ASTM D5034	Grab Tear (Length)	200 lbs/force
ASTM D4491	Carpet Permeability	>40 inches/hour
ASTM F355/F1936	Impact Attenuation (Gmax)	<125 at install <165 over life of warranty
	Infill Material Depth	1.5 inches
	Sand Infill Component	2.5lbs/square foot
	SBR Rubber Infill Component	3lbs/square foot
	Perforation	3/16" holes 4"x4"

C. Carpet shall consist of fibers tufted into a primary backing with a secondary backing.

D. Carpet Rolls shall be 15' wide rolls.

1. Rolls shall be long enough to go from field sideline to sideline.
2. Where the playing field is for football, the perimeter white line shall be tufted into the individual sideline rolls.

E. Backing:

1. Primary backing shall be a double-layered polypropylene fabric treated with UV inhibitors.
2. Secondary backing shall consist of an application of non-porous, heat-activated urethane to permanently lock the fiber tufts in place.

- F. Fiber shall be 10,000 denier, low friction, and UV-resistant fiber measuring not less than 2 or more than 2.25" inches high.
 - 1. Systems with less than a 2 inch fiber are unacceptable.
- G. Infill materials shall be approved by the manufacturer.
 - 1. Infill shall consist of a resilient layered granular system, comprising selected and graded dust-free silica sand and 100% ground SBR rubber crumb.
 - 2. Artificial Grass products without 100% ground SBR ambient process rubber will not be acceptable.
- H. Poly-Green Foam GreenFoam playground pad as manufactured by Poly-Green Foam, LLC, Lamar, Missouri. Pad shall be placed beneath turf for shock absorption and drainage.
- I. Thread for sewing seams of turf shall be as recommended by the synthetic turf manufacturer.
- J. Glue and seaming fabric for inlaying lines and markings shall be as recommended by the synthetic turf manufacturer.

2.3 SHOCK ASSORBANCY

- A. The maximum G-Max at time of installation shall be 125. Contractor shall provide testing.
- B. G-Max shall not exceed 165 through the life of the warranty.

PART THREE – EXECUTION

3.1 EXAMINATION

- A. Verify that all sub-base leveling is complete prior to installation. Turf Contractor/manufacturer shall inspect the subbase and supply a Certificate of Subbase Acceptance for the purpose of obtaining manufacturer's warranty for the finished synthetic turf playing surface.
- B. Installer shall examine the surface to receive the synthetic turf and accept the sub-base planarity in writing prior to the beginning of installation.
 - 1. Acceptance is dependent upon the Owner's test results indicating compaction and planarity are in compliance with manufacturer's specifications.
 - 2. The surface shall be accepted by Installer as "clean" as installation commences and shall be maintained in that condition throughout the process.
- C. Compaction of the aggregate base shall be 95%, in accordance with ASTM D1557 (Modified Proctor procedure); and the surface tolerance shall not exceed 0-1/4 inch over 10 feet and 0-1/2" from design grade.
- D. Correct conditions detrimental to timely and proper completion of Work.
- E. Do not proceed until unsatisfactory conditions are corrected.

- F. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Prior to the beginning of installation, inspect the sub-base for tolerance to grade.
- B. Sub-base acceptance shall be subject to receipt of test results (by others) for compaction and planarity that sub-base is in compliance with manufacturer's specifications and recommendations.
- C. Dimensions of the field and locations for markings shall be measured to verify conformity to the specifications and applicable standards. A record of the finished field as-built measurements shall be made.
- D. When requested by Architect, installed sub-base shall be tested for porosity prior to the installation of the turf. A sub base that drains poorly is an unacceptable substrate

3.3 INSTALLATION - GENERAL

- A. The installation shall be performed in full compliance with approved Shop Drawings.
- B. Only trained technicians, skilled in the installation of athletic caliber synthetic turf systems working under the direct supervision of the approved installer supervisors, shall undertake any cutting, sewing, gluing, shearing, topdressing or brushing operations.
- C. Designs, markings, layouts, and materials shall conform to all currently applicable National Collegiate Athletic Association rules, NFHS rules, and/or other rules or standards that may apply to this type of synthetic grass installation. Designs, markings and layouts shall first be approved by the Architect or Owner in the form of final shop drawings. All markings will be in full compliance with final shop drawings.

3.4 INSTALLATION

- A. Install at location(s) indicated, to comply with final shop drawings, manufacturers'/installer's instructions.
- B. The Contractor shall strictly adhere to specified procedures. Any variance from these requirements shall be provided in writing, by the manufacturer's on-site representative, and submitted to the Architect and/or Owner, verifying that the changes do not in any way affect the Warranty. Infill materials shall be approved by the manufacturer and installed in accordance with the manufacturer's standard procedures.
- C. Carpet rolls shall be installed directly over the properly prepared aggregate base. Extreme care shall be taken to avoid disturbing the aggregate base, both in regard to compaction and planarity.
 - 1. Repair and properly compact any disturbed areas of the aggregate base as recommended by manufacturer.

- D. Full width rolls shall be laid out across the field.
 - 1. Turf shall be of sufficient length to permit full cross-field installation from sideline to sideline.
 - 2. No cross seams will be allowed in the main playing area between the sidelines.
 - 3. Each roll shall be attached to the next roll utilizing standard state-of-the-art sewing procedures.
 - 4. When all of the rolls of the playing surface have been installed, the sideline areas shall be installed at right angles to the playing surface.
- E. Artificial turf panel seams shall be sewn or glued along the selvedge edging flap of the turf roll.
 - 1. Seaming tape and adhesive must be approved by the manufacturer.
- F. Infill Materials:
 - 1. Infill materials shall be applied in numerous thin lifts. The turf shall be brushed as the mixture is applied. The infill material shall be installed to a depth determined by the manufacturer.
- G. Synthetic turf shall be attached to the perimeter edge detail in accordance with the manufacturer's standard procedures.
- H. Upon completion of installation, the finished field shall be inspected by the installation crew and an installation supervisor.

3.5 FIELD MARKINGS

- A. Field markings shall be installed in accordance with approved shop drawings. Perimeter lines and 5 yard lines shall be tufted in.
- B. Balance of sports markings will be inlaid or painted in accordance with the Drawings.
- C. Center field logo shall be inlaid according to artwork indicated on Drawings and in accordance with manufacturer's standard palette of turf colors.
- D. End-zone letters and logos shall be inlaid according to artwork and fonts indicated on the Drawings, and in accordance with manufacturer's standard palette of turf colors.

3.6 FIELD MAINTENANCE

- A. Installer shall provide and review manufacturers maintenance recommendations with Owner at completion of construction.

3.7 ADJUSTMENT AND CLEANING

- A. Do not permit traffic over unprotected surface.
- B. Contractor shall provide the labor, supplies, and equipment as necessary for final cleaning of surfaces and installed items.

- C. All usable remnants of new material shall become the property of the Owner.
- D. The Contractor shall keep the area clean throughout the project and clear of debris.
- E. Surfaces, recesses, enclosures, and related spaces shall be cleaned as necessary to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the Owner.

3.8 PROTECTION

- A. Protect installation throughout construction process until date of final completion.

END OF SECTION

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, 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.

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-eighths 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-eighths 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.

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, 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

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.

- 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.

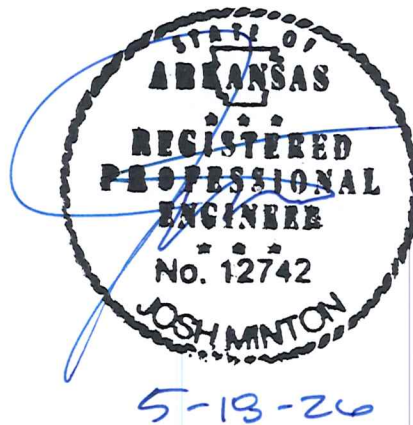
3.4 SEEDING

- 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

The Engineer of Record for New Elementary, Sheridan School District, Arkansas Division 33, Sections 330000 specifications.

May 18, 2026



UTILITIES

PART ONE - GENERAL

1.1 DESCRIPTION

- A. 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.
- B. The scope of work shall include the general listings as shown below. This contractor shall furnish and install all required pipe, fittings, valves, supports, blocking, and other such equipment, items, and appurtenances as may be required for complete and operative systems, including all parts auxiliary to the systems.

1.2 APPLICABLE GENERAL SPECIFICATIONS AND REGULATION

- A. 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.
- B. All utility 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.
 - 1. Arkansas Department of Health
 - 2. National Fire Protection Association Recommended Practice
 - 3. Local, City and State Codes and Ordinances.
 - 4. East End Water Department
- 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. The contractor shall not begin any building construction until possessing a copy of official acceptance of the Arkansas State Department of Health Department of Engineering which shall be provided by the Architect.
- E. Prior to final acceptance of the project, the contractor shall provide the Architect copies of the Health Department sample test report, pressure test report, and system approval letter issued by the city.

1.3 SUBMITTALS

- A. In accordance with Division One of the General Conditions, the Plumbing Contractor shall furnish the Architect five (5) complete sets of certified shop drawings. Submittal must be complete and in one installment in five bound manuals with title sheet and numbered index at the beginning of each. Piecemeal and unbound submittals will be returned without consideration.
- B. 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.
- C. All performance, data, details, dimensions, special features and accessories must be clearly marked.
- D. All differences between equipment specified and that submitted must be clearly indicated.
- E. Substitutions will not be considered without prior approval from the engineer.
- F. Shop Drawings are required even though the equipment is as specified.
- G. Provide Shop Drawings on the following Items:
 - a. Piping and fittings.
 - b. Valves.
 - c. Fire Hydrants.
 - d. Sterilization procedure.
 - e. Manholes.
 - f. Pressure testing procedure.
- H. 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.
- I. 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.
- J. 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.

- K. 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

- A. 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

- A. Contractor shall pay for all fees, permits and charges for utility connections. 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

- A. 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.
- B. 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

- A. The contractor shall provide two (2) sets in hardback three-ring binders of a compilation of catalog data of each manufactured item of equipment used in the mechanical work and shall present this compilation to the Architect for transmittal to the Owner before final payment is made. In each maintenance catalog shall be provided a complete set of approved submittals on all mechanical equipment, descriptive data, installation data, operating instructions, parts lists and maintenance instructions.

- B. A complete double index shall be provided: (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

- 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 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

- A. 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

- A. 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

- A. 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.

1.12 STANDARD PRODUCTS

- A. 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

- A. 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.
- B. 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

- A. This Contractor shall provide all necessary material and labor for the connection to the building plumbing and fire service systems. Coordinate with the appropriate trades for connection requirements and scope of work.

PART TWO - PRODUCTS

2.1 PIPE

- A. Exterior sewer service piping:
 - 1. Gravity sanitary sewer lines beyond 5'0" from building line shall be SDR-26 heavy wall PVC gasketed sewer pipe.
 - 2. PVC pipe for gravity sanitary sewers shall conform to the latest revision of ASTM Designation D3034 (Type PSM) and shall have a minimum Standard Dimension Ratio (SDR) of 26. The pipe shall have a minimum pipe stiffness (F/dY) of 115 psi at 5% deflection as defined in ASTM D2412.
 - 3. The pipe shall be made of a plastic having a cell classification of 12454-B as defined in ASTM D1784. All pipe and fittings shall be tested in accordance with ASTM Designations D2412, D2152, and D2444.
 - 4. All pipe sections shall be straight and true in alignment and shall be furnished in (13) feet lengths. Provision shall be made for expansion and contraction at each joint by use of a gasket type joint and integral bell.
 - 5. Users of PVC pipe are to take particular notice of the bedding and backfilling requirements for PVC gravity sewer pipe listed in paragraph 3.8.3 and the testing requirements listed in Section 3.3.
 - 6. All bends, tees, plugs, adaptors, wyes, or other fittings shall meet with the requirements of the type of pipe used and all joints shall meet with the requirements for the joints listed in Part Three. PVC sewer wyes, tee-wyes, bends or other fittings shall be one piece molded construction with elastomeric gaskets conforming to ASTM 3212 and ASTM F-477, self-cleansing sanitary flow and design meeting ASTM 3034 standards.

B. Exterior water service piping:

1. Exterior water piping shall be SDR 21 PVC with gasketed joints, 200 PSI for sizes two (2") inches and larger and type "K" hard drawn copper for 1-1/2" and smaller. Minimum depth to be 36". Any mechanical joints shall have to be coated with mastic and covered with two layers of 6 mil visqueen, secure with duct tape. Install No. 12 THHN copper tracer wire for PVC piping. Piping 2" and larger shall be gasketed-joint.
2. Unless detailed specifically on plans, all valves, controllers or meters below grade will be located in a concrete box with a cast iron cover equal to Neenah R-1912 series. PVC boxes are not acceptable.
3. Contractor shall verify water service arrangements and pay all charges required by local water utility. Meter type shall be as required by local utility and shall be sized to water service demand as indicated on plans. Contractor shall furnish a water shut off valve on both sides on the meter, unless otherwise instructed by local utility.

C. Water main piping:

1. Water main piping shall be C900 PVC and shall meet the requirements of DR14 per AWWA C150. Joints shall be bell and elastomeric ring. Fittings shall be mechanical joint ductile iron. Install No. 12 THHN copper tracer wire full length of PVC piping and terminate in accessible location.

D. Gas Piping:

1. Below grade:
 - a. All gas pipe below grade, and exterior of building, shall be approved plastic pipe unless otherwise indicated on plans or directed by local gas company. Plastic pipe shall conform to ASTM-D2513 and shall be installed per Arkansas Gas Code. An approved transition riser shall be used when connecting between plastic and steel. Provide tracer wire along entire length of all plastic below grade. Tracer wire shall not come in contact with the plastic pipeline. Tracer wire shall be 12 GAUGE, THHN copper.

2.2 PIPE UNIONS

- A. 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.
- B. 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.

- C. Each above ground portion of the gas piping system shall be bonded to a grounding electrode in accordance with National Electrical Code. Unless approved otherwise, grounding system shall consist of 10'0" electrode rod and No. 8 copper wire with grounding clamps.

2.3 VALVES

- A. Water main valve: Resilient seat, non-rising stem gate valve with O-ring stem seals, 2" square operating nut and a working pressure of 200 psi. Valves shall be manufactured by Mueller Company. See detail on drawings for valve box.

2.4 MANHOLES

- A. Poured-in-place manholes shall be constructed as detailed on the drawings.
- B. Precast reinforced concrete manholes shall be reinforced concrete manhole sections as manufactured by Peterson concrete or approved equal.
 - 1. The manhole sections shall be made from crushed granite coarse aggregates and natural silica fine sand aggregates. The concrete when tested in compression shall not be less than 4000 psi and absorption shall not exceed 9%. Minimum wall thickness of the manhole riser sections shall be 5". Cone sections will be made with a 5" minimum wall at the bottom and an 8" wall thickness at the top. All base riser sections will be made with the bottom cast monolithically. The minimum thickness of the bottom shall be 8".
 - 2. The joints between the manhole sections shall be the Forsheda 114 Pre-lubricated Seal, made of SBR rubber, and shall meet the requirements of ASTM Spec. D-443. There shall be a suitable spigot cast into the tongue of each manhole component to contain the seal. The seal shall consist of a supporting compression section and a thin sliding flap which has been pre-lubricated. When the sections are fitted together, the edge of the bell encounters the flap which then slides towards the compression section. The seal shall be installed on the manhole sections per the manufacturer's instructions.
 - 3. Two lift holes shall be cast into each cone or riser section for the purpose of handling and laying.
 - 4. Suitable openings for the inlet and outlet sewer pipe shall be placed in the base sections (riser section for drop manholes). These openings shall be true size, circular and located as required for each manhole.

5. A flexible pipe-to-manhole connector shall be used in the connection of the sewer pipe to precast manholes. The connector shall be equal to Kor-N-Seal as manufactured by NPC, Inc., Milford, New Hampshire, or equal. The connector shall be the sole element relied on to assure a flexible watertight seal of the pipe to the manhole. No adhesives or lubricants shall be employed in the installation of the connector into the manhole. The rubber for the connector shall comply with ASTM C443 and ASTM C923 and consist of EPDM and elastomers designed to be resistant to ozone, weather elements, chemicals, including acids, alkalis, animal and vegetable fats, oils and petroleum products from spills. All stainless steel elements of the connector shall be totally non-magnetic Series 304 Stainless, excluding the worm screw for tightening the steel band around the pipe which shall be Series 305 Stainless. The worm screw for tightening the steel band shall be torqued by a break-away torque wrench available from the precast manhole supplier, and set for 60-70 inch/lbs. The connector shall be installed in the manhole wall by activating the expanding mechanism in strict accordance with the recommendation of the connector manufacturer. The connector shall be of a size specifically designed for the pipe material and size being utilized on the project.
 6. Manhole steps shall be the H. Bowen Co. PS-1 reinforced plastic orange safety step.
 7. Manholes shall comply with ASTM C-478 latest revision.
- C. Drop manholes shall be constructed at all manholes where the difference in invert elevation between incoming and outgoing sewers is 2.0 feet or more. Drop manholes shall be constructed of the same material and dimensions as previously specified, the only difference being in the inlet arrangements as shown on the detail.
- D. All manholes constructed shall be watertight and show no visible evidence of infiltration or leakage. Manholes shall be tested in accordance with Part Three of this specification and any manhole that is not watertight will not be accepted by the Engineer. Manholes with visible signs of honeycombs are subject to vacuum testing to prove water tightness.

2.5 CONCRETE THRUST BLOCKS

- A. Install thrust blocks on water main or service at each change of direction and as indicated on drawings. Thrust block shall have a minimum compressive strength of 3000 psi at 28 days. Blocking shall be supported by undisturbed soil.

PART THREE - EXECUTION

3.1 PIPING INSTALLATION

- A. Gasketed Polyvinyl Chloride (PVC) 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. Public water mains to be installed in accordance w/ AWWA C605.
- B. Gas piping, general:
1. Gas regulators shall be Sensus Model 243-8 (7"-14" WC), size and capacities as required for pounds to ounce service. Model 043 may be used for low pressure/low demand appliances.

2. Provide electrodes, sleeves, vents, valves, and comply with all applicable portions of the Arkansas Fuel Gas Code, 2006 Edition. Minimum depth below grade shall be 18".
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.

3.2 CROSS CONNECTIONS

- A. 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.

3.3 TESTING

- A. 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.
- B. 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.
- C. Building Sewer: 6" or larger sewer consisting of multiple manholes shall be tested for deflection and air tested for watertightness.
 1. Deflection test (PVC piping only): After the pipe has been laid and backfilled, the Contractor shall perform a deflection test on all PVC sewer pipe. This test shall consist of pulling a mandrel through the pipe with a maximum allowable deflection of 5 percent.
 2. Leak test (low pressure air):
 - a. Plug all pipe outlets with suitable test plugs. Brace each plug securely.

- b. Pipe air supply to the pipeline to be tested in such a manner that the air supply may be shut off, pressure observed, and air pressure released from the pipe without entering the manhole.
- c. Add air slowly to portion of pipe under test until the internal pressure of the line is raised to approximately 4 psig, but less than 5 psig.
- d. Shut the air supply off and allow at least two minutes for the air pressure to stabilize.
- e. When the pressure has stabilized and is at or above the starting test pressure of 3.5 psi, start the test.
- f. Determine the time in seconds with a stopwatch for the pressure to fall 0.5 psig so that the pressure at the end of the time is at least 3.0 psig.
- g. The minimum time allowed for the pressure to fall 0.5 psig on 597 ft. of 4" pipe is 1 min.53 sec., 398 ft. of 6" pipe is 2 min.50 sec., and 298 ft. of 8" pipe is 3 min.47 sec. For minimum time required on pipe exceeding these limits, verify with the Engineer prior to testing.
- h. Use extreme caution when conducting this test. The low pressure air test may be dangerous to personnel if, through lack of understanding or carelessness, a line is over pressurized or plugs are installed improperly. It is extremely important that the various plugs be installed so as to prevent the sudden expulsion of a poorly inflated plug. As an example of the hazard, a force of 250 pounds is exerted on an 8 inch plug by an internal pressure of 5 psi. Observe the following safety precautions:
 - 1) No one shall be allowed in the manholes during the test or when a plugged pipe is under pressure.
 - 2) Gauges, air piping manifolds, and valves, shall be located at the top of the ground.
 - 3) Install and brace all plugs securely.
 - 4) Do not over pressurize the lines.

3. Manhole leak testing:

- a. Manholes shall be vacuum tested prior to backfilling.
- b. Architect shall have representative on site.
- c. All lift holes shall be plugged with an approved non-shrink grout.
- d. All pipes entering the manhole shall be plugged, taking care to securely brace the plug from being drawn into the manhole.
- e. The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturer's recommendations.
- f. A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop 9 inches. The manhole shall pass if the time is greater than 60 seconds for 48" diameter, 75 seconds for 60" diameter and 90 seconds for 72" diameter.
- g. If the manhole fails the initial test, necessary repairs shall be made with non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.

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.
5. Natural gas system:
 - a. 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.
 - b. 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.
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.
7. Water main system (fire main) - Hydrostatic and leaking testing: (In accordance w/ AWWA C605)
 - a. After the pipelines or isolated section of the pipelines have been filled with water, the pressure shall be increased to the test pressure by means of a pump.
 - b. The Contractor shall furnish a pump and appurtenances as described in Section 3.3.8.11 below and all labor for conducting all tests. In some cases the Owner will furnish the meter and pressure gauge, however, the Contractor shall be prepared to furnish these items. The meter and gauge shall be calibrated accurately. The meter shall register in gallons.
 - c. The test pressure shall be 160 psi or as specified. All pipelines and appurtenances shall be tested.
 - d. The duration of the leakage tests shall be two (2) hours or as specified by the Engineer. The source of water for the pump suction shall be a water pipeline in the Owner's distribution system. The vessel used must be approved by the Engineer.
 - e. All interior valves including valves on fire hydrant and other appurtenances shall be open during all tests.
 - f. After the specified test pressure has been applied the entire pipe line shall be checked in the presence of the Engineer, giving particular attention to the part of the pipeline and those appurtenances that are exposed.
 - g. If leaks are apparent, the Contractor shall, at his own expense, perform whatever work and/or replace whatever material that is required in order to remedy the defect and stop the leaks. All corrective work shall be approved by the Engineer.
 - h. After the Contractor has taken the necessary action to repair or replace any part of the pipeline or appurtenances where leaks were apparent or if no leaks were apparent, the pipelines shall be subjected to a leakage test at the pressure specified with a meter inserted in the test pump discharge line.

- i. The maximum leakage per hour shall be as calculated from the following formula:

$$Q = \frac{LD \sqrt{P}}{148,000}$$

Where:

Q = Quantity of make-up water in gallons per hour.

L = Length of pipe section being tested, in feet.

D = Nominal diameter of the pipe, in inches.

P = Average test pressure during the hydrostatic test in pounds per square inch (gauge).

- j. If any test of pipe laid discloses leakage greater than the allowable leakage as calculated from above formula or table, or leaks are discovered after testing, the Contractor shall, at his expense, locate the leak or leaks and perform whatever work and/or replace whatever materials that is required in order to remedy the defect and stop the leak. All corrective work must be approved by the Engineer.

- k. Test Pump:

- 1) The contractor shall provide a water pump for testing the mains hydrostatically. The pump shall have the following features:
- 2) Designed so that the required test pressure can be attained and equipped with a by-pass between the pump suction and discharge. By-pass shall be equipped with an in-line valve and a valved exhaust outlet.
- 3) The pump discharge shall be equipped with the following, in the order listed from the pump outward:
 - a) Pump by-pass outlet.
 - b) Check valve arranged so as to prevent flow back toward pump.
 - c) Adjustable pressure regulating device capable of maintaining discharge pressure at a constant level.
 - d) Valved exhaust outlet.
 - e) Section of flexible hose – length sufficient that ends of hose rest on ground.
 - f) Straight meter coupling – 1/2" M.I.P. x 3/4" F.I.P.
 - g) 5/8" meter.
 - h) Straight meter coupling – 1" M.I.P. x 3/4" F.I.P.
 - i) Outlet for pressure gauge. Outlet shall be equipped with valve and surge dampening device. Connection for gauge shall be 1/4" F.I.P.
 - j) The pump suction shall be equipped with the following from the pump outward:
 - i. Pump by-pass outlet.
 - ii. Suction pipe.
 - iii. End strainer to prohibit entry of foreign matter if pump suction is connected to a vessel instead of a water main.

- l. The Contractor shall provide all other necessary connections for connecting pump to suction source and the main to be tested.

8. Test compliance letter:

Contractor shall furnish to the Architect a letter of compliance for each test as completed and inspected by the job superintendent and city authorities.

3.4 STERILIZATION

A. Water main system: In accordance with AWWA (651).

1. Disinfecting pipe lines and appurtenances: In accordance with AWWA (651).
2. Blowoff and sample points shall be constructed by the Contractor as shown on the plans or as directed by the Engineer. Fire hydrants are not satisfactory for sample points. Openings for sample points shall be 3/4" copper riser pipe which extends well above the surface. The line shall not be considered acceptable until two (2) consecutive samples taken twenty-four (24) hours apart are negative.
3. There are two acceptable methods of disinfecting: continuous feed method using liquid chlorine or calcium hypochlorite and the slug method using liquid chlorine or calcium hypochlorite. The slug method applies to large mains and shall be used only when the Contractor has suitable equipment available and employees who are familiar with the physiological, chemical and physical properties and who are properly trained and equipped to handle any emergency that may arise. If in the opinion of the Engineer, the equipment is inadequate or the personnel are not qualified, this method shall not be used.
4. When the continuous feed or slug method is to be used, the pipelines and appurtenances shall be thoroughly flushed prior to disinfecting. The flushing plan shall be approved by the city. The city may halt or reduce flushing if the distribution system pressures are reduced by the flushing operations.
5. Chlorine is a powerful oxidant and reacts readily with foreign substances. All chlorine compounds shall be handled and stored in accordance with the manufacturers recommendations. breathing of chlorine gas can be fatal. Hypochlorite solutions should not come into contact with skin or clothing. Containers used for mixing hypochlorite solution shall be clean and dry.
6. Calcium hypochlorite shall contain 60% available chlorine by weight either in tabular or granular form.
7. When the continuous feed or slug method is used or the source of chlorine is calcium hypochlorite, a solution of hypochlorite and water shall be prepared by mixing thoroughly in a suitable container. The mix shall contain one (1) pound of calcium hypochlorite per gallon of water. A suitable pump shall be provided for pumping this solution into the pipelines to be disinfected. This pump shall be equipped with a flow measuring device.
8. When liquid chlorine is used the equipment for injection shall consist of a solution feed chlorinator in combination with a booster pump for injecting the chlorine gas water solution into the pipe line Introduction of chlorine gas directly from the supply cylinder shall not be permitted. The pump shall be equipped with a flow measuring device.
9. During the application of any chlorine solution, care shall be taken to assure that the solution does not blow back into the distribution system.

10. The procedures for disinfecting by the continuous flow method shall be as follows:
 - a. The flow through the pipeline and the solution flow shall be regulated so that the required concentration of chlorine is attained. The flow through the main shall be measured by using a pitot gauge or meter.
 - b. The introduction of the solution shall be continuous until the desired concentration is attained throughout the pipeline system. The concentration shall be checked by the Drop Dilution Method.
 - c. After the required concentration has been attained all internal valves shall be operated in order to assure that the solution comes in contact with all appurtenances.
 - d. The solution shall remain in the pipe line system for 24 hours after which the pipelines shall be thoroughly flushed. The chlorine concentration shall be checked before flushing. If the concentration is less than 25 parts per million the disinfection procedure shall be repeated if directed by the Engineer.
11. The procedure for disinfecting by the slug method shall be the same as the continuous flow method except that the flow rates shall be regulated so that the specified concentration of chlorine shall be in contact with all parts of pipe line for at least one (1) hour.
12. After final flushing, two series of samples of water shall be collected from the sample points provided by the Contractor and tested by the Owner at a certified laboratory of the Arkansas State Health Department. The Contractor shall provide any assistance required in collecting the samples.
13. If any of the samples collected are positive, the disinfecting procedures shall be repeated as directed by the Engineer until negative samples are collected. Only the continuous flow or slug method may be used.
14. The cost of water used for flushing after positive samples have been collected may be deducted from the amounts due Contractor. The amount used shall be determined by measurements of flow using a pilot gauge. Payment shall be based on the lowest prevailing water rate.

3.5 CERTIFICATE OF INSPECTION

- A. 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.

3.6 MANHOLES

- A. Precast reinforced manholes shall be installed per manufacturer's instructions.
- B. Poured-in-place:
 1. Prior to setting the forms in place, any water that may have accumulated in the excavated area shall be pumped out the concrete base thoroughly cleaned, if required, of dirt and debris. All concrete shall be poured in the dry.

2. The forms shall be removed after the initial set of the concrete so that holes may be cut in the manhole barrel for the installation of pipes which are to enter the manhole at points other than adjacent to the manhole base. After these pipes have been put in place, the barrel shall be repaired using a grout mixture.
 3. If honeycombing of the barrel is found to be present after removal of the forms, they shall be repaired as directed by the Engineer.
 4. Manholes are to be built to the established final grade unless otherwise noted on the plans or directed by the Engineer. The manhole rings and covers shall be attached preferably by being cast into the top of the manhole or by being grouted to completed manhole. If manhole rings are grouted to completed manholes, a keyway shall be formed in the top of the manhole outside of where the manhole ring will rest.
 5. Mortar for grouting manhole rings to manholes shall be mixed in the proportions by volume of one (1) part Portland Cement to two (2) parts sand. Masonry cement is prohibited for use. Tops of the manhole rings and covers shall be level except in public rights of way where the top shall be set flush with pavement, sidewalks, or other surface area.
- C. The invert of the manhole shall be hand placed and shaped from the concrete poured for the base prior to the initial set of the concrete base. The invert shall be shaped and smoothed so that the manhole will be self-cleaning and free of areas where solids may be deposited as sewage flows through the manhole and from service lines. The sidewall depth of the invert shall be approximately 1/2 the diameter of the abutting pipe and the shape shall approximate the bottom half of the pipe. The bottom flow line of the invert shall connect the flowline of all main sewer pipes entering the manhole bottom. Inverts shall be shaped, formed, and brushed smooth from the concrete poured for the base prior to the initial set of the base. Inverts shall be smooth.
- D. No pipeline will be laid entirely through the manhole barrel and broken out. In all cases, the pipe or pipes shall extend entirely through the manhole wall so that a joint occurs approximately (3) feet outside the manhole wall. The pipe may extend through the barrel into the manhole no more than 4" and the invert must be shaped throughout from all inlet pipes to the outlet pipe.
- E. Additional smoothing of manhole inverts may be necessary. Mortar for smoothing inverts shall be mixed in the proportions by volume of one (1) part cement to two (2) parts sand. If carefully done, mortar may be mixed in a mortar box. Mortar shall have a workable consistency, but shall be as dry as feasible.
- F. Backfill around manholes shall not be completed until adequate strength has been obtained to support the backfill without damage to the manhole. In no case will backfill be allowed on manholes until the concrete is at least 48 hours old. Manholes must be leak tested prior to backfilling.
- G. Connection to existing manholes shall not be made until all other manholes and sewer lines have been completed, cleaned, tested and inspected in accordance with these specifications.

- H. Where the gravity outfall lines discharge into an existing manhole, the flow of sewage must be diverted around this construction. The Contractor shall intercept the sewage flow at the existing manhole first upstream from the construction and shall provide suitable pumping equipment and rerouting conduit to pump the sewage around the involved construction. Discharge shall be into an appropriate manhole downstream from the construction.

3.7 EXCAVATING AND TRENCHING FOR PIPING

- A. Excavate to the depths indicated on the Drawings or as otherwise specified. Excavated materials not required or suitable for backfill or fill shall be removed from the site. Do such grading as is necessary to prevent surface water from flowing into trenches or other excavations. Water 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.
- B. 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.
- C. 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, shall be protected from damage during excavation and backfilling, and if damaged, shall be repaired by the Contractor, at his expense.
- D. Separation of private utilities: Water, gas and sewer piping shall be installed in separate trenches. In no case shall any utility piping be installed in same trench as electrical lines, TV cable, intercom, etc. The underground water service pipe and the building drain, or building sewer shall not be less than 10 feet apart horizontally and shall be separated by undisturbed or compact earth. When approved by Engineer the water and sewer may be installed in same trench provided the water is 18" above the sewer at all points. The combining of gas and water must be approved by the Engineer and the Local Administrative Authority.

- E. Separation of public utilities: The operating routine shall include necessary protective measures to detect and remove or destroy any contaminant of concern or regulation that might enter the distribution system. Every precaution must be taken against the possibility of sewage contamination of the water in the distribution system. Water mains and sanitary sewers shall be constructed as far apart as practicable, and shall be separated by undisturbed and compacted earth. A minimum horizontal distance of ten feet should be maintained between water lines and sewer lines or other sources of contamination. Water lines and sewers shall not be laid in the same trench except on the written approval of the Arkansas Department of Health & Human Services. Water mains necessarily in close proximity to sewers must be placed so that the bottom of the water line will be at least 18 inches above the top of the sewer line at its highest point. If this distance must unavoidably be reduced, the water line or the sewer line must be encased in watertight pipe with sealed watertight ends extending at least ten feet either side of the crossing. Any joint in the encasement pipe is to be mechanically restrained. The encasement pipe may be vented to the surface if carrying water or sewer under pressure. Where a water line must unavoidably pass beneath the sewer line, at least 18 inches of separation must be maintained between the outside of the two pipes in addition to the preceding encasement requirement. Exceptions to this must be approved in writing by the Arkansas Department of Health & Human Services. A minimum horizontal distance of three feet shall be maintained between water lines and other underground utilities of a nonsanitary nature (gas, electric, etc.). Exceptions to this must be approved in writing by the Arkansas Department of Health and Human Services.

3.8 BACKFILLING OF TRENCHES

- A. 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.
- B. 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.
- C. The embedment for schedule 40 PVC sanitary sewer below slab 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 – Grading. The maximum bury of PVC pipe shall be sixteen (16) feet.
- D. The bedding requirement for water mains, and exterior fire lines and domestic water lines shall have a maximum angular particle size less than or equal to 3/4" as per AWWA C-605.
- E. 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-C605-13 Standards (3/4" maximum for angular rock and 1 1/2" maximum for rounded rock).

- F. 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.

3.9 CUTTING AND PATCHING

- A. 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.

3.10 DEFECTIVE WORK

- A. 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.

3.11 CLEANUP

- A. 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.

3.12 GUARANTEE

- A. 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.
- B. 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.

END OF SECTION

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.

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.

- 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