PROJECT MANUAL

OWNER:

TULSA
PUBLIC SCHOOLS
INDEPENDENT SCHOOL DISTRICT NO. ONE
OF TULSA COUNTY
3027 South New Haven
Tulsa, Oklahoma 74114

TULSA PUBLIC SCHOOLS
INDEPENDENT SCHOOL DISTRICT NO. ONE OF TULSA COUNTY
MacARTHUR ELEMENTARY SCHOOL
CLASSROOM ADDITION
2182 SOUTH 73RD EAST AVENUE TULSA, OK

ARCHITECT:

HELMS + ASSOCIATES
ph: 918.298.7257 wb: gshelms.com 424 e. main st. jenks, ok 74037

M.E.P. CONSULTANTS:

ALLIED ENGINEERING GROUP, LLC
MECHANICAL-ELECTRICAL-PLUMBING CONSULTANTS
1401 SOUTH DENVER STREET SUITE A
TULSA, OK 74119
(918) 384-0593 FAX (918) 384-3186
CA 3479 EXPIRES: 06.30.18

CIVIL ENGINEERING CONSULTANT:

WALLACE ENGINEERING
STRUCTURAL AND CIVIL CONSULTANTS
200 EAST BRADY
TULSA, OKLAHOMA 74103
PH 918.584.5858 FAX 918.584.8689
OKLAHOMA CERTIFICATE OF AUTHORIZATION: #1460
EXPIRATION DATE: 06.30.19

STRUCTURAL ENGINEERING CONSULTANT:

RICHARDS & ASSOCIATES, INC.
424 EAST MAIN STREET JENKS, OK
405.627.9384 FAX 918.355.9309
CA. #4458 EXP. DATE 06.30.19

CONSTRUCTION MANAGER:

TRIGON
GENERAL CONTRACTORS & CONSTRUCTION MANAGERS
11345 EAST 80TH PLACE
TULSA, OKLAHOMA 74146
PHONE: 918.252.7162 FAX: 918.250.2151

ISSUE:
CONSTRUCTION DOCUMENTS
ISSUED FOR BIDDING
PROJECT NOS.: 17-03900
SET NUMBER: 17-03900
ISSUE DATE: JUNE 21, 2018
DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

Section 000010 – Solicitation and Notice for Bids
Section 000020 – Insurance Requirements
Section 000100 – Instructions to Bidders
Section 000110 – Special Conditions of the Contract
Section 000120 – Supplemental Conditions to the Contract
Section 000125 – GeoTechnical Information
Section 000140 – Bid Bond
Section 000150 – Non Collusion Affidavit
Section 000160 – Business Relationship Affidavit
Section 000170 – Non Discrimination Affidavit
Section 000180 – Felony Free Affidavit
Section 000190 – Asbestos Compliance Form
Section 000191 – Contractors Qualification Statement
Section 000260 – No Kick-Back Statement
Section 000270 – Owner / Contractor Agreement

DIVISION 01 – GENERAL REQUIREMENTS

Section 011000 – Summary
Section 012300 – Alternates
Section 012900 – Payment Procedures
Section 013000 – Administrative Requirements
Section 014000 – Quality Requirements
Section 016000 – Product Requirements
Section 017300 – Execution Requirements
Section 017800 – Closeout Submittals
Section 018000 – Project Sign

DIVISION 02 – EXISTING CONDITIONS

Section 023610 – Termite Control
Section 024119 – Selective Demolition

DIVISION 03 – CONCRETE

Section 031119 – Insulating Concrete Forming
Section 032000 – Reinforcing Steel
Section 033000 – Cast In Place Concrete
Section 035210 – Lightweight Concrete Deck & Insulation System
Section 036600 – Non Shrink Grout
DIVISION 04 – MASONRY
Section 041000 – Mortar and Grout
Section 042200 – Concrete Unit Masonry
Section 048100 – Brick Unit Masonry

DIVISION 05 – METALS
Section 051200 – Structural Steel Framing
Section 052000 – Steel Joists
Section 053100 – Metal Roof Deck
Section 054000 – Cold-Formed Metal Framing
Section 055000 – Metal Fabrications

DIVISION 06 – WOOD, PLASTICS AND COMPOSITES
Section 061000 – Rough Carpentry
Section 061643 – Exterior Gypsum Sheathing
Section 062000 – Finish Carpentry
Section 064000 – Architectural Woodwork

DIVISION 07 – THERMAL AND MOISTURE PROTECTION
Section 072100 – Thermal Insulation
Section 074100 – Metal Panels
Section 072500 – Fluid Applied Weather Barrier
Section 072510 – Weather Barrier
Section 075110 – Multi Ply Cold Process Built-Up Roofing System
Section 076200 – Sheet Metal Flashing and Trim
Section 077200 – Rooftop Fall Protection and Accessories
Section 077233 – Roof Hatches
Section 078443 – Joint Firestopping
Section 079000 – Joint Protection

DIVISION 08 – OPENINGS
Section 081113 – Hollow Metal Doors and Frames
Section 081416 – Flush Wood Doors
Section 083100 – Floor Access Doors
Section 083350 – Tornado Resistant Coiling Door
Section 084113 – Entrances and Storefronts
Section 081613 – Flush FRP Doors
Section 087100 – Door Hardware
Section 087150 – Finish Hardware Schedule
Section 088000 – Glass & Glazing
Section 088100 – Heavy Vandal Resistant Security Screens

DIVISION 09 – FINISHES
Section 092116 – Gypsum Board Assemblies
Section 093013 – Porcelain / Ceramic / Quarry Tile
Section 095113 – Suspended Acoustical Ceilings
Section 096513 – Resilient Base and Accessories
Section 096520 – Resilient Tile Flooring (VET)
Section 096720 – Resinous Flooring
Section 096800 – Carpet
Section 097700 – Fiberglass Reinforced Panels
Section 099000 – Paints and Coatings

DIVISION 10 – SPECIALTIES

Section 101100 – Visual Display Units
Section 101700 – Toilet Partitions
Section 102600 – Wall Protection Panels
Section 102800 – Toilet Accessories
Section 104300 – Interior Signage
Section 104413 – Fire Extinguishers and Cabinets
Section 107300 – Aluminum Walkway Covers

DIVISION 11 – EQUIPMENT

Not Used

DIVISION 12 – FURNISHINGS

Section 124920 – Manual Roller Shades

DIVISION 13 – SPECIAL CONSTRUCTION

Not Used

DIVISION 14 – CONVEYING EQUIPMENT

Not Used

DIVISION 21 – FIRE SUPPRESSION

Not Used

DIVISION 22 – PLUMBING

Section 220000 – Plumbing

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING

Section 230000 – HVAC

DIVISION 25 – INTEGRATED AUTOMATION

Not Used

DIVISION 26 – ELECTRICAL

Section 260450 - Electrical Demolition
Section 260519 - Low-Voltage Electrical Power Conductors and Cables
Section 260523 - Control-Voltage Electrical Power Cables
Section 260526 - Grounding and Bonding for Electrical Systems
Section 260529 - Hangers and Supports for Electrical Systems
Section 260533 - Raceways and Boxes for Electrical Systems
Section 260543 - Underground Ducts and Raceways for Electrical Systems
Section 260544 - Sleeves and Sleeve Seals for Electrical Raceways and Cabling
Section 260553 - Identification for Electrical Systems
Section 260923 - Lighting Control Devices
Section 262413 - Switchboards
Section 262416 - Panelboards
Section 262726 - Wiring Devices
Section 262813 - Fuses
Section 262816 - Enclosed Switches and Circuit Breakers
Section 262913 - Enclosed Controllers
Section 263353 - Central Battery Inverters
Section 265119 – LED Interior Lighting

DIVISION 27 – COMMUNICATIONS

Section 270526 - Grounding and Bonding for Communications Systems
Section 270528 - Pathways for Communications Systems
Section 271500 - Communications Horizontal Cabling

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

Section 280513 - Conductors and Cables for Electronic Safety and Security Systems
Section 281600 – Existing Intrusion Detection
Section 283111 - Digital, Addressable Fire-Alarm System
Section 287300 - Valcom IP Solution for Classroom-Intercom and Clock System

DIVISION 31 – EARTHWORK

Section 311000 – Site Clearing
Section 311100 – Stormwater Pollution Prevention Plan
Section 312000 – Earthwork
Section 316329 – Drilled Concrete Piers and Shafts

DIVISION 32 - EXTERIOR IMPROVEMENTS

Section 321200 – Hot Mix Asphalt Paving
Section 321313 – Concrete Paving
Section 321373 – Pavement Joint Sealants
Section 323113 – Chain Link Fences and Gates

DIVISION 33 – UTILITIES

Section 332000 – Water Distribution
Section 333300 – Facility Sanitary Sewers
Section 334000 – Storm Drainage
Sealed Bids in duplicate for **TULSA PUBLIC SCHOOLS – MACARTHUR ELEMENTARY SCHOOL CLASSROOM ADDITION** project will be received and publicly opened and read aloud by INDEPENDENT SCHOOL DISTRICT NUMBER ONE OF TULSA COUNTY, OKLAHOMA, hereinafter referred to as “Owner,” in Room 444, the Bond Conference Room, Education Service Center, 3027 S. New Haven Ave, Tulsa, OK, 74114 until **2:00PM JULY 12, 2018**.

The bidding process will be in compliance with the Public Competitive Bidding Act of 1974. Bids must be accompanied by a bid security in the amount of 5% of the bid. By this notice, all provisions of the act apply to this project and are incorporated into notice by reference.

Upon receipt of an acceptable bid, the contract will be awarded within thirty days after the opening of bids and the written contract executed within sixty days thereafter.

Contractor qualification statement must be submitted **seven (7)** calendar days prior to bid date to the Owner, if not currently on file.

Attention is called to the fact that a designated completion date for this project site will be established based on the number of calendar days, as stated in the accepted bid, required to complete the Project work. There will be a $2500 Liquidated Damages Clause for each day the contract is not completed. The scheduled completion date will be a very significant and material factor to the owner when selecting the Lowest Responsible Bid. Each Bidder must include (in the space provided on the Bid Form) the number of calendar days, which the Bidder will require to complete the specified Project.

Failure to comply with the above bid requirements will result in return of unopened Bid Proposal.

Construction Manager for the project is Trigon General Contractors & Construction Managers, Inc.

Architect for the project is GSHELMS & Associates, LLC

Bid Documents may be obtained from:

http://www.tulsaschools.org/6_Community/bond_bids.asp

Owner reserves the right to reject any or all bids and to waive informalities or minor irregularities in any bid.

INDEPENDENT SCHOOL DISTRICT NUMBER ONE OF TULSA COUNTY OKLAHOMA

By Ms. Suzanne Schreiber, Board President

ATTEST:

By Cindy Hutchings, Clerk
SECTION 000020

INSURANCE REQUIREMENTS

Contractor shall obtain insurance of the types and in the amounts described below. The insurance shall be written by insurance companies and on forms acceptable to Owner.

1). Commercial General and Excess Liability or Umbrella Liability Insurance:

Contractor shall maintain commercial general liability (CGL) and, if necessary, commercial excess liability or umbrella insurance with a limit of not less than $1,000,000 each occurrence. CGL insurance should contain a general aggregate with a $2,000,000 limit, and should apply separately to the Project.

   a) CGL insurance shall be written on an ISO occurrence form and shall cover liability arising from premises, operations, independent contractors, at a minimum, contractual liability equivalent to an intermediate form of contractual liability insurance, products/completed operations and personal injury and advertising injury;
   b) Owner shall be included as an injured CGL, using ISO Additional Insured Endorsement CG 20101185 or a substitute providing equivalent coverage, and under the commercial excess liability or umbrella, if any. This insurance, including insurance provided under the commercial excess liability or umbrella, if any, shall apply as primary insurance with respect to any other insurance or self insurance programs afforded to or maintained by Owner;
   c) There shall be no endorsement or modification of the CGL limiting the scope of coverage for liability arising from pollution, explosion, collapse or underground property damage;
   d) **Waiver of Subrogation.** Contractor waives all rights against Owner and its agents, officers, directors and employees for recovery of damages to the extent these damages are covered by the commercial general liability, excess liability or umbrella liability insurance maintained pursuant to this agreement.

2). Business Auto and Excess Liability or Umbrella Liability Insurance:

Contractor shall maintain business auto liability and, if necessary, excess liability or umbrella liability insurance with a limit of not less than $1,000,000 each accident.

   a) Such insurance shall cover liability arising out of any auto (including owned, hired and non-owned autos);
   b) Business auto coverage shall be written on an ISO form. If necessary, the policy shall be endorsed to provide contractual liability coverage equivalent to that provided in the 1990 and later editions of CA 00 01;
   c) If the Contract Documents require Contractor to remove and haul hazardous waste from the project site or if the Project involves such similar environmental exposure, pollution liability coverage equivalent to that provided on the ISO Pollution Liability Broadened Coverage for Covered Autos Endorsement (CA 99 48) shall be provided, and the Motor Carrier Act Endorsement (MCS 90) shall be attached;
   d) **Waiver of Subrogation.** Contractor waives all rights against the Owner and its agents, officers, directors and employees for recovery of damages to the extent these damages are covered by the business auto liability, excess liability or umbrella liability insurance obtained by Contractor pursuant to this Agreement or under any applicable auto physical damage coverage.

3). Workers Compensation Insurance

Contractors shall maintain workers compensation and employers liability insurance.
a) The employers liability, and if necessary excess liability or umbrella insurance limits shall not be less than $1,000,000 each accident for bodily injury by accident or $1,000,000 each employee for bodily injury by disease;

b) The alternate employer endorsement (WC 00 03 01 A) shall be attached showing Owner in the schedule as the alternate employer.

4). Property Insurance

a) Owner may choose to purchase and maintain in force property insurance for the entire Work. Such insurance shall be written in an amount at least equal to the initial contract sum as well as subsequent modifications of that sum. The insurance shall apply on a replacement cost basis. If the insurance obtained in compliance with the Paragraph is Builders Risk insurance, coverage shall be written on a completed value form;

b) The insurance as required in subparagraph (a) shall name as insured the Owner, Contractor and all subcontractors and sub-subcontractors on the Project. The insurance policy shall contain a provision that the insurance will not be canceled or allowed to expire until at least 30 days prior written notice has been given to the Contractor;

c) The insurance as required in Subparagraph (a) shall cover the entire Work as outlined in the project specifications and shall also cover portions of the Work located away from the site but intended for use at the site and shall also cover portions of the Work in transit. The policy shall include as insured property scaffolding, false work and temporary buildings located at the site. The policy shall cover the cost of removing debris, including demolition, as any is made legally necessary by the operation of any law, ordinance or regulation.

d) Owner shall purchase and maintain boiler and machinery insurance required by the contract documents or by law, covering insured objects during installation and until final acceptance by Owner. This insurance shall name as insured Owner, Contractor and all subcontractors and sub-subcontractors in the Work;

e) The insurance as required by this Paragraph shall be written to cover all risks of physical loss except those specifically excluded in the policy and shall inure at least against the perils of fire, lightning, explosion, windstorm or hail, smoke, aircraft or vehicles, riot or civil commotion, theft, vandalism, malicious mischief and collapse;

f) Any deductible applicable to the insurance purchased in compliance with this Paragraph shall be paid by Owner;

g) Before the commencement of Work, Owner shall provide Contractor a copy the insurance policy obtained in compliance with this Paragraph;

h) Before the commencement of Work, Owner shall declare to Contractor any decision on its part not to obtain any or all of the insurance coverage as required in this Paragraph. Upon such declaration, Contractor shall then have the right to obtain insurance equivalent in coverage to that required in this Paragraph 4 and by appropriate change order, charge the cost of such insurance to Owner. If Contractor is damaged by the failure of Owner to comply with the requirements of this Paragraph, then Owner shall bear all reasonable costs properly attributable to that failure.

i) Waiver of Subrogation. Owner and Contractor waive all rights against each other and each of their subcontractors, sub-subcontractors, officer, directors, agents and employees for recovery for damages caused by fire and other perils to the extent covered by builders risk or property insurance purchased pursuant to the requirements of this Paragraph 4 or any other property insurance applicable to the Work.

j) Partial occupancy or use of the Work shall not commence until the insurance company or companies providing insurance as required in this Paragraph have consented to such partial occupancy or use. Owner and Contractor shall take reasonable steps to obtain consent of the insurance company or companies and agree to take no action, other than upon mutual written consent, with respect to occupancy or use of the Work that could lead to cancellation, lapse or reduction of insurance;
5). Evidence of Insurance

Prior to commencing the Work, Contractor shall furnish Owner with a certificate(s) of insurance, executed by a duly authorized representative of each insurer, setting out compliance with the insurance requirements set forth above.

   a) All certificates shall provide for 30 days written notice to Owner prior to the cancellation or material change of any insurance referenced to herein;
   b) The work “endeavor to” and “but failure to mail such notice shall impose no obligation or liability of any kind upon the company, its agents or representatives” shall be deleted from the cancellation provision of all certificates provided by the Contractor;
   c) Failure of Owner to demand such certificate or other evidence of full compliance with these insurance requirements or failure of Owner to identify a deficiency from evidence that is provided shall not be construed as a waiver of Contractor’s obligation to maintain such insurance;
   d) Owner shall have the right, but not the obligation to prohibit Contractor or any subcontractor from entering the Project site unit such certificates or other evidence that insurance has been placed in the complete compliance with these requirements is received and approved by the Owner;
   e) Failure to maintain the insurance in this Insurance Requirement Section shall constitute an event of default pursuant to this Agreement and shall allow Owner to terminate this Agreement to Owner’s option. If Contractor fails to maintain the insurance set forth herein, Owner shall have the right, but not the obligation, to purchase said insurance at Contractor’s expense;
   f) Contractor shall provide certified copies of all insurance policies required above within 10 working days of Owner’s written request for said copies.


   a) No Representation of Coverage Adequacy. By requiring the insurance as set out in the Insurance Requirement Section, Owner does not represent that coverage and limits will necessarily be adequate to protect Contractor and such coverage and limits shall not be deemed as a limitation on Contractor’s liability under the indemnities provided to Owner in this Agreement or any other provision of the Contract documents;
   b) Cross Liability Coverage. If Contractor’s liability policies do not contain the standard ISO separation of insureds provision or a substantially similar clause, they shall be endorsed to provide cross liability coverage;
   c) The insurance requirements set out in this Insurance Requirement Section are independent from all other obligations of Contractor under this Agreement and apply whether or not required by any other provision of this Agreement;
   d) Subcontractor’s Insurance. Contractor shall cause each subcontractor employed by Contractor to purchase and maintain insurance of the type specified in the Insurance Requirement Section. When requested by the Owner, Contractor shall furnish to Owner copies of certificates of insurance evidencing coverage for each subcontractor.

END OF SECTION
SECTION 000100
INSTRUCTIONS TO BIDDERS

SCOPE:

1. GENERAL CONDITIONS:

Standard form “General Conditions of the Contract for Construction,” The American Institute of Architects, Document A201, Fourteenth Edition, 2007, (“General Conditions”) shall apply to the Work, except insofar as the General Conditions are modified, amended, waived, or changed by these Supplementary General Conditions. The following paragraph numbers refer to the paragraphs in the above referenced “General Conditions”:

(a) Paragraph 1.1.1: The last sentence is amended to read as follows: “The Contract Documents include the advertisement or invitation to bid, notice to bidders, instructions to bidders, sample forms, the Contractor’s bid or proposal, any addenda relating to the foregoing and any other documents specifically enumerated in the Owner-Contractor Agreement.”

(b) Paragraph 3.7.1 is amended to read as follows: “When applicable, Contractor shall secure all permits, licenses and inspections necessary for the proper execution and completion of the Work. Owner will not reimburse Contractor for any fees paid by Contractor for permits and inspections.”

(c) Paragraph 13.6.1 is amended to read as follows: “Any moneys not paid within thirty (30) days after they become due and payable under the terms of this Contract shall bear interest at the rate of six percent (6%) per annum from and after said thirty (30) day period.”

(d) Paragraph 8.3.1 is amended to read as follows: “The Contractor shall not be entitled to compensation for any loss, cost or expense, sustained by reason of delay in completion of the Work from any cause whatever.”

(e) Paragraph 11.3.1 is amended to read as follows: “The Contractor shall purchase and maintain, at Contractor’s expense, property insurance upon the entire Work at the site to the full insurable value thereof. This insurance shall include the interests of Owner, Contractor, Subcontractor and Sub-subcontractors in the Work and shall insure against perils of fire and extended coverage on a ‘broad-form, all risk’ basis for physical loss of damage, including theft, vandalism and malicious mischief. Such insurance shall be purchased from a carrier licensed to do business in the State of Oklahoma. Certificates of such insurance shall be delivered to the Department Manager of Building Planning, Maintenance and Plant Operations of Owner prior to commencement of the Work. Said certificates shall provide that the carrier must give Owner at least thirty (30) days prior written notice before cancellation or reduction of the coverage for any reason. If not covered by the above insurance, Contractor shall also purchase and maintain similar coverage on portions of the Work stored off site or in transit when such portions of the Work are to be included in an Application for Payment under Subparagraph 9.3.2. Until substantial completion of the Work, all risk of loss shall be upon Contractor.”

(f) Paragraph 11.3.4 is eliminated.

(g) Paragraph 3.6.1 is amended by adding the following “Contractor assumes full responsibility for the payment of all contributions and payroll taxes (State and Federal) for all employees engaged on the Work and provide proof of worker compensation coverage for all employees.”
2. **DEFINITIONS:**

Wherever the words herein defined, or pronouns used in the stead, occur in this contract and these specifications, they shall have the meanings herein given.

(a) The word “OWNER” shall mean the Independent School District Number One of Tulsa County, Oklahoma, a public corporation.

(b) The word “CONTRACTOR” shall mean the person, persons, Partnership, company, firm or corporation entering into the contract for the performance of the Work, and the legal representative of said party, or agent appointed to act for said party in the performance of the Work.

(c) The word “SURETY” or “SURETIES” shall mean the bondsman or party of parties who have made sure the fulfillment of the requirement of the contract by bonds, including the Payment Bond, and whose signatures are attached to said bonds.

(d) The word “ADVERTISEMENT” shall mean all of the legal publications pertaining to the Work.

(e) The word “SPECIFICATIONS” shall mean, collectively, all of the terms and stipulations contained in those portions of the contract known as Instructions to Bidders, General, Mechanical and Electrical Specifications.

(f) The word “PLAN” shall mean, collectively, all of the drawings pertaining to the contract and made part thereof, and also such supplementary drawings as may be issued from time to time in order to elucidate the drawings or for the purpose of showing changes in the Work as authorized under the section “Changes and Alterations,” or for showing details which are not shown thereon.

(g) The words “CONTRACT PRICE” shall mean either the unit prices or unit price, or lump sum price, named in the contract or the total of all payments according to schedule or prices in the contract, as the case may be.

(h) The word “BID” or “BIDS” shall mean the written statements duly filed with the Clerk of Independent School District Number One of Tulsa County, Oklahoma, for the person or persons, partnership, company, firm or corporation proposing to do the Work and furnish materials called for on plans at the prices named on said statement.

(i) The word “CALENDAR DAYS” shall mean the actual days to complete the contract excluding days due to inclement weather.

3. **BONDS:**

If the Contract Price is in excess of **$50,000.00**, Contractor will furnish the following bonds: (i) a Payment Bond (the “statutory” bond required by Section 1 of Title 61, Okla. State, as amended) in an amount equal to 100% of the Contract Price; and (ii) a Performance Bond in such form as directed by Owner in an amount equal to 100% of the Contract Price for work on the project(s) as security for the proper and prompt completion of the Work in accordance with the contract and bidding documents; and (iii) a Warranty Bond in an amount equal to 100% of the Contract Price for work on the project(s) to protect Owner against defects in workmanship and materials for a period of one (1) year from Owner’s acceptance of the Project(s); or (iv) a Letter of Eligibility notarized by the bonding company verifying the ability of the Contractor to be bonded for the total amount of the project as specified in the project manual. The Surety on all bonds of the
successful bidder must be approved in the Treasury Department Circular 570. If the Surety Company is not on the list, those bids shall be rejected.

Where the Contract Price is $50,000.00 or less, the above bonds will not be required. However, in lieu of the Payment Bond, as to contracts where the Contract Price is $25,000.00 or less, Contractor shall submit an affidavit of the payment of all indebtedness incurred by the Contractor, Subcontractors, and all material men for labor, material, rental of machinery or equipment and repair of and parts for equipment as are used or consumed in the performance of the contract. The execution of the affidavit with knowledge that any of the contents of the affidavit are false, upon conviction, shall constitute perjury, punishable as provided by law. Copies of the affidavit form may be obtained from the Facilities Bond Office Room 201 South, Charles C. Mason Education Service Center, 3027 South New Haven Avenue, Tulsa, Oklahoma, 74147.

4. CORPORATE SURETY BONDS:

To be acceptable, a corporate surety bond (including both a bid bond and the payment/performance/warranty bonds of the successful bidder) must be signed by BOTH the bidder, as principal, and by a properly authorized representative of the bonding company. If the bonding company is a corporation, the bond must have attached a power of attorney from the corporation authorizing the person signing the bond on behalf of the bonding company to sign bonds for the bonding company. Only original executed instruments will be acceptable.

The corporate surety issuing the bond must be licensed by the Oklahoma State Insurance Commissioner to issue corporate surety bonds in the State of Oklahoma. The Owner reserves the right to require the bidder to submit evidence that the corporate Surety Company is so authorized. The Corporate Surety on all bonds of the successful bidder must be approved in the Treasury Departments Circular 570. If the Surety Company is not on the list, those bids shall be rejected. A bond written by an “offshore” (non-United States) surety company will not be acceptable.

5. LETTERS OF CREDIT:

If a bidder submits an irrevocable letter of credit in lieu of a bond (either a bid bond or a payment/performance/warranty bond), the irrevocable letter of credit must be issued by a financial institution having an office in the State of Oklahoma and insured by the Federal Deposit Insurance Corporation or Federal Savings and Loan Insurance Corporation. The letter of credit must be written on a form, which can be obtained from the Owner.

6. SPECIFICATIONS REGARDING EQUALS:

It is not the intent of these documents to have closed specifications and the brand names shown are the desired materials to be used. The name of a certain brand, make or manufacturer does not restrict proposals to the specified brand, make or manufacturer named unless a brand, model or manufacturer is labeled “No Substitution” in the bid. It is not intended to exclude other products, but to convey the type, functional characteristics and quality of the item desired. Any item that the Owner, in its sole discretion, determines and approves to be the equal of that specified considering quality, workmanship, economy of operation and suitability for the purpose intended will be considered. Thus “equal” products of other manufacturers may be considered if the products meet or exceed the stated specifications, and if a detailed explanation of a claim of equivalency is submitted five (5) days prior to the bid opening. It will be the responsibility of the Bidder to provide data on all products so that the Owner can compare.

7. COMPLETION:

Upon completion of the project, the Contractor will notify Owner and Owner’s Representative will make a final inspection of the work. The project shall be completed in good and workmanlike manner and to the satisfaction of the Owner.
8. ETHICS IN PUBLIC CONTRACTING:

By submitting their bid, Bidders certify that their bids are made without collusion or fraud and that they have not offered or received any kickbacks or inducements from any other bidder, supplier, manufacturer or subcontractor in connection with their proposal, and that they have not conferred on any public employee having official responsibility for this procurement transaction any payment, loan, subscription, advance, deposit of money, services or anything of more than nominal value, present or promised unless consideration of substantially equal or greater value was exchanged.

9. NON-DISCRIMINATION:

Contractor agrees Contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, age, or national origin. Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex, age or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff-, or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting for the provisions of this non-discrimination clause.

10. ERRORS OR OMISSIONS:

The Bidder shall not be allowed to take advantage of any errors or omissions in the specifications. Where they occur, the Bidder shall promptly notify the contact person listed. Inconsistencies in the specifications are to be reported before bids are submitted.

11. BID FORM:

The bid MUST be submitted on the bid form provided in the bid packet. A Xerox copy of this bid form is acceptable. All blanks must be completed.

END OF SECTION
SECTION 000110
SPECIAL CONDITIONS OF THE CONTRACT

The following conditions also apply to this contract:

1. **WORK COVERED UNDER THE CONTRACT:**

   The scope of the work consists of all new materials, tools, equipment, labor and services, to complete the **TULSA PUBLIC SCHOOLS – MacARTHUR ELEMENTARY SCHOOL CLASSROOM ADDITION** project listed in the "Solicitation and Notice for Bids" in accordance with the "Form of Proposal" and as indicated by the Drawings and by the Specifications included in this Project Manual.

2. **MATERIALS AND EQUIPMENT:**

   All material and equipment utilized shall be in conformance with these Specifications and with good Standards of practice and shall meet or exceed the latest applicable industry standards such as A.S.T.M., Standards and Specifications along with all applicable local and national codes and ordinances, including ICC, N.E.C. and N.F.P.A.

   Failure to comply with the terms and conditions of this solicitation or to deliver equipment, supplies or services identified in the Solicitation and Contract at the discount quoted will void the contract award. In the case of failure to deliver goods or provide services in accordance with the contract terms and conditions, Owner, after due oral or written notice, may procure them from other sources and hold the contractor responsible for any resulting additional purchase and administrative costs.

3. **CONTRACT METHOD:**

   The method of Contract and Management shall be in accordance with the Owner's requirements and guidelines set forth at the time the Contract is signed and a Work Order issued.

4. **CONTRACT ADMINISTRATOR:**

   This individual shall serve as the monitor of the conditions of the contract and shall work directly with the contractor to schedule and coordinate the performance of services and to provide general direction under the resulting contract. The following individual is identified to use all powers under the contract to enforce its faithful performance for the Owner: **Chris Hudgins**, Project Supervisor, (918) 746-6684.

5. **PRIORITIES AND WORK SEQUENCE:**

   The priority will be furnished by the Owner to the successful bidder at the Issuance of the Work Order. Completion of the project(s) in a timely manner is critical. The bidder is required to give the actual number of days to complete each project. Timing will be a consideration in determining the successful bidder.

6. **CONTRACTOR'S USE OF PREMISES:**

   The contractor shall also furnish a schedule of intended workdays to the owner through the Department of Building Planning prior to commencing the work at any site and keep all
parties informed of any adjustments made necessary by changes of shipping schedules or other causes.

Permission must be obtained from the Owner for temporary use of electric power, water, toilet facilities or other utilities. The Owner’s approval must also be obtained for the exact on-site location of any storage of materials, tools or equipment. Owner assumes no responsibility for items stored on school property.

Demolition items and/or debris shall be hauled away from the site after each day’s activity and the site always maintained in a clean condition free of any build-up of objectionable scraps, waste material or refuse.

7. OWNER OCCUPANCY AND PROTECTION OF PROPERTY:

The owner’s Site-based Personnel may occupy the site. Therefore, it may be necessary to erect a system of barricades or markers to direct traffic away from the area of each day’s operations. The Contractor shall protect and safeguard against damage to all adjacent or nearby surfaces, materials, hardware, glass, furnishings, signage or other site improvements and/or vehicles if in the area of intended loading and unloading operations.

8. SALES TAX: (None Required)

The Owner will issue such Documents as necessary to exempt the sales tax upon execution of a contract for the Project(s); therefore the Contractors are advised to omit the State Sales Tax when preparing their Bid.

9. PROJECT START-UP:

The contractor is advised to notify the Owner well in advance of commencing the work on the site.

10. KNOWLEDGE OF SITE AND SCOPE OF WORK REQUIREMENTS:

All Contractors shall visit the site on which work is proposed and become thoroughly familiar with the existing conditions and with the Bid Documents and the Scope of the Work included prior to submitting their bid. Sign in at the main office when visiting the site(s).

11. SUBMITTALS AND CLOSING PROCEDURES:

(Other than Start-up Contract Requirements such as Certificates of Insurance, Bonds, Etc.)

A. Submit Schedules of intended workdays and activity planned for each Site after receiving Owner’s Project Priority list prior to commencing work. Shop drawings and/or product data and samples shall be submitted to Tulsa Public Schools’ Building Planning department covering all Items in the Scope of Work for approval prior to manufacture shipment and installation at the project site. Submit the number of copies, which the contractor requires plus one copy, which will be retained by Tulsa Public Schools’ Building Planning Department. Furnish information on characteristics of finish materials proposed for use, to ensure compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify the architect in writing of any anticipated problems using specified coating systems with substrates primed by others.

B. Unless the contract stipulates “Payment upon Completion” of the project or another method of payment; during Progress of the work, submit a separate “Application
and Certificate for Payment”-AIA Document G702 on or about the 25th day of each month for work performed in that same month. A 5% retainage shall be calculated and withheld from each Pay Application until the project is completed and accepted by Owner.

C. Upon Final Completion and Final Acceptance by Owner, submit the following prepared and properly signed Closing Documents:

1. Certificate of Substantial Completion
   (AIA Document G704)

2. Final Application and Certificate for Payment
   (AIA Document G702)

3. Contractor’s Affidavit of Payment of Debts and Claims
   (AIA Document G706)

4. Contractor’s Affidavit of Release of Liens
   (AIA Document G706A)

5. Consent of Surety Company to Final Payment
   (AIA Document G707)

6. Contractor’s Affidavit Pursuant to Title 61
   O.S.- Optional in lieu of items 3 above.

7. Contractor’s Written Warranty for one (1) year against defects in Material or Workmanship.

12. SUBSTITUTIONS AND DEVIATIONS FROM THE SPECIFICATIONS:

Substitutions prior to Bid are covered under Paragraph 6 “Instructions to Bidders”. Any substitution or deviation from the specifications must be by Owner’s prior approval and accepted by an approved change order stipulating the change in price and change in construction time, if any.

13. OWNER’S RIGHT TO REJECT BIDS:

The Owner reserves the right to reject any or all bids and to waive minor irregularities in any bid. In addition, Bidders should recognize the right of the Owner to reject a bid if said bidder fails to provide any data required in the bid or if the bid is in any way incomplete.

14. FINAL CLEANING:

   A. Execute prior to final inspection.

   B. Clean surfaces exposed to view; remove temporary labels, stains and foreign substances and polish transparent and glossy surfaces. Clean equipment and fixtures, sweep and vacuum interior areas and rake clean exterior areas. Remove waste and surplus materials, rubbish and construction facilities from the Project and from the site.
15. **SPECIAL TERMS AND CONDITIONS:**

15.1 **Testing and Inspections:** Owner reserves the right to conduct any test or inspection it may deem advisable to assure supplies and services conform to specifications.

15.2 **Proprietary Indemnity:** Bidder warrants that the system, each part of the system, and all other products and services used by or furnished by bidder, do not infringe upon or violate any patent, copyright, trade, secret, trademark, or any other proprietary right of any third party. In the event of claim against Owner, Owner shall promptly notify vendor and vendor shall defend and indemnify Owner against any loss, cost expense, claim, or liability arising out of such claim, whether or not such claim is successful.

15.3 **Patent and Copyright Materials:** Unless otherwise expressly provided in a contract, bidder shall be solely responsible for clearing the right to use any patented or copyrighted materials in the performance of this contract.

15.4 **Audit:** Contractor hereby agrees to retain all books, records and other documents relative to this contract for five (5) years after final payment or until audited by the owner, whichever is sooner. Owner, its authorized agents and/or auditors reserve the right to perform or have performed an audit of contractor’s records and therefore shall have full access to the right to examine any of said materials within those five years.

15.5 **Open Records:** Ownership of all data, materials and documentation originated and prepared for the owner pursuant to this bid shall belong exclusively to Owner and be subject to inspections in accordance with the Oklahoma Open Records Act.

15.6 **Contractor Compliance:** Contractor shall comply with all procedural instructions that may be issued from time to time by Owner; however, the terms and conditions of the contract will not change:

16. Lead based paint, contractors shall be certified and follow work practices established under the EPA Renovations, Repairing, and Painting Program applicable to schools when performing any work which will disturb interior or exterior lead based surface coatings in buildings constructed before 1997/8. All such work shall be performed in compliance with 40 CFR Part 745.
SECTION 000120
SUPPLEMENTAL CONDITIONS TO THE CONTRACT

(References are to Articles, Paragraphs, Subparagraphs and Clauses of the General Conditions of the Contract for Construction, AIA Document A201, 2007 Edition)

2.2.5 **Delete** entire Subparagraph, and substitute the following:

“The Owner shall furnish Contractor with five (5) copies of Drawings and Project Manuals. Additional copies needed by the Contractor shall be provided and paid for by the Contractor.”

4.3.1 **Delete** entire Subparagraph, and substitute the following:

“Definition”

“A Claim is any demand or assertion by the Contractor that it should be paid more money than the Contract Sum, as adjusted under the Change Order provisions herein, by the Owner because of action or inaction on the part of Owner, Program Manager, Architect, or any party for whom Owner is responsible, or any party with whom Owner has separately contracted for other portions of the Project, including, but not limited to, any demand or assertion that Contractor's performance has been delayed, interrupted or interfered with, that Contractor's performance has been accelerated or suspended, that Contractor's performance has been wrongfully terminated, that the Contract Documents have been misinterpreted, that there has been a failure of payment, that Contractor has encountered concealed or unknown conditions, that Contractor has encountered hazardous materials, that there are problems with the Contract Documents, or the timing of Architectural approvals or decisions, that actions of the Owner have been intentionally wrongful or deceptive, that Owner is directly or indirectly guilty of negligence or an intentional tort related in any way to the Work, that the amount of time or money granted in a Construction Change Directive is inadequate, that an item treated as a minor change in the Work should have been treated as a Change Order, that a time extension grant was inadequate, or that Contractor is entitled to any other relief, on any legal theory, related to the Work and the Contract.”

“Notice Requirement”

“Within five (5) days of the first occurrence of an event that Contractor has any reason to believe might result in a Claim, or within five (5) days of Contractor's discovery of the first occurrence of an event that Contractor has any reason to believe might result in a Claim, if the first occurrence of the event was willfully hidden from the Contractor, the Contractor shall file a written document clearly captioned "Notice of Claim" with Tulsa Public Schools, Program Manager and the Architect. The notice shall clearly set out the specific matter of complaint, and the impact or damages which may occur or have occurred as a result thereof, to the extent the impact or damages can be assessed at the time of the notice. If the impact or damages cannot be assessed as of the date of the notice, the notice shall be amended at the earliest date this is reasonably possible.”

**Add** the following Subparagraph:

“Any claim or portion of a Claim that has not been made the specific subject of a notice strictly in accordance with the requirements of this section shall be waived. It is imperative
that Owner have timely, specific notice of any subject, the impact of which Owner may be in a position to mitigate."

4.3.3 Add the following sentences:

"Claims Handling During Construction. After receipt of a Notice of Claim, the Owner may elect to refer the matter to the Architect, Program Manager or another party for review. Contractor will attend meetings called to review and discuss the Claims and mitigation of the problem, and shall furnish any reasonable factual backup for the Claim requested. The Owner may also elect to defer consideration of the Claim until the Work is completed, in which case the same review options shall be available to the Owner at the completion of the Work. At any stage the Owner is entitled to refer a Claim to mediation under the Construction Industry Mediation Rules of the American Arbitration Association, and if this reference is made Contractor and the Owner will take part in the mediation process. The filing, mediation or rejection of a Claim does not entitle Contractor to stop performance of the Work. The Contractor shall proceed diligently with performance of the Contract."

4.3.6.1 Add the following Subparagraph:

"Calculating Claim Amount"

"In calculating the amount of any Claim the following standards will apply:

.1 No indirect or consequential damages will be allowed.

.2 All damages must be directly and specifically shown to be caused by a proven wrong. No recovery shall be based on a comparison of planned expenditures to total actual expenditures, or on estimated losses of labor efficiency, or on a comparison of planned manloading to actual manloading, or any other analysis that is used to shown damages indirectly.

.3 Damages are limited to extra costs specifically shown to have been directly caused by a proven wrong.

.4 The maximum daily limit on any recovery for delay shall be the amount estimated by the Contractor for job overhead costs divided by the total number of calendar days of Contract Time called for in the original Contract."

.5 No monetary costs shall be allowed for delay.

5.2.1 In the first sentence, delete "as soon as practicable" and substitute "within seventy-two (72) hours."

5.2.5 Add this new Subparagraph:

"The Contractor shall not sublet the work as a whole. The approval of Subcontractors in no way relieves the Contractor from full responsibility for performance and completion of the Work and its obligations under the Contract Documents."

5.3.1 Delete the remainder of the second sentence beginning with the words "and shall allow to the Subcontractor."
5.4.2 **Delete** entire Subparagraph and substitute the following:

"Owner shall only be responsible for compensating Subcontractors for work done or materials furnished after the date Owner gives written notice of its acceptance of the subcontract agreement."

5.5 **Add** this new Paragraph:

5.5 "RESPONSIBILITY"

5.5.1 "Contractor shall be fully responsible for the performance of its Subcontractors.

6.1.1 **Delete** the entire Subparagraph, and substitute the following:

"The Owner reserves the right to perform other construction work, maintenance and repair work and school program operations at the site and near the site during the time period of the Work. Owner may perform other work with separate contractors or with its own forces. On renovation/addition projects, the Owner shall have access to the site and all buildings on the site at all times. On new construction, the Owner shall have access to the site and all buildings during normal business hours."

10.1.2 **Add** this new Subparagraph:

"The Contractor shall be responsible for the protection and security of the Work and the Project, until he receives written notification that the Substantial Completion of the work has been accepted by the Tulsa Public Schools."

10.2.8 **Add** this new Subparagraph:

"In an emergency affecting the safety of persons or property, the Contractor shall notify the Owner, Program Manager and Architect immediately of the emergency, simultaneously acting at his discretion to prevent damage, injury, or loss. Any additional compensation or extension of time claimed by the Contractor on account of emergency work shall be determined as provided in Article 4.3 and Article 7."

10.3.1 **Delete** entire Subparagraph and substitute the following:

"Contractor is responsible for reviewing all Asbestos Hazard Emergency Act Management Plans on file with Owner and for obtaining sign-off from Tulsa Public Schools Hazardous Materials Bureau prior to commencing the Work. In no event shall the Contractor engage in the disturbance or removal of asbestos or polychlorinated biphenyl (PCB). In the event the Contractor encounters on the site material reasonably believed to be asbestos or PCB which has not been rendered harmless, the Contractor shall immediately stop work in the area affected and report the condition to the Architect in writing. If the portion of the Work that is stopped is critical to overall completion, the Contractor shall reschedule the Work, if possible, to minimize the impact of the stoppage. The work in the affected area shall not thereafter be resumed except by written agreement of the Owner and Contractor if in fact the material is asbestos or PCB and has not been rendered harmless. The work in the affected area shall be resumed when the asbestos or polychlorinated biphenyl (PCB) has
been removed, or when it has been rendered harmless. If the Work is stopped due to the presence of such materials, Owner shall arrange for the removal and/or rendering harmless of such materials prior to Contractor being allowed to proceed. The Owner shall have the option of arranging for removal by a qualified, adequately insured third party tendered to Contractor, and mutually agreed to by both parties, as a Subcontractor in which case a Change Order will be issued for the cost of this subcontract. Any tendered Subcontractor must indemnify the Contractor and the Owner with regard to its work. In the case of such a tender, Owner will not hold Contractor responsible for the work or other actions of the tendered Subcontractor, and Contractor's approval of tendered Subcontractor shall not be unreasonably withheld. In those instances in which the presence of such materials was set forth in the Hazardous Materials documents or in which Contractor had other notice of such through information given to Contractor by Owner or its representative prior to the commencement of the Work, Contractor shall not be entitled to a Claim for any delays, disruption or interference it encounters. In those instances of work stoppage due to the existence of such hazardous materials which were not set forth in the Hazardous Materials Control plans and of which Contractor had no other prior notice, Contractor may be entitled to a Claim for extension of time due to the work stoppage."

11.4 PROPERTY INSURANCE

11.4.1 **Delete** entire Subparagraph, and substitute the following:

"Until the Work is completed and accepted by the Owner, the Contractor shall purchase and maintain property insurance upon the entire Work at the site to the full insurable value thereof. The property insurance shall also cover portions of the Work stored off site after written approval of the Owner of the value established in the approval, and also portions of the Work in transit. This insurance shall include the interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Work and shall insure against the perils of fire and extended coverage including flood and earthquake and shall include "all risk" insurance for physical loss or damage including, without duplication of coverage, theft, vandalism and malicious mischief. The insurance shall cover reasonable compensation for Architect's and Program Manager's services and expenses required as a result of an insured loss. This "all risk" policy shall be written incorporating Actual Completed Value Form and General Change Endorsement incorporating the following language:

"Permission is given for the Project insured hereunder to become occupied, the insurance remaining in full force and effect until such time as the Project has been accepted by the Owner, all as currently approved by the Laws for the State of Oklahoma."

"The policy shall include coverage for Explosion, Collapse and Underground (XCU). Such insurance shall be evidenced by the kind of policy which does not have to be adjusted or reported upon periodically but provides constant insurance at full one hundred percent (100%) of all insurable values as they are created during construction by performance of the Contract. The Certificate of Insurance must include the names of the insured Contractor and the Tulsa Public Schools."

11.4.1.2 **Delete** entire Clause, and substitute the following:

"Loss under such All Risk Builder's Risk Insurance shall be made payable jointly to the Tulsa Public Schools and to the Contractor by name (and, if separate mechanical contracts are awarded to each, by name, of the plumbing, heating, ventilating and electric contractors)."

11.4.1.3 **Delete** entire Clause, and substitute the following:
"In the case of loss under the risks covered, and of collection by insured, the Owner shall act as trustee for all parties concerned as their interests may appear."

12.1.3 **Add** this new Clause:

"Where nonconforming work is found, the entire area of work involved shall be corrected unless the contractor can completely define the limits to the Architect's satisfaction. Additional testing, sampling, or inspecting needed to define nonconforming work shall be at the Contractor's expense. He shall employ the Owner's testing laboratory if such services are reasonably required by the Architect. All connected work shall be retested at the contractor's expense. Extra Architectural or Program Manager Services required to analyze nonconforming work shall be paid for by the Contractor."

13.1.1 **Delete** entire Subparagraph, and substitute the following:

“District Court in and for the County of Tulsa, State of Oklahoma shall have sole jurisdiction in any action brought under this contract.”

14.2.5 **Add** this new Subparagraph:

"If a Performance Bond has been furnished and the Contractor is declared by the Owner to be in default under the Contract, the Surety shall promptly remedy the default by completing the Contract in accordance with its terms and conditions, or by obtaining a bid or bids in accordance with its terms and conditions. Upon determination by the Owner and the Surety of the lowest responsible bidder, the Surety will arrange for a contract between such bidder and the Owner, and make available as work progresses sufficient funds to pay the cost of completion less the balance of the Contract Sum, but not exceeding the Penal Sum of the bond and other costs and damages for which the Surety may be liable under the bond. The phrase 'balance of the Contract Sum' as used herein shall mean the total amount payable by the Owner to the Contractor under the Contract and amendments thereto less the amount previously paid by the Owner to the Contractor."

**END OF SECTION**
See Attached Geotechnical Engineering Report performed by AimRight Testing & Engineering

Report #4870318 April 27, 2018
AIMRIGHT TESTING & ENGINEERING

Construction Materials Testing • Special Inspections • Geotechnical Engineering

GEOTEchnical Engineering REPORT

AIMRIGHT Project No. 4870318
April 27, 2018

MacArthur Elementary School
Classroom Addition
2182 South 73rd East Avenue
Tulsa, OK 74129

Prepared for:

Tulsa Public Schools
P.O. Box 470208
Tulsa, OK 74147
April 27, 2018

Tulsa Public Schools
P.O. Box 470208
Tulsa, OK 74147

Attn: Mr. Gregory Helms, A.I.A.
(918) 298-7257
greg.helms@gahelms.com

Re: Geotechnical Engineering Report
MacArthur Elementary School Classroom Addition
2182 South 73rd East Avenue, Tulsa, OK 74129
AIMRIGHT Project No. 4870318

It has been a pleasure serving you on this project. AIMRIGHT is pleased to submit this Geotechnical Engineering Report for the proposed construction planned at the referenced site. This report presents the findings of the geotechnical exploration and presents recommendations for design for the project.

We appreciate the opportunity to provide geotechnical consultation services for the subject project. We look forward to serving as your geotechnical engineer and construction materials testing laboratory on the remainder of this and future projects. Please do not hesitate to contact us with any concerns or questions regarding this report.

Respectfully submitted,

AIMRIGHT Testing & Engineering, LLC
CA No. 5794 (exp. 6/30/18)

[Signature]
Justin J. Boyd Jr., P.E.
Engineering Manager
jboyd@aimrighttesting.com
# TABLE OF CONTENTS

1.0 PROJECT SCOPE AND PROCEDURES  
   1.1 Project Location and Description  
   1.2 Scope of Services  
   1.3 Field Exploration  
   1.4 Laboratory Testing  

2.0 SUBSURFACE CONDITIONS  
   2.1 Subsurface Findings  
   2.2 Groundwater  

3.0 RESULTS OF LABORATORY TESTING  

4.0 ENGINEERING ANALYSIS  

5.0 ENGINEERING RECOMMENDATIONS  
   5.1 Site Preparation and Earthwork  
   5.2 Site Drainage  
   5.3 Fill Material  
   5.4 Shallow Foundation Design  
   5.5 Shallow Foundation Construction Considerations  
   5.6 Deep Foundation Design  
   5.7 Deep Foundation Construction Considerations  
   5.8 Slab-on-ground Design  
   5.9 Pavement Design  
   5.10 Pavement Construction Considerations  

6.0 CONSTRUCTION QUALITY CONTROL  

7.0 REPORT LIMITATIONS  

APPENDIX  
   Boring Location Plan  
   Boring Logs  
   Boring Log Key to Symbols  

Geotechnical Engineering Report  
MacArthur Elementary School Classroom Addition  
AIMRIGHT Project No. 4570318  
April 27, 2018  

Page iii
1.0 PROJECT SCOPE AND PROCEDURES

1.1 Project Location and Description

The project is located at 2182 South 73rd East Avenue in Tulsa, Oklahoma. We understand that a new one-story building (~ 12,500 sf) and new parking/drive areas will be constructed on the referenced site. The site is developed with existing structures, various pavement areas, grass-cover with few trees and shrubbery as well as above and below-grade infrastructure. It is our understanding that demolition and removal of the existing mobile structures and improvements within those areas will be required prior to beginning construction.

The topography is generally level with minimal elevation differences across the site. Cut/fill depths have not been finalized; however, we estimate that a minimum cut/fill of less than 1 to 2 feet will be required to reach the final site elevations.

The structure is anticipated to be supported by a concrete slab-on-ground and shallow or deep foundation system. Information regarding estimated structural loading conditions was provided; and, we utilized estimated maximum column loads of 180 kip and wall loads of 15 kip per linear foot in our engineering analyses.

The new parking/drive areas will more than likely be constructed with a flexible or rigid surface and aggregate base course overlying a properly prepared subgrade. We estimate that traffic volume to be equal to less than 25,000 (medium duty) and 50,000 (heavy duty) equivalent 18-kip single-axle loads (ESALs) over a 20-year period.

1.2 Scope of Services

The primary purpose of this report is to provide geotechnical engineering recommendations for the proposed site development. Our Scope of Services consisted of the following:

- Drilling eight (8) soil test borings (borings) to depths of 5 to 25 feet or 5 feet into rock, whichever occurred first;
- Performing laboratory testing of selected soil samples obtained from the borings; and
- Providing engineering analysis and preparation of this report discussing, in general, project description, our scope, exploration, testing, analysis, and recommendations.

The Boring Location Plan, Boring Logs, and other supporting data are presented in the Appendices to this report. Our Scope of Services did not include a survey of boring locations and elevations, rock coring, quantity estimates, preparation of plans or specifications, or the identification and evaluation of environmental aspects of the project site.
1.3 Field Exploration

AIMRIGHT located the borings in the field by making measurements from known existing site features. The boring elevations were interpreted from the provided contour elevations on the current project grading plan. No claim is made as to the accuracy of the boring locations and elevations shown on the Boring Logs and Boring Location Plan, respectively, and they should be considered approximate.

At each boring location with an existing pavement section, the surface was penetrated with the drill rig auger to access the subsurface. Field measurement of the existing pavement section thickness including aggregate base course or gravel, if present, were recorded. The borings were advanced using a CME 550 ATV-mounted drill rig equipped with an automatic hammer and 6-inch diameter augers. Representative soil samples were obtained using a standard 2-inch outside diameter split-barrel sampler in general compliance with the Standard Penetration Testing (SPT) method of the American Society of Testing and Materials (ASTM) D1586 standard to evaluate the consistency and general engineering properties of the subsurface soils.

The number of blows required to drive the split-barrel sampler three (3) consecutive 6-inch increments is recorded and the blows of the last two 6-inch increments are added to obtain the SPT N-value in blows per foot (bpf) representing the penetration resistance of the soil. At regular intervals within the borings, split-spoon samples were visually classified based on texture and plasticity. During the drilling process, all encounters with groundwater, if any, were recorded. Upon completion of drilling, all borings were backfilled per OWRB requirements.

1.4 Laboratory Testing

The samples obtained from the geotechnical exploration were transported to the AIMRIGHT laboratory where representative samples were selected for testing. Testing consisted of Atterberg limits, sieve analysis and determination of moisture content in general accordance with the ASTM testing procedures.
2.0 SUBSURFACE CONDITIONS

2.1 Subsurface Findings

The subsurface conditions illustrated in the table below represent an estimate of the subsurface conditions based on interpretation of the boring data using normally accepted geotechnical engineering judgments. The transitions between soil strata are usually less distinct than shown on the Boring Logs.

<table>
<thead>
<tr>
<th>Stratum</th>
<th>Boring Nos.</th>
<th>General Depth Interval</th>
<th>Description of Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface</td>
<td>B-1 to B-4, P-4</td>
<td>2 to 3 inches</td>
<td>organic laden soils (topsoil) sampled as silty sand/sandy silt with organics and root matter</td>
</tr>
<tr>
<td>Native Soils</td>
<td>P-1, P-3</td>
<td>6 to 12 inches</td>
<td>existing pavement section</td>
</tr>
<tr>
<td>Weathered Rock</td>
<td>All</td>
<td>0 to 18.5 feet</td>
<td>at or below the surface, generally moist, medium stiff to hard, lean clay and loose to dense, clayey sand with varying amounts of clay, silt, sand, and small rock fragments</td>
</tr>
<tr>
<td></td>
<td>B-1 to B-4</td>
<td>6 to 21 feet</td>
<td>below and within the native soils, generally moist, highly to moderately weathered, soft to hard, shale and limestone (highly weathered, poorly cemented sandstone was encountered above the shale in B-3)</td>
</tr>
</tbody>
</table>

Auger refusal was encountered in borings B-1, B-2, and B-4 at depths of approximately 20 to 21 feet. Auger refusal is defined as material that could not be penetrated with the drill rig equipment used on the project. Auger refusal material may be caused by large boulders, rock ledges, lenses, seams, or the top of parent bedrock.

2.2 Groundwater

Groundwater was not encountered during or at the completion of drilling in any of the borings. Water traveling through soil and rock is often unpredictable and may be present at shallow depths. Due to the seasonal changes in groundwater and the unpredictable nature of groundwater paths, groundwater levels will fluctuate. As such, groundwater levels at other times of the year may be different than those described in this report.

Generally, the highest groundwater levels occur in late winter and early spring and the lowest levels in late summer and fall. Therefore, it is necessary during construction to be observant for groundwater seepage in excavations to assess the situation and make necessary changes. Where applicable, the contractor should determine the actual groundwater levels at the time of construction.
3.0 RESULTS OF LABORATORY TESTING

Laboratory tests were conducted on selected samples in general accordance with ASTM standards. The laboratory testing performed for this project consisted of Atterberg Limits (ASTM D4318), Moisture Content (ASTM D2216) and Sieve Analysis – No. 200 Wash Method (ASTM D1140) testing. The test results are presented on the Boring Logs and are summarized in the table below.

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Sample Depth Interval (ft)</th>
<th>In-place Moisture Content (%)</th>
<th>Finer than No. 200 Sieve (%)</th>
<th>Liquid Limit (%)</th>
<th>Plastic Limit (%)</th>
<th>Plasticity Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>0 to 1.5</td>
<td>14.1</td>
<td>40.6</td>
<td>25</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>B-1</td>
<td>3.5 to 5</td>
<td>16.3</td>
<td>36.0</td>
<td>26</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>B-2</td>
<td>0 to 1.5</td>
<td>15.1</td>
<td>60.0</td>
<td>22</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>B-2</td>
<td>1.5 to 3</td>
<td>16.2</td>
<td>44.9</td>
<td>30</td>
<td>13</td>
<td>17</td>
</tr>
<tr>
<td>B-3</td>
<td>1.5 to 3</td>
<td>20.6</td>
<td>69.0</td>
<td>37</td>
<td>15</td>
<td>22</td>
</tr>
<tr>
<td>B-3</td>
<td>3.5 to 5</td>
<td>14.5</td>
<td>52.4</td>
<td>26</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>B-4</td>
<td>0 to 1.5</td>
<td>13.0</td>
<td>51.3</td>
<td>26</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>B-4</td>
<td>3.5 to 5</td>
<td>16.4</td>
<td>21.2</td>
<td>28</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>P-1</td>
<td>0 to 1.5</td>
<td>11.8</td>
<td>51.5</td>
<td>28</td>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td>P-2</td>
<td>0 to 1.5</td>
<td>17.4</td>
<td>58.0</td>
<td>27</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>P-3</td>
<td>1.5 to 3</td>
<td>13.3</td>
<td>25.1</td>
<td>26</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>P-4</td>
<td>0 to 1.5</td>
<td>11.3</td>
<td>23.2</td>
<td>25</td>
<td>13</td>
<td>12</td>
</tr>
</tbody>
</table>

Note: Sample depth is the measured depth from the existing surface grades.
4.0 ENGINEERING ANALYSIS

The following recommendations are based on our observations at the site, interpretation and analysis of the field and laboratory data obtained during this exploration, assumed loads, and our experience with previous exploration and testing with similar projects. Soil penetration data have been used to estimate an allowable bearing pressure and associated settlement using established correlations. Subsurface conditions in unexplored locations may vary from those encountered. If structure location, loadings, or elevations are changed, we request that we be advised so that we may re-evaluate our recommendations. In the event changes are made in the proposed design/construction plans, the recommendations presented in this report shall not be considered valid unless reviewed by AIMIRIGHT and modified or verified in writing.

Determination of an appropriate foundation system for a given structure is dependent on the proposed structural loads, soil conditions, and construction constraints such as proximity to other structures, etc. The subsurface exploration aids the geotechnical engineer in determining the soil stratum appropriate for structural support. This determination includes considerations regarding both allowable bearing pressure and compressibility of the soil strata. In addition, since the method of construction greatly affects the soils intended for structural support, consideration must be given to the implementation of suitable methods of site preparation, fill compaction, and other aspects of construction.

Provided the recommendations outlined in this report are followed throughout the design and construction phases of this project, it is our opinion that the proposed site is suitable for the planned construction and a concrete slab-on-ground in conjunction with a shallow or deep foundation design may be used to support the building structure as outlined in the following recommendations:

Building Structure Foundation

OPTION 1 – Shallow Foundation Support with Lean Concrete Extension

To reduce settlement risk and provide strengthened and more uniform bearing support conditions, AIMIRIGHT recommends extending foundation bearing elevations deeper to a minimum depth of 6 feet (hard/dense native soils) and backfilling with properly designed lean concrete to the designed bottom of footing elevation.

AIMIRIGHT recommends carefully evaluating all building shallow foundation excavations prior to the required lean concrete placement and implementing an intensive bearing grade observation and testing protocol prior to identify any unsuitable material within reasonable accessibility. This evaluation should include, as a minimum, Dynamic Cone Penetrometer (DCP) testing at the planned bearing elevations. Any unsuitable materials observed during the evaluation should be undercut and replaced with lean concrete.
OPTION 2 – Shallow Foundation Support with Compacted Aggregate Base

To reduce settlement risk and provide strengthened and more uniform bearing support conditions, AIMRIGHT recommends that the anticipated shallow foundation bearing subgrade soils be replaced, and a minimum thirty (30) inches depth (D) of properly compacted aggregate base be provided below all shallow foundation bearing grades. The width of the excavation for all footings shall extend a minimum of ½ D (20 inches) beyond the footing footprint and the exposed bearing grade soils should be evaluated and re-compacted or replaced.

AIMRIGHT recommends carefully evaluating all building shallow foundation excavations prior to the required aggregate base placement and implementing an intensive bearing grade observation and testing protocol prior to identify any unsuitable material within reasonable accessibility. This evaluation should include, as a minimum, Dynamic Cone Penetrometer (DCP) testing at the planned bearing elevations. Any unsuitable materials observed during the evaluation should be undercut and replaced with properly compacted aggregate base.

OPTION 3 – Shallow Foundation Support with Ground Improvement

Alternatively, the structure may be supported by a shallow foundation system bearing on ground improvement techniques such as rammed aggregate piers or vibro-piers. This option will require design by an approved design consultant and recommendations are not provided in this report. AIMRIGHT would be pleased to discuss these options with you in more detail, if applicable.

OPTION 4 – Deep Foundation Support

In lieu of a shallow foundation system, a deep foundation system comprised of grade beams and drilled piers bearing in the underlying weathered shale and limestone could be utilized for design. Our exploration indicates that a softer stratum of highly weathered rock (limestone, shale, and/or sandstone) exists above the native soils at depths of approximately 6 to 13.5 feet in borings B-1 to B-3 (not present in B-4). AIMRIGHT recommends that drilled piers penetrate this stratum and bear into the underlying shale and limestone encountered at depths of approximately 18.5 feet.

Building Structure Slab-on-ground and Parking/Drive Areas

The building and parking/drive area footprints generally consist of near surface conditions that are generally suitable for support of the anticipated loads. However, soft, or other unsuitable conditions may be encountered in some locations and remediation of these soils shall be required during site preparation and earthwork while following the recommendations outlined in this report. Although moderately to highly plastic clay capable of moderate shrink/swell potential not encountered in our borings, AIMRIGHT recommends conducting additional soil sampling and laboratory testing of the final soil subgrades during grading activities to verify native soil characteristics prior to beginning slab or pavement construction.
5.0 ENGINEERING RECOMMENDATIONS

5.1 Site Preparation and Earthwork

Before proceeding with construction, AIMRIGHT recommends conducting a pre-grading meeting to discuss recommendations as outlined in this report. As such, any structures, foundations, driveways, topsoil, moderately to highly plastic soils, wet, soft, or loose soils and any other deleterious non-soil materials should be removed to a minimum distance of 2 feet beyond the proposed parking/drive area footprints and 5 feet beyond the structure footprints.

Existing utility lines beneath the existing or proposed structure, where applicable, should be located and properly abandoned; or, should be removed and backfilled with properly compacted engineered fill as outlined in this report.

Upon completion of required excavations, proof-rolling of the subgrade with a 20 to 30-ton loaded truck or other pneumatic-tired vehicle of similar size and weight should then be performed. Proof-rolling should be performed during a time of good weather and not while the site is wet, frozen, or severely desiccated. The proof-rolling observation is an opportunity for the geotechnical engineer to locate inconsistencies intermediate of our boring locations in the existing subgrade.

Any unsuitable materials observed during the evaluation and proof-rolling operations should be undercut and replaced with compacted fill or stabilized in place. The possible need for, and extent of undercutting and/or in-place stabilization required can best be determined by the geotechnical engineer at the time of construction.

The upper 8 inches of the existing subgrade in construction areas shall then be scarified, moisture-conditioned and re-compacted to at least ninety-five percent (95%) of the maximum dry density and within ±2 percentage points of the optimum moisture content as determined by a Standard Proctor (ASTM D698). The moisture content and compaction shall be maintained prior to beginning any fill or aggregate placement and/or construction.

At the time of the investigation, the site soils were generally moist. If dry weather conditions exist prior to and during construction, the near surface soils may need moisture-conditioning to sufficiently enable adequate scarifying and compaction. However, if wet conditions exist at the time of construction, then care shall be taken to assure proper surface water drainage. If these soils do get wet, they must be dried or treated prior to further compaction efforts.
5.2 Site Drainage

An important aspect to consider during development of this site is surface water control. During the initiation of grading operations, we recommend that the grading contractor take those steps necessary to enhance surface flow and promote rapid clearing of rainfall and runoff water following rain events. It should be incumbent on the contractor to maintain favorable site drainage during construction to minimize deterioration of otherwise stable subgrades.

Permanent positive drainage should be provided around the perimeter of the structures to minimize moisture infiltration into the foundation and/or subgrade soils. We recommend landscaped areas adjacent to the structures be provided with a fall of at least 6 inches for the first 10 feet outward from the structure areas. All grades must provide effective drainage away from the structures during and after construction. Water permitted to pond next to the structures can result in unacceptable differential floor slab movements and cracked slabs and/or walls.

Exposed ground should be sloped at a minimum 5 percent away from the buildings for at least 10 feet beyond the perimeter of the buildings. After building construction and landscaping, AIMRIGHT recommends verifying final grades to document that effective drainage has been achieved. Grades around the structures should also be periodically inspected and adjusted as necessary, as part of the structure’s maintenance program.

Planters located within 10 feet of the structures should be self-contained to prevent water accessing the building subgrade soils. Sprinkler mains and spray heads should be located a minimum of 5 feet away from the building lines. Low-volume, drip style landscaped irrigation should not be used near the building. Roof runoff should be collected in drains or gutters. Roof drains and downspouts should be discharged onto pavements which slope away from the buildings or downspouts should be extended a minimum of 10 feet away from the structures.
5.3 Fill Material

A sample of each material type should be submitted to the geotechnical engineer for evaluation. Frozen material should not be used, and fill should not be placed on a frozen subgrade.

All fill material in structural areas (including utility backfill) should be placed in continuous, horizontal lifts having a maximum pre-compacted thickness of 9 inches. Aggregate base should have a maximum pre-compacted thickness of 6 inches; and fill compacted with hand-held or smaller-sized equipment having a maximum pre-compacted thickness of 4 to 6 inches.

Each lift should be compacted to at least ninety-five percent (95%) of the maximum dry density and within ±2 percentage points of the optimum moisture content as determined by a Standard Proctor (ASTM D698), unless noted otherwise. The moisture content and density shall be maintained throughout construction activities.

A minimum of two (2) field tests to determine in-place density and moisture content should be performed per lift for each 2,000 and 5,000 sf within building structure and parking/drive footprints, respectively.

Engineered fill should consist of approved materials that are free of organic matter and debris, exhibit a plasticity index (PI) of 8 to 18 and contain at least 15% fines (material passing the No. 200 sieve, based on dry weight) with a maximum rock size of 1.5 inches.

Native soils could be used as fill or final subgrade; whereby, upon re-use, the soils meet the requirements for engineered fill as stated in this report. AIMRIGHT recommends conducting additional sampling and laboratory testing during the earthwork and grading activities to determine the presence of materials not meeting the engineered fill requirements, where applicable.

Aggregate base shall meet the requirements for ODOT Type A and beneath pavements, shall be compacted to at least ninety-five percent (95%) of the maximum dry density and within ±2 percentage points of the optimum moisture content as determined by a Modified Proctor (ASTM D1557).
5.4 Shallow Foundation Design

The project structural engineer should determine the final foundation sizes based on the actual design loads, building code requirements, and other structural considerations. The magnitude of the settlements will be highly influenced by the variation in excavation requirements across the structure footprint, the distribution of loads, and the variability of underlying soils. Structure foundations may be designed utilizing the following parameters:

<table>
<thead>
<tr>
<th>Bearing Material</th>
<th>Option 1</th>
<th>Option 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Structural Loads (Provided)</td>
<td>Approved Hard/Dense Native Soils</td>
<td>Approved Properly Compacted Aggregate Base</td>
</tr>
<tr>
<td>Allowable Bearing Capacity² (FS = 3.0)</td>
<td>15 kip/ft (wall); 180 kip (column)</td>
<td>4,000 psf</td>
</tr>
<tr>
<td>Minimum Footing Embedment³</td>
<td>24 inches</td>
<td>18 inches (wall); 30 inches (column)</td>
</tr>
<tr>
<td>Minimum Footing Width</td>
<td>≤ 1 inch</td>
<td>≤ ½ inch</td>
</tr>
<tr>
<td>Estimated Maximum Settlement</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>Earthquake Loads Site Class⁴</td>
<td>C</td>
<td>C</td>
</tr>
</tbody>
</table>

1. **OPTION 1**: AIMRIGHT recommends extending foundation bearing elevations deeper to a minimum depth of 6 feet (into approved hard/dense native soils) and backfilling with properly designed lean concrete to the designed bottom of footing elevation as illustrated in Figure 1.

**OPTION 2**: AIMRIGHT recommends that a minimum of thirty (30) inches of properly compacted aggregate base be provided below all foundation bearing elevations. All foundation (wall footings) subgrades should be over-excavated to a minimum depth, D, of 30 inches and the width of the excavation shall extend a minimum of ½ D (20 inches) beyond the entire footing footprint as illustrated in Figure 2.

![Figure 1](image1.png)

**Figure 1**

![Figure 2](image2.png)

**Figure 2**

Note: Figures are shown for convenience and excavations shall be conducted with appropriate safety requirements.

Although not indicated in the illustration for Figure 2, the over-excavated foundation subgrade footprints may be backfilled with approved properly compacted engineered fill or native soils above the design bearing elevation and planned foundation bearing elevations may then be excavated to the aggregate base; thus, reducing the amount of required formed footing construction backfill.
2. The recommended net allowable bearing pressure is based on foundations within approved bearing materials. The net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. AIMRIGHT recommends carefully evaluating all foundation excavations prior to aggregate base or lean concrete placement.

3. Minimum depth applies to both perimeter and interior footings.

4. 2015 International Building Code (IBC) Section 16, a weighted average of the soil penetration resistance conditions recorded (limited N-value of 100 bpf) and estimated for the upper 100 feet of the site was calculated.

5.5 Shallow Foundation Construction Considerations

All foundation subgrades should be observed, evaluated, and verified for the design soil bearing capacity by the geotechnical engineer after excavation and prior to aggregate base or lean concrete placement. This evaluation should include, as a minimum, Dynamic Cone Penetrometer (DCP) testing at the planned bearing elevations.

Foundation excavations must be maintained in a drained/de-watered condition throughout the foundation construction process and water should not be allowed to pond in any excavation. Excavations for footings should be made in such a way as to provide bearing surfaces that are firm and free of loose, soft, wet, or otherwise disturbed soils. Foundations should be concreted as soon as practical after they are excavated, and concrete should also not be placed on frozen or saturated subgrades.

If the foundation excavations must remain open overnight, or if rainfall becomes imminent while the bearing soils are exposed, it is recommended that a 2 to 4-inch-thick "mud mat" of lean concrete with a minimum compressive strength of 1,500 pounds per square inches (psi) be placed on the bearing soils before placing the reinforcing steel to minimize damage to the bearing surface from weather or construction activities.
5.6 Deep Foundation Design

Straight-sided drilled piers bearing into the weathered rock stratum (shale and limestone) may be used to support the proposed structure. Grade beams along the perimeter should extend at least 24 inches below the lowest final adjacent grade to provide frost protection. Grade beams should be designed to span the piers without deriving support from the soil between the piers. The project structural engineer should determine the final foundation sizes based on the actual design loads, building code requirements, and other structural considerations. The following may be utilized to assist in drilled pier design.

<table>
<thead>
<tr>
<th>Axial Load Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Structural Loads (Provided)</td>
</tr>
<tr>
<td>Bearing Material</td>
</tr>
<tr>
<td>Bearing Material Depth</td>
</tr>
<tr>
<td>Allowable End Bearing Capacity (FS = 3.0)</td>
</tr>
<tr>
<td>Allowable Unit Side Resistance (FS = 2.0)</td>
</tr>
<tr>
<td>Minimum Pier Diameter</td>
</tr>
<tr>
<td>Minimum Pier Length</td>
</tr>
<tr>
<td>Minimum Pier Embedment Depth</td>
</tr>
<tr>
<td>Estimated Maximum Settlement</td>
</tr>
<tr>
<td>Earthquake Loads Site Class</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lateral Load Design³</th>
</tr>
</thead>
<tbody>
<tr>
<td>L-Pile Layer Type</td>
</tr>
<tr>
<td>Unit Weight, γ</td>
</tr>
<tr>
<td>Friction Angle, Φ</td>
</tr>
<tr>
<td>Undrained Cohesion, c_u</td>
</tr>
<tr>
<td>Horizontal Subgrade Modulus, k</td>
</tr>
<tr>
<td>Strain Factor, ε_i/k_m</td>
</tr>
<tr>
<td>Rock Quality Designation, RQD</td>
</tr>
<tr>
<td>Uniaxial Compressive Strength</td>
</tr>
<tr>
<td>Initial Modulus of Rock Mass</td>
</tr>
</tbody>
</table>

1. Unit side resistance (skin friction) between the pier and surrounding bearing material can be used to develop pier capacity in compression. The pier weight and a maximum allowable unit side resistance (for that portion of the pier extending more than 2 feet into the recommended bearing material) may be utilized to resist structural upward loadings.

2. 2015 International Building Code (IBC) Section 16, a weighted average of the soil penetration resistance conditions recorded (limited N-value of 100 bpf) and estimated for the upper 100 feet of the site was calculated.

3. A lateral load analysis was not performed; however, a range of parameters are provided for analysis assistance in general accordance with typical L-Pile recommendations.
5.7 Deep Foundation Construction Considerations

Installation of the drilled piers and placement of concrete within the piers should be performed in accordance with the most recent ACI Specifications and installation monitoring shall be observed under supervision by AIMRIGHT. A representative of the geotechnical engineer should observe the drilled pier installation to verify that the recommend bearing materials are encountered and sufficiently penetrated and to observe the concreting techniques.

We anticipate the near-surface soils at the site can be excavated using conventional drill rigs with sufficient torque and ability. Our experience indicates rock in a weathered, boulder, and/or massive form may vary erratically in location and depth within the referenced site. Therefore, there is always a potential that these materials could be encountered at shallower depths between the boring locations and should be anticipated during construction.

Furthermore, auger refusal was encountered in borings B-1, B-2, and B-4 at depths of approximately 20 to 21 feet. Auger refusal is defined as material that could not be penetrated with the drill rig equipment used on the project. Auger refusal material may be caused by large boulders, rock ledges, lenses, seams, or the top of parent bedrock. The drilling rig should be equipped with an earth and rock augers and other necessary tools to excavate, clean and level rock bottoms properly, and without construction delay. The contractor should assess the subsurface conditions prior to mobilizing and should be prepared to utilize other techniques such as rock coring to reach planned pier bottom depths.

Following drilling, loose, or disturbed materials and any accumulated water should be removed from the bottom of the drilled piers prior to concrete placement. To facilitate construction, reinforcing steel should be ready and on site, and concrete should be available within a very short period for placement after excavation is completed. Drilled pier excavations must not set overnight prior to placing concrete.

Groundwater was not encountered during or at the completion of drilling in any of the borings. Therefore, the need for casings will may not be required. Water traveling through soil and rock is often unpredictable, however, and may be present in other areas at shallow depths. Due to the seasonal changes in groundwater and the unpredictable nature of groundwater paths, groundwater levels can fluctuate. The contractor should determine the actual groundwater levels at the time of construction.

Where casings are used, it is recommended that the concrete have a slump in the range of 5 to 7 inches to reduce the potential of arching when removing the casing. When removing the casing, the concrete inside the casing should be maintained at a sufficient level to reduce any earth and hydrostatic pressure outside the casing during removal. Concrete slump should be at least 5 inches, and generally in the range of 5 to 7 inches; however, a higher slump may be used to increase fluidity if appropriate for the concrete mix used. An uninterrupted supply and placement of concrete is recommended to produce a monolithic shaft. The maximum size of the concrete aggregate should not exceed one-third of the minimum clear spacing between individual reinforcing bars or bundles.
5.8 Slab-on-ground Design

The structure subgrades should be prepared as described in this report. The building footprint area generally consist of near surface conditions that are suitable for support of the anticipated loads. However, soft, or other unsuitable conditions will be encountered in some locations within the footprint. Remediation of these soils shall be required during site preparation and earthwork while following the recommendations outlined in this report.

Four (4) inches or more of granular base should be placed over the final soil subgrade and shall meet the requirements outlined in the table below. The modulus of subgrade reaction, $k$, value illustrated in the table below is based on 30-inch diameter plate load test.

<table>
<thead>
<tr>
<th>Minimum Percent Finer than 1 ½-inch Sieve</th>
<th>Maximum Percent Finer than No. 200 Sieve</th>
<th>Maximum Plasticity Index</th>
<th>Modulus of Subgrade Reaction, $k$ w/ 4 inches of Granular Base (pci)</th>
<th>Modulus of Subgrade Reaction, $k$ w/ 8 inches of Granular Base (pci)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>15</td>
<td>6</td>
<td>125</td>
<td>150</td>
</tr>
</tbody>
</table>

At the time of concrete placement, the granular base should be moist, but free of any self-draining water. If floor coverings are susceptible to moisture damage by moist floor conditions (capillary moisture), a vapor retarder should be placed below the slab-on-ground in accordance with the most recent addendum to ACI 302.1R-04 / 302.2R-06 and other current industry recommendations for use and placement of vapor retarders.
5.9 Pavement Design

These recommendations are based on our discussions with you, interpretation of the field and laboratory data, assumed traffic loading conditions, review of the provided documents, our experience with similar projects and utilization of the 1993 AASHTO Pavement Design Guidelines. AIMRIGHT recommends that governing authorities (i.e. city, county, or other recognized officials) be contacted to discuss appropriate pavement section requirements with respect to this project. The project architect or engineer of record should design the final pavement section. We utilized the design parameters as illustrated below.

<table>
<thead>
<tr>
<th>Estimated Traffic, ESALs</th>
<th>Light Duty</th>
<th>Overall Standard Deviation</th>
<th>Asphalt Concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Duty</td>
<td>25,000</td>
<td>3.000</td>
<td>4.2</td>
</tr>
<tr>
<td>Heavy Duty</td>
<td>50,000</td>
<td>100</td>
<td>4.5</td>
</tr>
<tr>
<td>Subgrade Resilient Modulus (M_r), psi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modulus of Subgrade Reaction (K),pci</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concrete Modulus of Rupture (R), psi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load Transfer Coefficient</td>
<td>3.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drainage Coefficient</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reliability, %</td>
<td>85</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It is our opinion the following minimum sections overlying a properly prepared subgrade as outlined in this report may be utilized for construction:

<table>
<thead>
<tr>
<th>Pavement Type</th>
<th>Section</th>
<th>Light Duty (inches)</th>
<th>Heavy Duty (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td>Concrete (≥ 4,000 psi, air-entrained)</td>
<td>4.0</td>
<td>6.0</td>
</tr>
<tr>
<td></td>
<td>ODOT Type A Aggregate Base</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Engineered Fill or Lime Stabilized Subgrade</td>
<td>8.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ODOT Type B, S4</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>ODOT Type A, S3</td>
<td>2.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Asphalt</td>
<td>ODOT Type A Aggregate Base</td>
<td>6.0</td>
<td>8.0</td>
</tr>
<tr>
<td></td>
<td>Engineered Fill or Lime Stabilized Subgrade</td>
<td>8.0</td>
<td></td>
</tr>
</tbody>
</table>

1. Constructed in accordance with Oklahoma Department of Transportation (ODOT) and city or county governing specifications and applicable American Concrete Institute (ACI) guidelines.

2. A minimum thickness of 7 inches of concrete and 6 inches of aggregate base should be provided in front of and beneath dumpster areas or any other areas subjected to continuous concentrated truck wheel loading.

3. Per Section 5.1, 5.3, and 5.10.
5.10 Pavement Construction Considerations

The parking/drive areas generally consist of near surface conditions that are suitable for support of the anticipated loads. However, soft, or other unsuitable conditions will be encountered in some locations within the footprint. Remediation of these soils shall be required during site preparation and earthwork while following the recommendations outlined in this report.

Although moderately to highly plastic clay capable of moderate shrink/swell potential not encountered in our borings, AIMRIGHT recommends conducting additional soil sampling and laboratory testing of the final soil subgrades during grading activities to verify native soil characteristics prior to beginning slab or pavement construction.

In general, long-term pavement performance requires good drainage, performance of periodic maintenance activities, and attention to subgrade preparation. We emphasize that good base course drainage is essential for successful pavement performance and should be maintained in a drained condition at all times.

Consideration for proper drainage design should be carefully evaluated where unequal minimum pavement sections meet (i.e. light to heavy duty). Depending on drainage flow design, it may be necessary to deepen the aggregate base course for the thinner section requirement.

Water build-up in the base course could result in premature pavement failures. Sub-drains are typically utilized beneath a pavement where water may enter the pavement from below or above. Based on the results of the borings, we do not anticipate that sub-drains are required for this site. However, site drainage problems may be revealed during construction that requires sub-drains.

Proper drainage may be aided by grading the site such that surface water is directed away from pavements and by construction of swales adjacent to the pavements. All pavements should be graded such that surface water is directed towards the outer limits of the paved areas or to catch basins located such that surface water does not remain on the pavement.
6.0 CONSTRUCTION QUALITY CONTROL

We recommend that all earthwork construction be monitored by an experienced engineering technician of AIMRIGHT. Monitoring should include site preparation, subgrade earthwork, engineered fill earthwork, structure foundation systems, conventional and/or structural slabs.

Monitoring will allow AIMRIGHT to confirm the soil conditions on site and evaluate the recommendations presented within this report. If at the time of construction, our recommendations are inappropriate for the project, monitoring will allow us to remediate the recommendations at that time to better serve the project.

Monitoring during construction will also allow for the testing of all construction materials for the project. This includes but is not limited to:

- subgrade inspection and density testing,
- structural area fill placement density testing,
- foundation bearing grade observations and testing,
- structural and reinforcing steel inspection,
- concrete testing, and
- asphaltic concrete testing, as applicable.

We recommend that AIMRIGHT be retained to provide these services based upon our current familiarity with the project subsurface conditions, and the provided intent of the geotechnical recommendations pertaining to the proposed development.
7.0 REPORT LIMITATIONS

The recommendations provided are based in part on project information provided to us and they only apply to the specific project and site discussed in this report. If our statements or assumptions concerning the location and design of this project contain incorrect information, or if additional information is available, you should convey the correct or additional information to us and retain us to review our recommendations. We can then modify our recommendations if they are inappropriate for the proposed project.

Regardless of the thoroughness of the geotechnical exploration, there is always a possibility that subsurface conditions will be different from those at a specific boring location and that conditions will not be as anticipated by the designers or contractors. In addition, the construction process may itself alter soil conditions. Therefore, experienced geotechnical personnel should observe and document the construction procedures used and the conditions encountered. Unanticipated conditions and inadequate procedures should be reported to the design team along with timely recommendations to solve the problems created. The conclusions and recommendations presented in this report were derived in accordance with standard geotechnical engineering practices and no other warranty is expressed or implied.
### LOG OF BORING B-1

**PROJECT:** MacArthur Elementary School Classroom Addition  
**CLIENT:** Tulsa Public Schools  
**PROJECT LOCATION:** 2182 South 73rd East Avenue, Tulsa, OK 74129  
**LOCATION:** see Boring Location Plan  
**ELEVATION:** 722  
**DRILLER:** B. Parks  
**LOGGED BY:** J. Woods  
**DRILLING RIG:** CME 550 ATV-Mounted  
**DEPTH TO WATER INITIAL:** N/A  
**DEPTH TO WATER AT COMPLETION:** N/A  
**DATE:** 4/9/18

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Sampler Type</th>
<th>Description</th>
<th>Graphic</th>
<th>USCS Symbol</th>
<th>SPT N-value (blow)</th>
<th>Groundwater</th>
<th>Moisture Content</th>
<th>% &lt; #200</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plasticity Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 722</td>
<td></td>
<td>TOPSOIL - 3 inches</td>
<td></td>
<td>SC</td>
<td>8</td>
<td>14.1</td>
<td>40.6</td>
<td>25</td>
<td>14</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>1 - 721</td>
<td></td>
<td>CLAYEY SAND w trace gravel</td>
<td>loose, medium brown, moist</td>
<td></td>
<td></td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 - 720</td>
<td></td>
<td>CLAYEY SAND</td>
<td>loose, dark brown, moist</td>
<td></td>
<td></td>
<td>13</td>
<td>16.3</td>
<td>36.0</td>
<td>26</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>3 - 719</td>
<td></td>
<td>CLAYEY SAND w trace sandstone fragments</td>
<td>medium cence, reddish brown moist, moist</td>
<td></td>
<td></td>
<td>6.0</td>
<td>50/3.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 - 718</td>
<td></td>
<td>SHALE w thin limestone seams, highly weathered</td>
<td>soft, light brown, moist</td>
<td>CL</td>
<td>50/6.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 - 717</td>
<td></td>
<td>SHALE w sandstone fragments, thin limestone seams, highly weathered</td>
<td>soft, medium brown, moist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 - 716</td>
<td></td>
<td>LEAN CLAY w limestone fragments</td>
<td>hard, medium brownish olive, moist</td>
<td></td>
<td></td>
<td>13.5</td>
<td>53</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 - 715</td>
<td></td>
<td>SHALE w thin limestone seams, highly to moderately weathered</td>
<td>soft to moderately hard, light gray, moist to dry</td>
<td></td>
<td></td>
<td>18.5</td>
<td>50/1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Auger refusal encountered at 21 ft.  
Boring terminated at 21 ft.
## LOG OF BORING B-2

**PROJECT:** MacArthur Elementary School Classroom Addition  
**CLIENT:** Tulsa Public Schools  
**PROJECT LOCATION:** 2182 South 73rd East Avenue, Tulsa, OK 74129  
**LOCATION:** see Boring Location Plan  
**ELEVATION:** 721  
**DRILLER:** B. Parks  
**LOGGED BY:** J. Woods  
**DRILLING RIG:** CME 550 ATV-Mounted  
**DRILLING METHOD:** Rotary 6-inch Diameter Augers  
**DATE:** 4/9/18  
**DEPTH TO WATER INITIAL:** N/A  
**AT COMPLETION:** N/A  
**CAVING:** N/A

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sampler Type</th>
<th>Description</th>
<th>Graphic</th>
<th>USCS Symbol</th>
<th>SPT N-value (blp)</th>
<th>Groundwater</th>
<th>Moisture Content</th>
<th>% (&lt;#200)</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plastic Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 721</td>
<td>TOPSOIL - 3 inches</td>
<td></td>
<td></td>
<td>CL</td>
<td>6</td>
<td>15.1</td>
<td>60.0</td>
<td>22</td>
<td>14</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>1 - 720</td>
<td>SANDY LEAN CLAY</td>
<td>medium stiff, dark brown, moist</td>
<td></td>
<td>SC</td>
<td>11</td>
<td>16.2</td>
<td>44.9</td>
<td>30</td>
<td>13</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>2 - 719</td>
<td>CLAYEY SAND w/trace sandstone fragments</td>
<td>medium dense, reddish medium brown, moist</td>
<td></td>
<td>CL</td>
<td>6.0</td>
<td>50/4.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 - 718</td>
<td>LIMESTONE highly weathered</td>
<td>soft, light brown, moist</td>
<td></td>
<td>CL</td>
<td>6.0</td>
<td>50/4.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 - 717</td>
<td>SHALE w/limestone fragments, highly weathered</td>
<td>soft, reddish medium brown, moist</td>
<td></td>
<td>CL</td>
<td>6.5</td>
<td>50/4.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 - 716</td>
<td>LEAN CLAY w/trace limestone fragments</td>
<td>hard, dark grayish olive, moist</td>
<td></td>
<td>CL</td>
<td>8.5</td>
<td>41</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 - 715</td>
<td>SHALE w/thin limestone seams, highly to moderately weathered</td>
<td>soft to moderately hard, dark gray, moist to dry</td>
<td></td>
<td>CL</td>
<td>13.5</td>
<td>41</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 - 714</td>
<td>LIMESTONE moderately to slightly weathered</td>
<td>moderately hard to hard, light grayish white, moist to dry</td>
<td></td>
<td>CL</td>
<td>18.5</td>
<td>50/0.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Auger refusal encountered at 20.5 ft.  
Boring terminated at 20.52 ft.
<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Sampler Type</th>
<th>Description</th>
<th>Graphic</th>
<th>USCS Symbol</th>
<th>SPT N-value (bp)</th>
<th>Groundwater</th>
<th>Moisture Content</th>
<th>% &lt; #200</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plasticity index</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>TOPSOIL - 2 inches</td>
<td></td>
<td>CL</td>
<td>12</td>
<td>7</td>
<td>14.5</td>
<td>52.4</td>
<td>26</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>1&lt;br&gt;1.1</td>
<td></td>
<td>LEAN CLAY w/ SAND, trace gravel</td>
<td>0.167</td>
<td>CL</td>
<td>12</td>
<td>69.0</td>
<td>37</td>
<td>15</td>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2&lt;br&gt;2.4</td>
<td></td>
<td>stiff, dark brown, moist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3&lt;br&gt;3.0</td>
<td></td>
<td>SANDY LEAN CLAY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4&lt;br&gt;4.0</td>
<td></td>
<td>SANDY LEAN CLAY w/ trace sandstone fragments</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5&lt;br&gt;5.0</td>
<td></td>
<td>hard, light reddish brown, moist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6&lt;br&gt;6.0</td>
<td></td>
<td>SANDSTONE clayey, highly weathered</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7&lt;br&gt;7.0</td>
<td></td>
<td>poorly cemented, light brown, moist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8&lt;br&gt;8.0</td>
<td></td>
<td>SHALE w sandstone and limestone seams, highly weathered</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9&lt;br&gt;9.0</td>
<td></td>
<td>soft, light brownish gray, moist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10&lt;br&gt;10.0</td>
<td></td>
<td>SHALE highly weathered</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11&lt;br&gt;11.0</td>
<td></td>
<td>soft, dark gray, moist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12&lt;br&gt;12.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13&lt;br&gt;13.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14&lt;br&gt;14.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Boring terminated at 14.96 ft.
<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sampler Type</th>
<th>Description</th>
<th>Graphic</th>
<th>USCS Symbol</th>
<th>SPT N-value (bf)</th>
<th>Groundwater</th>
<th>Moisture Content</th>
<th>% &lt; #200</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plastic Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-721</td>
<td>TOPSOIL - 2 inches</td>
<td></td>
<td>CL</td>
<td>0.167</td>
<td>6</td>
<td>13.0</td>
<td>51.3</td>
<td>26</td>
<td>16</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>1-720</td>
<td>SANDY LEAN CLAY w/ trace gravel</td>
<td>medium stiff, dark brown, moist</td>
<td>SC</td>
<td>3.5</td>
<td>10</td>
<td>15.4</td>
<td>31.2</td>
<td>28</td>
<td>14</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>2-719</td>
<td>CLAYEY SAND w/ trace sandstone fragments</td>
<td>loose, light reddish brown, moist</td>
<td></td>
<td>4.3</td>
<td>10</td>
<td>15.4</td>
<td>31.2</td>
<td>28</td>
<td>14</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>3-718</td>
<td>CLAYEY SAND w/ trace sandstone fragments</td>
<td>dense, light reddish brown, moist</td>
<td></td>
<td>8.5</td>
<td>57</td>
<td>57</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-717</td>
<td>LEAN CLAY w/ trace sand, limestone fragments and limestone seams</td>
<td>hard, light brown, moist</td>
<td></td>
<td></td>
<td>68</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-716</td>
<td>LEAN CLAY w/ trace limestone fragments and limestone seams</td>
<td>hard, dark grayish olive, moist</td>
<td></td>
<td></td>
<td>68</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-715</td>
<td>LEAN CLAY w/ trace limestone fragments and limestone seams</td>
<td>highly to moderately weathered soft to moderately hard, light gray, moist to dry</td>
<td></td>
<td></td>
<td>18.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7-714</td>
<td>SHALE w/ thin limestone seams, highly to moderately weathered</td>
<td>soft to moderately hard, light gray, moist to dry</td>
<td></td>
<td></td>
<td>50/4.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Auger refusal encountered at 20.5 ft.
Boring terminated at 20.5 ft.
<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sampler Type</th>
<th>Description</th>
<th>Graphic</th>
<th>USCS Symbol</th>
<th>SPT N-value</th>
<th>Groundwater</th>
<th>% &lt; #200</th>
<th>Liquid Limit</th>
<th>Paste Limit</th>
<th>Plasticity Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>ASPHALT - 3 inches</td>
<td></td>
<td>CL</td>
<td>14</td>
<td>11.8</td>
<td>51.5</td>
<td>28</td>
<td>13</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>AGGREGATE BASE - 3 inches</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>SANDY LEAN CLAY</td>
<td>very stiff to medium stiff, dark brown, moist</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Boring terminated at 5 ft.
<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Sampler Type</th>
<th>Description</th>
<th>Graphic</th>
<th>USCS Symbol</th>
<th>SPT N-value (tpf)</th>
<th>Groundwater</th>
<th>Moisture Content</th>
<th>% &lt; #200</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plasticity Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 716</td>
<td></td>
<td>SANDY LEAN CLAY w/ trace sandstone fragments</td>
<td></td>
<td>CL</td>
<td>5</td>
<td>17.4</td>
<td>58.0</td>
<td>27</td>
<td>16</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>1 - 710</td>
<td></td>
<td>medium stiff, dark brown, moist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 - 717</td>
<td></td>
<td></td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 - 715</td>
<td></td>
<td>LEAN CLAY w/ trace sand</td>
<td></td>
<td></td>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 - 715</td>
<td></td>
<td>very stiff, dark and light brown, moist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Boring terminated at 5 ft.
<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Sampler Type</th>
<th>Description</th>
<th>Graphic</th>
<th>USCS Symbol</th>
<th>SPT N-value</th>
<th>Groundwater</th>
<th>Moisture Content</th>
<th>% &lt; #200</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plasticity Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 720</td>
<td></td>
<td>ASPHALT - 4 inches</td>
<td>-0.67</td>
<td></td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 - 719</td>
<td></td>
<td>AGGREGATE BASE - 6 inches</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 - 718</td>
<td></td>
<td>SANDY LEAN CLAY w/ trace sandstone fragments stiff, dark and medium brown, moist</td>
<td>1.5</td>
<td>SC</td>
<td>12</td>
<td>13.3</td>
<td>25.1</td>
<td>26</td>
<td>13</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>3 - 717</td>
<td></td>
<td>CLAYEY SAND w/ trace sandstone fragments medium dense to dense, reddish medium brown, moist</td>
<td></td>
<td>37</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Boring terminated at 5 ft.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depth (feet)</td>
<td>Sampler Type</td>
<td>Description</td>
<td>Graphic</td>
<td>USCS Symbol</td>
<td>SPT N-value (sf)</td>
<td>Groundwater</td>
<td>Moisture Content</td>
<td>% &lt; #200</td>
<td>Liquid Limit</td>
<td>Plastic Limit</td>
<td>Plastic Index</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------</td>
<td>------------------------------------------------------------------------------</td>
<td>---------</td>
<td>-------------</td>
<td>-----------------</td>
<td>-------------</td>
<td>-----------------</td>
<td>----------</td>
<td>-------------</td>
<td>--------------</td>
<td>---------------</td>
</tr>
<tr>
<td>0</td>
<td>Topsoil</td>
<td>3 inches</td>
<td>SC</td>
<td>0.25</td>
<td>9</td>
<td>11.3</td>
<td>23.2</td>
<td>25</td>
<td>13</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Clayey Sand</td>
<td>w/ trace sandstone fragments loose to medium dense, reddish medium brown, moist</td>
<td></td>
<td></td>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Lean Clay</td>
<td>w/ trace sand, sandstone, limestone fragments hard, light reddish brown, moist</td>
<td></td>
<td></td>
<td>63</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Boring terminated at 5 ft.
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Strata Symbols</strong></td>
</tr>
<tr>
<td>🌱</td>
<td>Topsoil</td>
</tr>
<tr>
<td>🌱</td>
<td>Clayey Sand</td>
</tr>
<tr>
<td>🌱</td>
<td>Shale</td>
</tr>
<tr>
<td>🌱</td>
<td>Low Plasticity Clay</td>
</tr>
<tr>
<td>🌱</td>
<td>Limestone</td>
</tr>
<tr>
<td>🌱</td>
<td>Sandstone</td>
</tr>
<tr>
<td>🌱</td>
<td>Asphalt</td>
</tr>
<tr>
<td>🌱</td>
<td>Aggregate Base</td>
</tr>
<tr>
<td></td>
<td><strong>Misc. Symbols</strong></td>
</tr>
<tr>
<td>↑</td>
<td>Auger Refusal</td>
</tr>
<tr>
<td></td>
<td><strong>Soil Samplers</strong></td>
</tr>
<tr>
<td>🌱</td>
<td>Standard Penetration Test</td>
</tr>
<tr>
<td>🌱</td>
<td>Auger</td>
</tr>
</tbody>
</table>
SECTION 000140

BID BOND

See Attached AIA Document A310 – Bid Bond
KNOW ALL MEN BY THESE PRESENTS, that we
(Here insert full name and address or legal title of Contractor)

« »
« »

as Principal, hereinafter called the Principal, and
(Here insert full name and address or legal title of Surety)

« »
« »

a corporation duly organized under the laws of the State of « » as Surety, hereinafter called the Surety, are held and firmly bound unto
(Here insert full name and address or legal title of Owner)

« »
« »

as Obligee, hereinafter called the Obligee, in the sum of « » ($ « »), for the payment of which sum well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for
(Here insert full name, address and description of project)

«TPS»
« »
« »

NOW, THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a Contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such Contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another party to perform the Work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect.

Signed and sealed this « » day of « », « »
STATE OF OKLAHOMA )
COUNTY OF TULSA ) ss.

______________________________, of lawful age, being first duly sworn, on oath says that
(she)he is the agent authorized by the bidder to submit the attached bid. Affiant further states that the bidder has
not been a party to any collusion among bidders in restraint of freedom of competition by agreement to bid at a
fixed price or to refrain from bidding; or with any state official or employee as to quantity, quality, or price in any
discussions between bidders and any state official concerning exchange of money or other thing of value for
special consideration in the letting of a contract.

Subscribed and sworn to before me this ___________ day of _____________________, 2018.

______________________________
Company Representative

______________________________
Notary Public

My Commission Expires:
STATE OF OKLAHOMA )
COUNTY OF TULSA ) ss.

, of lawful age, being first duly sworn, on oath says that
(she) he is the agent authorized by the bidder to submit the attached bid. Affiant further states that the nature of
any partnership, joint venture, or other business relationship presently in effect or which existed within one (1) year
prior to the date of this statement with the Architect, Engineer, or other party to the project is as follows:

Affiant further states that any such business relationship presently in effect or which existed within one (1) year
prior to the date of this statement between any officer or director of the bidding company, any officer or director of
the architectural or engineering firm or other party to the project is as follows:

Affiant further states that the names of all persons having any such business relationships and the positions they
hold with their respective companies or firms are as follows:

(If none of the business relationships herein above mentioned exist, affiant should so state.)

Company Representative

Subscribed and sworn to before me this _________ day of ________________, 2018.

Notary Public

My Commission Expires:
SECTION 000170
NON-DISCRIMINATION AFFIDAVIT

The Contractor affirms and states that he/she complies with the following:

1. The Contractor will not discriminate against any employee or applicant for employment because of race, color, sex, religion, national origin or age. The Contractor will take affirmative action to insure that applicants are employed and that employees are treated during employment without regard to their race, color, sex, religion, national origin or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the requirements of these nondiscrimination provisions.

2. The Contractor will state, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, that all qualified applicants will receive consideration for employment without regard to race, color, sex, religion, national origin or age.”

Company Representative

Subscribed and sworn to before me this ___________ day of ________________, 2018.

Notary Public

My Commission Expires:
STATE OF OKLAHOMA )
COUNTY OF TULSA ) ss.

The undersigned, under the penalties of perjury, certifies to the Tulsa Public Schools ("School District") as follows:

1. The undersigned:
   _______ has a contract with the School District; OR
   _______ is the duly authorized representative of a business ("entity") having a contract with the School District, to perform work on School District premises on a full-time or part-time basis.

2. The undersigned hereby certifies that neither the undersigned nor any employee of the undersigned or of the entity, or of any subcontractor of the undersigned or the entity, will perform work on School District premises on a full-time or part-time basis that would otherwise be performed by School District employees if such employee has been convicted in this State, the United States or any other state of any felony offense unless ten (10) years have elapsed since the date of the criminal conviction or the employee has received a pardon for the offense.

3. Neither the undersigned nor any employee of the undersigned, or the entity, or of any subcontractor of the undersigned or the entity, who performs any work on School District property is currently registered under the Oklahoma Sex Offenders Registration Act or the Mary Rippy Violent Crime Offenders Registration Act.

4. The undersigned, or the entity, has conducted a felony record search of all employees who will be assigned to work on a full-time or part-time basis on School District property.

5. This Affidavit is made and delivered pursuant to the requirements of OKLA. STAT. tit. 70, § 6-101.48 (Supp. 2000) and OKLA. STAT. tit. 57, § 589 (Supp. 2004) (the “Acts”). The undersigned further certifies to the School District that the undersigned and/or the entity are in full compliance with the requirements of the Acts.

EXECUTED AND DELIVERED this _____ day of _____________________, 2018.
SHORT-TERM WORKER NOTICE

TO ALL SHORT-TERM WORKERS AT THIS LOCATION, NOT OTHERWISE CONSIDERED EMPLOYEES OF TULSA PUBLIC SCHOOLS

This is to advise you that this site has been inspected for asbestos-containing material. Please refer to the Asbestos Management Plan for the exact location. The Plan is available for your review in the administrative office of this building.

Please acknowledge that you have read this Notice by signing your name, the company you are representing and the date of your visit. Return copy to Tulsa Public Schools contact below.

If you have any questions, the contact person is:

Asbestos Specialist
Tulsa Public Schools.
Maintenance Department
1555 North 77 East Avenue
Tulsa, Oklahoma 74115
Telephone: 831-2400

Signed: ___________________________________________

Date: _____________________________________________

Company: _________________________________________
CERTIFICATION OF COMPLIANCE WITH ASBESTOS RESTRICTIONS

STATE OF _________________________________________________) SS.

COUNTY OF _______________________________________________)

The undersigned Contractor, of lawful age, being first duly sworn, on oath says that:

A. Building materials or products incorporated or installed in the construction of 
   __________________________________________ School addition and/or remodel will be 
   free of asbestos containing materials or products of any kind.

B. Certification of Compliance with Asbestos Restrictions will be included in any sub-
   contract connected with the performance of work for this project.

C. Submit copy in O&M Manuals.

CONTRACTOR

By __________________________________________

_________________________________________
(Title)

SUBSCRIBED AND SWORN to before me this ________ day of ________________________ 2018.

_________________________________________
Notary Public

My Commission Expires:
SECTION 000191

CONTRACTORS QUALIFICATIONS STATEMENT

This form must be submitted seven (7) days prior to the bid date. All questions must be answered, the data must be clear and comprehensive, and must be signed and notarized. If not previously on file.

1. Name of Bidder: _________________________________________________________________

2. Permanent Main Office Address: ____________________________________________________

3. When organized: _________________________________________________________________

4. If incorporated, when and where ___________________________________________________

5. How many years have you been engaged in the contracting business under your present firm or trading name? ___________________________________________________________________

6. List 5 projects of similar size work, references with telephone numbers, cost of project and year completed:____________________________________________________________________

(1) Project: __________________________________________, Year: ______________
Cost: $________________________
Reference: _______________________, Phone: __________________________

(2) Project: __________________________________________, Year: ______________
Cost: $________________________
Reference: _______________________, Phone: __________________________

(3) Project: __________________________________________, Year: ______________
Cost: $________________________
Reference: _______________________, Phone: __________________________

(4) Project: __________________________________________, Year: ______________
Cost: $________________________
Reference: _______________________, Phone: __________________________

(5) Project: __________________________________________, Year: ______________
Cost: $________________________
Reference: _______________________, Phone: __________________________
7. Have you ever failed to complete any work awarded to you? Please explain.

8. Please state the size of your business:
   # of employees (total):

9. Are any of your job captains bilingual?

10. Financial Information:
    a. State the name of the bank with whom you do your principal business:

       | Name of Bank | Address | City, State | Phone Number |
       |-------------|---------|-------------|--------------|
       |             |         |             |              |
       |             |         |             |              |

    b. State 5 trade references with whom you do business:

       1. __________________________________________________________
       2. __________________________________________________________
       3. __________________________________________________________
       4. __________________________________________________________

________________________________________
President of Company

________________________________________
(Notary Public) (Date)

Affix Notary Seal
SECTION 000260

NO KICK-BACK STATEMENT

A duplicate of the following statement is required to be signed, notarized, and submitted with each and every copy of the AIA Document G702, “Application and Certificate for Payment”, that is presented to the Owner for payment.

STATE OF OKLAHOMA )
COUNTY OF TULSA )

The undersigned Contractor, of lawful age, being first duly sworn, an oath says that this invoice is true and correct. Affiant further states that the services as shown by the invoice have been completed in accordance with the contract. Affiant further states that he has made no payment directly or indirectly to any elected official, officer or employee of the State of Oklahoma, any county or local subdivision of the state, of money or any other things of value to obtain payment.

Contractor

(Title)

By

Subscribed and sworn to before me this __________ day of ________________, 2018.

Notary Public

My Commission Expires:

[SEAL]

END OF SECTION
SECTION 000270

OWNER / CONTRACTOR AGREEMENT

See Attached
SAMPLE AGREEMENT BETWEEN

OWNER AND CONTRACTOR

#         #

AGREEMENT made as of the _____ day of __________, 2018;

BETWEEN the Owner: INDEPENDENT SCHOOL DISTRICT NUMBER ONE OF TULSA COUNTY, OKLAHOMA
3027 South New Haven
Tulsa OK 74114

and the Contractor:

The Project is: ___________ @ Owner’s ___________

The Construction Manager: Trigon, Inc.
11345 East 60th Place
Tulsa, OK 74146
(918) 252-7162

The Architect is: GSHELMS & ASSOCIATES
424 E. Main St.
Jenks OK 74037
(918) 298-7257

The Owner and Contractor agree as set forth below.

ARTICLE 1
THE CONTRACT DOCUMENTS

1.1 The Contract Documents consist of this Agreement, the Conditions of the Contract (General, Supplemental and Other Conditions), Drawings, Specifications, Addenda issued prior to this Agreement, the Project Manual dated ________________, other documents listed in this Agreement and Modifications issued after Agreement with ________________________________ ( )
execution of this Agreement; these form the Contract and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than Modifications, appears in ARTICLE 8.

ARTICLE 2
THE WORK OF THIS CONTRACT

2.1 The Contractor shall execute the entire Work described in the Contract Documents for the _______ _________ Project, except to the extent specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3
DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

3.1 The date of commencement is the date from which the Contract Time in Paragraph 3.2 is measured, and shall be when Owner's Notice To Proceed (work order) is delivered to Contractor.

3.2 The Contractor shall achieve Substantial Completion of the entire Work in accordance with the time allotted in the Contractor’s bid in order for the entire Project to be completed no later than _________, subject to adjustments of this Contract Time as provided in the Contract Documents. Time is of the essence with respect to the Substantial Completion date.

ARTICLE 4
CONTRACT SUM

4.1 The Owner shall pay the Contractor in current funds for the Contractor's performance of the Contract the Contract Sum of _________ _________( ), subject to additions and deductions as provided in the Contract Documents.

4.2 The time of Substantial Completion is critical to Owner. Contractor's bid time for Substantial Completion has been a significant and material consideration in Owner’s decision to award the Contract to Contractor.

ARTICLE 5
PROGRESS PAYMENTS

5.1 Based upon Applications for Payment submitted to the Construction Manager by the Contractor and the Certificate of Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

5.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month. Applications for Payment shall be delivered to the Architect promptly thereafter.

5.3 The Owner shall make payment to the Contractor within THIRTY (30) days after Owner's receipt of the Application for Payment approved by the Architect.
5.4 Each Application for Payment shall be based upon the Schedule of Values submitted by the Contractor in accordance with the Contract Documents. The Schedule of Values shall allocate the entire Contract Sum, except unauthorized allowances, among the various portions of the Work and be prepared in such form and supported by such data to substantiate its accuracy as the Construction Manager or Architect may require. This Schedule, unless objected to by the Construction Manager or Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

5.5 Applications for Payment shall indicate the percentage of completion of each portion of the Work as of the end of the month covered by the Application for Payment.

5.6 Subject to the provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

5.6.1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the total Contract Sum allocated to that portion of the Work in the Schedule of Values, less retainage of ten percent (5%). The retainage will be reduced to five percent (5%) when the Work completed, as reflected in the Schedule of Values, equals fifty percent (50%). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute may be included as provided in Subparagraph 7.3.7 of the General Conditions even though the Contract Sum has not yet been adjusted by Change Order;

5.6.2 Add that portion of the Contract sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less retainage of ten percent (5%);

5.6.3 Subtract the aggregate of previous payments made by the Owner;

5.6.4 Subtract amounts, if any, for which the Construction Manager or Architect has not approved payment; and

5.6.5 Subtract liquidated damages, if any.

5.6.7 At any time the Contractor has completed in excess of fifty percent (50%) of the total Contract Sum, retainage shall be reduced to five percent (5%) of the amount earned to date if the Owner or Architect determines that satisfactory progress is being made and upon written approval of Contractor’s surety.

ARTICLE 6
FINAL PAYMENT

6.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when (1) the Contract has been fully performed by the Contractor except for the Contractor's responsibility to correct nonconforming Work as provided in Subparagraph 12.2.2 of the General Conditions and to satisfy other requirements, if any, which necessarily survive final payment; and (2) a final Certificate for Payment has been issued by the Architect; such final payment shall be made by the Owner not more than THIRTY (30) days after the issuance of the Architect’s final Certificate for Payment.

Agreement with ___________________________ ( )
ARTICLE 7
MISCELLANEOUS PROVISIONS

7.1 Where reference is made in this Agreement to a provision of the General Conditions or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

7.2 Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate of six percent (6%) per annum.

ARTICLE 8
ENUMERATION OF CONTRACT DOCUMENTS

8.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated as follows:

8.1.1 The Agreement is this Agreement Between Owner and Contractor.


8.1.3 The Special and other Conditions of the Contract contained in the Project Manual dated ________.

8.1.4 The Contractor's Proposal (Bid).

8.1.5 The Specifications contained in the Project Manual and the Addenda.

8.1.6 The Drawings:

8.1.7 The Addenda, as follows:

8.1.8 Other documents, if any, forming part of the Contract Documents are as follows:

8.1.8.1 Owner's Notice to Bidders

8.1.8.2 Owner's Instructions to Bidders

ARTICLE 9
BONDS, INSURANCE, INDEMNITY AND COMPLIANCE WITH LAWS

9.1 Before commencing the performance of its obligations hereunder, Contractor agrees to furnish Owner with the following at Contractor's expense: (i) a performance bond in an amount equal to the Contract Sum; (ii) a warranty bond in an amount equal to the Contract Sum for a period of one year from the date of completion of
the Work; and (iii) the payment bond in an amount equal to the Contract Sum, required by Oklahoma law in connection with contracts for the making of public improvements (tit. 61, (1991) O.S. § 1).

9.2 The surety providing the above bonds shall be listed in the most recent edition of U.S. TREASURY CIRCULAR 570 and be fully authorized to do business in Oklahoma.

9.3 Contractor agrees to carry worker's compensation insurance at its expense. Before commencing the performance of its services hereunder, Contractor agrees to furnish Owner with certificates of insurance coverage, naming Owner, Construction Manager and Architect as co-insureds as required by Article 11 of the Supplementary Conditions in the Project Manual. Each certificate shall require at least 10 days' notice to Owner, Construction Manager and Architect before cancellation of the coverage for any reason. Contractor agrees to maintain said insurance coverage in force during the entire term of this Agreement. In addition to such insurance, and not in lieu thereof, Contractor agrees to indemnify and hold Owner, Construction Manager, and Architect and their respective agents, employees and officers harmless (including defense costs) against any claim, demand or action arising from or growing out of Contractor's performance of the Work.

9.4 Contractor agrees to comply with all city, county, state and federal laws applicable to the Project.

9.5 Contractor acknowledges that Federal Executive Orders number 11246 as amended; Vietnam Era Veteran Readjustment Assistance Act, as amended (VEVRAA); and Section 503 of the Rehabilitation Act of 1973, as amended are incorporated herein by reference. Contractor shall not discriminate against any applicant for employment because of race, color, religion, gender, age, national origin, sexual preference, disability, veteran status or any other protected classification, and shall ensure that employees are treated during employment without regard to their race, color, religion, gender, age, national origin, disability, veteran status or any other protected classification. Contractor further agrees to fully comply with any and all laws, statutes, regulations, orders, and directives presently or hereafter imposed by local, state or federal governments, or any agencies thereof, with respect to nondiscrimination in employment, civil rights laws and fair employment practices, and mandated reporting requirements thereof.

9.6 Contractor shall take all safety precautions with respect to its Work as may be required by the U.S. Department of Labor Occupational Safety and Health Administration and shall be responsible for compliances with all safety rules and regulations in connection with all Work to be performed by Contractor on this project. Contractor shall indemnify Owner, Construction Manager, and Architect for any and all expenditures or obligations for expenditures made or imposed upon Owner for fines, penalties, counsel fees, expenses and costs of litigation and costs of corrective measures necessary to comply with rules, regulations or orders which result from acts of commission or omission by Contractor, its agents, employees, suppliers, Contractors, and assigns due to failure upon the part of any one or all of them to comply with such safety rules and regulations.

9.7 Contractor acknowledges that this contract has been or will be assigned to ______________, the Projects Construction Manager (""). Contractor agrees to prosecute the Work, and the several parts thereof at such times and in such order as (Construction Manager) considers necessary to keep the same sufficiently in advance of the other parts of the Project work and to avoid any delay in the completion of the Project as a whole. If Contractor:

a. fails or refuses to proceed with or to properly perform the Work as directed by , or

b. fails or refuses to properly perform or abide by any terms, covenants, conditions, or provisions contained in this Contract, or

c. fails or refuses to obey laws, ordinances, regulations, or other codes of conduct,

shall notify Contractor, in writing, of Contractor’s failure to comply. If determines that Contractor has not remedied and cured the event(s) of default in Contractor’s performance within three (3) days of the written notification, then

Agreement with ____________________________ ( )
(Construction Manager) may, at its option, without releasing or waiving its rights and remedies against Contractor or Contractor’s sureties and without prejudice to any other right may be entitled to hereunder or by law, terminate this Contract and take possession of the Work and all materials, tools, equipment and appliances of Contractor and finish Contractor’s work by whatever means, method, or agency which may, in its sole discretion, choose. In the alternative, without terminating this Contract, (Construction Manager) may, at its option, without releasing or waiving its rights and remedies against Contractor or Contractor’s sureties and without prejudice to any other right (Construction Manager) may be entitled to hereunder or by law, take any steps (Construction Manager) deems advisable to secure any labor, materials, equipment, and services, and shall have a lien on and may take over all of Contractor’s equipment, tools, appliances, and materials and may prosecute the Work to completion. In the event that (Construction Manager) deems any of the foregoing remedies necessary, Contractor agrees that Contractor shall not be entitled to receive any further payment until after the Project shall have been completed. Moreover, all monies expended and all of the costs, losses, damages and extra expenses, including all management, administrative, and other overhead and other direct and indirect expenses (including without limitation attorney’s fees), incurred by (Construction Manager) incidental to such termination or completion, shall be deducted from the Contract sum herein stated, and if such expenditures, together with said costs, losses, damages, and extra expenses, exceed the unpaid balance of the Contract sum, the Contractor agrees to pay immediately to , on demand, the full amount of such excess, including costs of collection, attorney’s fees, and interest thereon at the maximum legal rate of interest per annum until paid. An itemized statement thereof or the checks or other evidence of payments shall be prima facie evidence of the fact and extent of Contractor’s liability. Furthermore, (Construction Manager) may reconcile and pay any Contractor debts which should arise out of this Contract with monies due under any other contracts between (Construction Manager) and the Contractor.

ARTICLE 10
EMPLOYEE CRIMINAL CONVICTIONS

10.1 The Contractor will not allow any employee to work on school premises on a full-time or part-time basis, which work would not otherwise be performed by Owner employees, if the employee is convicted in this state, the United States or another state of any felony offense, unless ten (10) years have elapsed since the date of the criminal conviction or the employee has received a Presidential or Gubernatorial pardon for the criminal offense.

10.2 No employee of the Contractor who performs any Work on Owner’s property is currently registered under the Oklahoma Sex Offenders Registration Act or the Mary Rippy Violent Crime Offenders Registration Act.

10.3 As a condition to payments, the Contractor will furnish a signed statement declaring that no employee working on Owner’s property under the authority of the Contractor is in violation of the provisions of this Article. The signed statement referred to in this Section will be furnished as required from time to time by the Owner/District. Owner’s form of the signed statement will be used.

10.4 The Contractor agrees to obtain similar compliance statements from all Contractors on the Project with reference to employees of the Contractors.

10.5 If the Contractor is convicted of a violation of tit. 57, O.S. (1998 Supp.) § 589, Owner may terminate this Contract.
This Agreement is entered into as of the date first above written.

**CONTRACTOR:**

_________________________________

By_________________________________

Printed Name and Title

Contractor’s Tax ID #:

_________________________________

Date of signature

**OWNER:**

INDEPENDENT SCHOOL DISTRICT NUMBER ONE OF TULSA COUNTY, OKLAHOMA

By_________________________________

President

[OK as to Form: ______]
SECTION 011000

PART 1    GENERAL

SUMMARY

1.01 PROJECT

A. Project Name: Tulsa Public Schools
   MacArthur Elementary School
   Classroom Addition
   2182 S. 73rd E. Ave.
   Tulsa, OK

B. Owner: Tulsa Public Schools, ISD #1
   3027 S. New Haven Ave.
   Tulsa, Oklahoma 74114

C. Architect: GSHELM & Associates, LLC
   424 E. Main St.
   Jenks, OK  74037
   918-298-7257

D. Construction Manager: Trigon General Contractors & Construction Managers, Inc.
   11345 E. 60th Pl.
   Tulsa, OK  74146
   918-252-7162

E. The Project consists:
   1. New addition consisting of seven classrooms, renovated office area and new parking lot.
   2. Four classrooms shall be a FEMA Community Safe Room.
   3. Work will include demolition, site utilities, site paving, cast-in-place concrete walls, interior
      gypsum wallboard assemblies, restrooms, HVAC, multi-ply roofing, structural steel,
      masonry, etc.

1.02 OWNER OCCUPANCY

A. Owner will occupy the school facility during construction.

B. Project Areas are located within and adjacent to existing Classroom Buildings that shall be
   protected during construction.

C. This project shall be completed during the Districts summer break and fall / spring school
   semesters. Contractors shall coordinate construction schedule / activities with Construction
   Manager, Architect and Owner.

1.03 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

B. Arrange use of site and premises to allow:
   1. Work by Others.
   2. Work by Owner.

C. Staging areas shall be coordinated with Owner, Architect and Construction Manager.

END OF SECTION
SECTION 012300

ALTERNATES

PART 1 GENERAL

1.01 SUMMARY

A. This section identifies the various Alternates to be bid as part of this project. It describes the general changes to be included in the project if the Alternate is made a part of the Work. The Alternates can only be made part of the Work by specific inclusion in the Owner-Contractor Agreement or by Change Order.

B. Each Alternate will be reviewed by the Owner and the Architect and either accepted or rejected at the Owner's decision.

C. Alternate Bid prices shall remain in effect for 90 days beyond date of execution of the Owner-Contractor Agreement.

D. Alternate Bid prices shall be included in the spaces provided on the Bid Form. All Alternates must be bid, or the Bid may be rejected.

E. Owner retains all rights to choose any one, combination of, or none of the alternates.

1.02 DESCRIPTION OF ALTERNATES

A. ALTERNATE #1 – CAST IN PLACE CONCRETE EXTERIOR WALLS

Provide cost to construct exterior walls between Grid Lines E & N of Cast-In-Place concrete in Insulating Concrete Forms (6” thick) in lieu of structural steel columns, beams and metals studs. Refer to Sheet A5.7 for additional information regarding the work required in this Alternate.

B. ALTERNATE #2 – INTERIOR RENOVATION OF OFFICES & CLASSROOMS

Provide cost to perform work associated with the renovation of the existing office area and sixth grade classrooms. Refer to Sheets D1.1, A0.5, A1.0 and A1.2 for additional information regarding work required in this Alternate.

PART 2 NOT USED

PART 3 NOT USED

END OF SECTION
PART 1  GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

1.02 SCHEDULE OF VALUES

A. Submit a printed schedule on AIA Form G703 - Application and Certificate for Payment Continuation Sheet. Contractor's standard form or electronic media printout will be considered.

B. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.

1.03 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in Agreement Between Owner and Contractor.

B. Present required information in typewritten form.

C. Form: AIA G702 Application and Certificate for Payment and AIA G703 - Continuation Sheet using continuation sheets when required. Any other form submitted must be pre-approved by Broken Arrow Public Schools.

D. Execute certification by signature of authorized officer.

E. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored Products.

F. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work.

G. Submit three copies of each Application for Payment.

H. Include the following with the application:

1. Transmittal letter as specified for Submittals.
2. Partial release of liens from major Subcontractors and vendors.

I. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of Certificate for Payment submitted. Show application number and date, and line item by number and description.

1.04 MODIFICATION PROCEDURES

A. Architect will advise of minor changes in the Work not involving an adjustment to Contract Sum or Contract Time as authorized by the Conditions of the Contract by issuing supplemental instructions on AIA Form G710.

B. Construction Change Directive: Architect may issue a document, signed by Broken Arrow Public Schools, instructing Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. The document will describe changes in the Work, and will designate method of determining any change in Contract Sum or Contract Time.
2. Promptly execute the change in Work.

C. Proposal Request: Architect may issue a document which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 10 days.

D. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 016000.

E. Computation of Change in Contract Amount:
   1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor’s price quotation.
   2. For change requested by Contractor, the amount will be based on the Contractor’s request for a Change Order as approved by Architect.
   3. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor’s substantiation of costs as specified for Time and Material work.

F. Substantiation of Costs: Provide full information required for evaluation.
   1. On request, provide following data:
      a. Quantities of products, labor, and equipment.
      b. Insurance, and bonds.
      c. Overhead and profit. (max 10% for sub contractor and 5% for general contractor)
      d. Justification for any change in Contract Time.
      e. Credit for deletions from Contract, similarly documented.
   2. Support each claim for additional costs with additional information:
      a. Origin and date of claim.
      b. Dates and times work was performed, and by whom.
      c. Time records and wage rates paid.
      d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.

G. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract on AIA G701.

H. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

I. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

J. Promptly enter changes in Project Record Documents.

1.05 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
   1. All closeout procedures specified in Section 017800.
2. Submit Consent of Surety.

PART 2  PRODUCTS - NOT USED

PART 3  EXECUTION - NOT USED

END OF SECTION
SECTION 013000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preconstruction meeting.
B. Progress meetings.
C. Construction progress schedule.
D. Submittals for review, information, and project closeout.
E. Number of copies of submittals.
F. Submittal procedures.

1.02 RELATED SECTIONS

A. Section 017300 - Execution
B. Section 017800 - Closeout Submittals: Project record documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Architect and Construction Manager will schedule a meeting after Notice of Award.

B. Attendance Required:
   1. Tulsa Public Schools' designated Representative.
   3. Construction Manager.
   4. Contractor's Project Manager.
   5. Contractor's Jobsite Superintendent for this project.

C. Agenda:
   1. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
   2. Designation of personnel representing the parties to Contract, Construction Manager and Architect.
   3. Procedures and processing of field decisions, submittals, substitutions, applications for payment, proposal requests, Change Orders, and Contract closeout procedures.
   4. Scheduling.

D. Construction Manager shall record minutes and distribute copies to Tulsa Public Schools, Architect, Attendees and affected parties.
3.02 PROGRESS MEETINGS

A. Owner, Construction Manager and Architect shall schedule and administer meetings throughout progress of the Work at weekly intervals.

B. Attendance Required: Job superintendent, major Subcontractors and suppliers, Tulsa Public Schools' Representative, Construction Manager, Architect and Consultants as appropriate to agenda topics for each meeting.

C. Agenda:
   1. Review minutes of previous meetings.
   2. Review of Work progress during the past period.
   3. Field observations, problems, and decisions.
   4. Identification of problems which impede planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of off-site fabrication and delivery schedules.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding work period.
  10. Maintenance of quality and work standards.
  11. Effect of proposed changes on progress schedule and coordination.
  12. Other business relating to Work.

D. Construction Manager shall record minutes and distribute copies to Tulsa Public Schools, Architect, Attendees and affected parties.

3.03 CONSTRUCTION PROGRESS SCHEDULE

A. Construction Manager shall prepare a Construction Schedule.

3.04 SUBMITTALS FOR REVIEW

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

B. Submit to Construction Manager and Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

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

D. After review, provide copies in accordance with NUMBER OF COPIES OF SUBMITTALS article below. Distribute in accordance with SUBMITTAL PROCEDURES article below, and for record documents purposes described in Section 017800 - CLOSEOUT SUBMITTALS.

3.05 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.
6. Manufacturer’s field reports.

3.06 SUBMITTALS FOR PROJECT CLOSEOUT

A. When the following are specified in individual sections, provide approved copies at project closeout:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   5. Other types as indicated.
   6. Submit for Tulsa Public Schools’ benefit during and after project completion.

3.07 NUMBER OF COPIES OF SUBMITTALS

A. Documents for Review:
   1. Small Size Sheets, Not Larger Than 8-1/2 x 11 inches: Submit the number of copies which the Contractor requires, plus two copies which will be retained by the Architect, plus one copy to be retained by the Construction Manager.
   2. Larger Sheets, Not Larger Than 30 x 42 inches: Submit the number of opaque reproductions which Contractor requires, plus two copies which will be retained by Architect, plus one copy to be retained by the Construction Manager.

B. Documents for Information: Submit two copies.

C. Documents for Project Closeout: Make one reproduction of reviewed submittal. Submit one extra of submittals for information.

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

3.08 SUBMITTAL PROCEDURES

A. Transmit each submittal with approved form.

B. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetical suffix.

C. Identify Project, Contractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.

D. Apply Contractor’s stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

E. Deliver submittals to Construction Manager at business address.

F. Schedule submittals to expedite the Project, and coordinate submission of related items.

G. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.

H. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.
I. Provide space for Construction Manager and Architect review stamps.

J. When revised for resubmission, identify all changes made since previous submission.

K. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

L. Submittals not requested will not be recognized or processed.

END OF SECTION
SECTION 014000
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.

2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.

3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

4. Specific test and inspection requirements are not specified in this Section.

C. Related Requirements:
   1. Section 011000 – Summary
   2. Section 017300 – Execution

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect or Construction Manager.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For testing agencies specified in “Quality Assurance” Article to determine their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.6 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Contractor-performed tests and inspections cannot be performed by the special inspector.
2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."

C. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and re-inspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.8 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented
according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
   1. Contractor responsibilities include the following:
      a. Provide test specimens representative of proposed products and construction.
      b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
      c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
      d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
      e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
      f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
   2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and Owner, with copy to Contractor and to authorities having jurisdiction. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

K. Special Inspector: Special Inspectors shall meet the more stringent of the qualifications listed in this section and the requirements listed in the Statement of Special Inspections submitted to the Authority Having Jurisdiction on this site or otherwise required by the Authority Having Jurisdiction.

L. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
   2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
   3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
   4. Demonstrate the proposed range of aesthetic effects and workmanship.
   5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
      a. Allow seven days for initial review and each re-review of each mockup.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed unless otherwise indicated.

M. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

1.9 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
   1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
   2. Payment for these services will be made from testing and inspecting allowances.
   3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
   1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
   2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
      a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
   3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
   4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
   6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting / Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.

3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.

5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.

6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.

2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.

4. Facilities for storage and field curing of test samples.

5. Delivery of samples to testing agencies.

6. Preliminary design mix proposed for use for material mixes that require control by testing agency.

7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor’s quality-control plan. Coordinate and submit concurrently with Contractor’s construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: It will be the owner’s responsibility to contract for special inspections to conduct special tests and inspections required by authorities having jurisdiction as follows:

1. Verifying manufacturer’s certification by submittal of documentation.

2. Notifying Architect, Owner and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.

3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Owner, with copy to Contractor and to authorities having jurisdiction.

4. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.

5. Retesting and reinspecting corrected work.

6. Submitting a final report of special tests and inspections at Substantial Completion, which shall include descriptions of satisfactory resolutions achieved for all previously reported deficiencies.
PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
2. Protect construction exposed by or for quality-control service activities.
3. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION
SECTION 016000

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.
B. Transportation, handling, storage and protection.
C. Product option requirements.
D. Substitution limitations and procedures.
E. Spare parts and maintenance materials.

1.02 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
B. Shop Drawing Submittals: Prepared specifically for this Project.
C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.
   2. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

PART 2 PRODUCTS

2.01 PRODUCTS

A. Provide interchangeable components of the same manufacture for components being replaced.
B. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.
C. Cord and Plug: Provide minimum 6 foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

2.02 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
B. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions:
Submit a request for substitution for any manufacturer not named at least ten (10) days prior to bid date. Approvals of substitution request are not valid unless noted by Addendum issued prior to bid date.

2.03 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Provide spare parts, maintenance, and extra products of types and in quantities specified in individual specification sections.

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

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

C. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Will provide the same warranty for the substitution as for the specified product.
   3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Tulsa Public Schools.
   4. Waives claims for additional costs or time extension which may subsequently become apparent.
   5. Will reimburse Tulsa Public Schools, and Architect for review or redesign services associated with re-approval by authorities.

D. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

E. Substitution Submittal Procedure:
   1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
   2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
   3. The Architect will notify all bidders in writing of decision to accept or reject request.

3.02 TRANSPORTATION AND HANDLING

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

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

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.
3.03 STORAGE AND PROTECTION

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

B. Store with seals and labels intact and legible.

C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

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

E. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

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

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

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

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

END OF SECTION
PART 1  GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.
B. Pre-installation meetings.
C. Cutting and patching.
D. Surveying for laying out the work.
E. Cleaning and protection.
F. Starting of systems and equipment.
G. Demonstration and instruction of Tulsa Public Schools personnel.
H. Closeout procedures, except payment procedures.

1.02 SUBMITTALS

A. Cutting and Patching: Submit written request in advance of cutting or alteration which affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   5. Work of Tulsa Public Schools or separate Contractor.

1.03 PROJECT CONDITIONS

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
B. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere.
C. Noise Control: Provide methods, means, and facilities to minimize noise from workers and noise produced by construction operations.
D. Pest Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
E. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.
F. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.
1.04 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate with Construction Manager work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

C. Coordinate space requirements, supports, and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

E. Coordinate completion and clean-up of work of separate sections.

F. After Tulsa Public Schools’ occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Tulsa Public Schools’ activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 016000.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Beginning new work means acceptance of existing conditions.

B. Verify that demolition is complete in alterations areas and areas are ready for installation of new work.

C. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

D. Examine and verify specific conditions described in individual specification sections.

E. Verify that utility services are available, of the correct characteristics, and in the correct
locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Cut, move, or remove items as necessary for access to alterations and renovation work. Replace and restore at completion.

B. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished work.

C. Remove debris and abandoned items from area and from concealed spaces.

D. Close openings in exterior surfaces to protect existing work and salvage items from weather and extremes of temperature and humidity. Insulate ducts and piping to prevent condensation in exposed areas.

E. Prepare surfaces and remove surface finishes to provide for proper installation of new work and finishes.

F. Clean substrate surfaces prior to applying next material or substance.

G. Seal cracks or openings of substrate prior to applying next material or substance.

H. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PRE-INSTALLATION MEETINGS

A. When required in individual specification sections, coordinate with Construction Manager and Architect a pre-installation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Construction Manager and Architect at least four days in advance of meeting date.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Construction Manager, Tulsa Public Schools’ Representative, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Promptly notify Construction Manager and Architect of any discrepancies discovered.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install Products as specified in individual sections.

B. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new Work abuts or aligns with existing, perform a smooth and even transition.

C. When existing finished surfaces are cut so that a smooth transition with new work is not
possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.

D. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.

E. Refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent finishes.

F. Re-cover and refinish work that exposes mechanical and electrical work exposed accidentally during the work.

3.06 CUTTING AND PATCHING

A. Execute cutting and patching including excavation and fill to complete the work, to uncover work to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit Products together to integrate with other work.

B. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

C. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

D. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

E. Restore work with new Products in accordance with requirements of Contract Documents.

F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

G. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material, to full thickness of the penetrated element.

H. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

I. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections. Repair substrate prior to patching finish. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.07 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
D. Collect and remove waste materials, debris, and rubbish from site periodically and dispose off-site.

3.08 PROTECTION OF INSTALLED WORK

A. Protect installed work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

3.09 STARTING SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Construction Manager, Architect and Owner's representative seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

A. Demonstrate operation and maintenance of Products to Tulsa Public Schools' personnel two weeks prior to date of Substantial Completion. Provide documentation stating Tulsa Public Schools' personnel was properly trained, and signed by the Tulsa Public Schools personnel who was trained.

B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

C. For equipment or systems requiring seasonal operation, perform demonstration for other
season 30 days prior to the start of that season.

D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.

E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Tulsa Public Schools’ personnel in detail to explain all aspects of operation and maintenance.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

3.11 ADJUSTING

A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

B. Testing, adjusting, and balancing HVAC systems: See Division 15 and Section 01400.

3.12 FINAL CLEANING

A. The Contractor shall be responsible for damaged or broken glass and at completion of the Work shall replace such damaged or broken glass.

B. Execute final cleaning following completion of the Work and prior to Substantial Completion. Final cleaning shall consist of no less than the following:
   1. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
   2. Remove all temporary protections.
   3. Remove marks, stains, fingerprints and other soil or dirt from all surfaces and other work.
   4. Remove spots, mortar, plaster, soil and paint from ceramic tile, marble and other finish materials from all surfaces and other work.
   5. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
   6. Clean fixtures, cabinets and other casework and equipment by removing any and all stains, paint, dirt, etc., and leave in an undamaged and new condition.
   7. Dust all walls that exhibit dust as was created by performance of this Work.
   8. Replace filters of operating equipment.
   9. Clean debris from roofs, gutters, downspouts, and drainage systems.
  10. Clean site; sweep paved areas, rake clean landscaped surfaces.
  11. Remove waste and surplus materials, rubbish, and construction facilities from the site.
  12. ALL surfaces and other work to be cleaned in accordance with recommendations of the manufacturer of the surface and/or equipment being cleaned.

3.13 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect and Construction Manager.

B. Notify Construction Manager and Architect when work is considered ready for Substantial Completion.

C. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for General Contractor’s and Architect’s review.
D. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Tulsa Public Schools occupied areas.

E. Notify Construction Manager and Architect when work is considered finally complete.

F. Complete items of work determined by Owner’s, Construction Manager’s and Architect’s final inspection.

END OF SECTION
SECTION 017800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.
B. Operation and Maintenance Data.
C. Warranties and bonds.

1.02 SUBMITTALS

A. Project Record Documents: Submit documents to Construction Manager and Architect with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Construction Manager and Architect will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Tulsa Public Schools, submit completed documents within ten days after acceptance.
   3. Submit 1 copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Construction Manager and Architect comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Tulsa Public Schools' permission, submit documents within ten days after acceptance.
   2. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Tulsa Public Schools.
C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   2. Field changes of dimension and detail.
   3. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Additional information as specified in individual product specification sections.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

E. Provide servicing and lubrication schedule, and list of lubricants required.

F. Include manufacturer's printed operation and maintenance instructions.

G. Include sequence of operation by controls manufacturer.

H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

I. Provide control diagrams by controls manufacturer as installed.

J. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

K. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

L. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

M. Include test and balancing reports.

N. Additional Requirements: As specified in individual product specification sections.

3.05 OPERATION AND MAINTENANCE MANUALS

A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

B. Prepare data in the form of an instructional manual.

C. Binders: Commercial quality, 8-1/2 x 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.

F. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.

G. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

H. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.

I. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone
numbers of Subcontractors and suppliers. Identify the following:
   a. Significant design criteria.
   b. List of equipment.
   c. Parts list for each component.
   d. Operating instructions.
   e. Maintenance instructions for equipment and systems.
   f. Maintenance instructions for special finishes, including recommended cleaning
      methods and materials, and special precautions identifying detrimental agents.

3. Part 3: Project documents and certificates, including the following:
   a. Shop drawings and product data.
   b. Air and water balance reports.
   c. Certificates.
   d. Photocopies of warranties and bonds.

J. Provide a listing in Table of Contents for design data, with tabbed dividers and space for
   insertion of data.

K. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of
   Architect, Consultants, Construction Manager and Contractor with name of responsible parties;
   schedule of products and systems, indexed to content of the volume.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers,
   and manufacturers, within ten days after completion of the applicable item of work. Except for
   items put into use with Tulsa Public Schools' permission, leave date of beginning of time of
   warranty until the Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

END OF SECTION
SECTION 018000
PROJECT SIGN

PART 1  GENERAL

1.01  DESCRIPTION
A. Project sign identifying Owner, Project Name, Architect, Consultants and Contractor

PART 2  PRODUCTS

2.01  MATERIALS
A. Four feet by Eight feet sheet of overlayed plywood
B. Primer Coat compatible with finish paint material
C. Finish Colors and Text shall be provided by Owner and Architect.

PART 3  EXECUTION

3.01  INSTALLATION
A. Install sign in accordance with all laws and codes.
B. Field locate sign location with Owner, Construction Manager and Architect prior to installation.
C. Erect sign plumb and level.

3.02  MAINTENANCE
A. Maintain sign plumb and level for the duration of the project.
B. Maintain vegetation around sign (weed killer, trimming, mowing, etc.) in good condition.

3.03  REMOVAL
A. At completion of project, remove sign from property.

END OF SECTION
SECTION 023610

TERMITE CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Treatment of soil against subterranean termites in area of new building slab and around entire building perimeter.

1.02 QUALITY ASSURANCE

A. Soil treatment shall be performed by a reliable, licensed commercial termite control firm with a minimum of 5 years experience.
B. Soil treatment shall be applied in accordance with all applicable codes.

1.03 WARRANTEE

A. Contractor shall submit the following warrantee upon completion of soil treatment:
   1. Warrant that the soil treatment shall be effective against subterranean termite infestation for a minimum of 5 years. Any re-infestation within this time period shall require re-treatment at no cost to the Owner.
   2. Warrant that the chemical used, and amount used, complies with all federal, state and local requirements.

PART 2 PRODUCTS

2.01 TREATMENT

A. Termite control products shall bare an EPA-registered label.
B. Termiticide Treatment
   1. Provide an EPA-registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's label.
   2. Active Ingredient: 40% Disodium Octaborate Tetrahydrate (DOT)
   3. Penetrant: Glycol mixture

PART 3 EXECUTION

3.01 APPLICATION

A. Treatment shall not be made immediately after heavy rains or when soil is excessively wet.
B. Treatment shall be made in such a manner to assure against contamination of adjacent areas.
C. Treatment shall be applied as follows:
   1. Mix termiticide treatment solution to a uniform consistency. Provide quantity required for application at label volume and rate for the maximum specified concentration of termiticide, according to the manufacturer’s EPA-registered label. Apply to create a continuous horizontal barrier. Distribute treatment evenly.

END OF SECTION
SECTION 024119
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Related Documents:
   1. Drawings and general provisions of the Subcontract apply to this Section.
   2. Review these documents for coordination with additional requirements and information that apply to work under this Section.

B. Section Includes: Selective demolition as follows:
   1. Remove architectural, structural, plumbing, fire protection, mechanical and electrical materials and equipment as indicated or required for new construction.
   2. Sawcut and remove concrete for drains, plumbing piping, etc. and where necessary to prepare for subsequent work.
   3. Cut and patch roof for new roof curbs, and mechanical and electrical items.
   4. Remove materials from site, and dispose of legally.
   5. Disconnect, remove, cap and identify utilities for later reconnection.

1.2 SUBMITTALS

A. Shop Drawings: Indicate areas for demolition, removal sequence, and location of salvageable items; location and construction of temporary Work.

B. Project Record Documents: Accurately record locations of capped utilities, subsurface obstructions, and other items that may require future locating.

C. Shoring Design: Demolition Contractor shall be responsible for retaining the services of a professional engineer, licensed in the State of Oklahoma, to design temporary shoring of existing structure when shoring is necessary. Shoring drawings shall be signed and sealed by the professional engineer responsible for the shoring design.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with requirements of applicable codes, rules and regulations referenced in Division 01 Section "General Requirements"
   2. Obtain required permits from applicable authorities.
   3. Do not close or obstruct roadways or sidewalks without permits.
   4. Utility Shutdowns: Comply with requirements of Division 01
   5. Maintain building and room egress and access at all times. Do not reduce required egress width to exits.
   6. Minimize interference with corridors, exits, sidewalks, roadways and public thoroughfares.
   7. Comply with applicable procedures if hazardous or contaminated materials are discovered or suspected.
1.4 MATERIALS OWNERSHIP

A. Unless noted specifically to be returned to Owner or to be reused or relocated, all demolition material shall be removed from the site and disposed of properly at a landfill suitable for the debris.

B. Existing materials in area of Project identified to be relocated or returned to Owner, shall be relocated by contractor to Owner’s designated location.

1.5 PROJECT CONDITIONS

A. Protect adjacent work to remain, and items to be turned over to Owner, from damage.

B. Existing Conditions:
   1. If asbestos or other hazardous materials are found or suspected, immediately stop work in the suspected area and advise the Construction Manager. Do not recommence work in the area until advised by the Construction Manager that the area has been cleared for work.

C. Owner will occupy adjacent areas during the course of the Work. Work under this Section shall not affect Owner’s operation of adjacent areas.

1.6 SEQUENCING

A. Submit schedule indicating proposed sequence of operations for selective demolition work to Construction Manager for review prior to start of work. Include coordination for shutoff, capping, and continuation of utility services, and details for dust and noise control.
   1. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner’s operations.
   2. Coordinate the scheduling of work of this Section with the work of other sections.

B. At re-roofing and roof tie-in locations, do not remove more roof at a time than can be reroofed in one day.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect and verify the existing conditions and become familiar with the extent of the Work.

B. Examine the site to determine proper access within the limitations of the site. Conduct operations so as not to interfere with adjacent roads, driveways, walks, buildings, corridors, means of access and egress, and work areas.
3.2 PREPARATION

A. Interfaces With Other Work: Coordinate extent of selective demolition work with limits of new work and existing work to remain, and with demolition and modification requirements shown on the Drawings.

B. Protection:
1. Protect existing materials, appurtenances and equipment which are not to be demolished. Existing materials, appurtenances and equipment, building exterior and interior, and landscaping altered or damaged during demolition work shall be repaired or replaced by the contractor to match existing undisturbed conditions at no additional cost to Owner.
2. Prevent movement of structure; provide bracing and shoring as required.
3. Provide proper and permanent support to adjacent structure for all piping, conduits and cables to remain.
4. Construction Manager shall provide and maintain temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage, or wind damage occurs to structure or interior areas of existing building.
5. Construction Manager shall provide and maintain temporary barriers and security devices. Barriers shall be one-hour fire-rated at exit corridors.
6. Use periodic light water mist, temporary enclosures, and other suitable methods to limit dust and dirt. Comply with applicable environmental protection regulations. Use water only if approved by Construction Manager.
7. Maintain path of travel for debris removal dust free and clean at all times.
8. Maintain ventilation system dust free at all times.
9. Cover and protect windows and walls that are adjacent to areas to be demolished.
10. Protect smoke alarms and fire sprinklers from dust intrusion.
11. Maintain parking areas, driveways, exterior walkways, exit paths, and landscaping in a clean, undisturbed condition. Any debris caused by selective demolition work shall be removed each day.

C. Field verify the exact location of existing concealed utilities. Use caution if working in or about concealed or exposed utilities.

D. Disconnect, remove, and cap designated utility lines within demolition areas. Mark locations of disconnected utilities. Identify utilities and indicate capping locations on Project Record Documents.

3.3 EXECUTION

A. Minimize interference with adjacent occupied areas, materials and equipment, and as required to allow Owner’s continued use of the facilities.

B. Remove items in an orderly and careful manner.
1. Remove only as much material as is required for new construction work to be conveniently performed.
2. Cut surfaces so as to minimize the amount of new surfaces required to match existing. Make cuts plumb, true, level and straight, or as otherwise required to provide proper surfaces to receive new work and repairs.
3. Cut asphalt and concrete by power saw in neat, sharp straight lines. Repair broken edges or as directed by Construction Manager.
C. Remove miscellaneous abandoned appurtenances that will be exposed to view, unless indicated otherwise.

D. Investigate and measure the nature and extent of unanticipated items that conflict with intended function or design. Submit written report with accurate detailed information to Construction Manager. While awaiting instructions, rearrange selective demolition schedule as necessary to continue overall job progress without delay.

E. Stop work and notify Construction Manager immediately if structure or other items to remain appear to be endangered. Do not resume work until directed by Construction Manager.

F. Do not disrupt service to existing fire sprinkler lines. If disruption becomes necessary, coordinate with Owner and Construction Manager.

G. Cover roof penetrations with plywood and visqueen to provide a weathertight enclosure until roof equipment is completely installed and roofing work in the area can be completed the same day.

H. Remove, store and protect materials to be re-installed or retained so as to prevent damage.

I. Remove and promptly dispose of vermin infested materials.

J. During torching, welding or any other construction activity that generates sparks or intense heat, the Contractor shall provide adequate fire protection to the existing structure and contents. As a minimum, Contractor shall remove combustibles from areas or torching or welding; provide fireproof blankets and shields to contain sparks where combustibles cannot be removed; provide a fire safety observer with a fire extinguisher during torching or welding operations.

3.4 DISPOSAL AND CLEANUP

A. Material removed under this Contract which is not to be salvaged or reused in the Project shall become the property of the Contractor and shall be promptly removed from the site. Do not store or permit debris to accumulate at the site.

B. Upon completion, clean the entire area of demolition residue satisfactory for the continuation of the Work. Remove temporary work.

END OF SECTION
SECTION 031119

INSULATING CONCRETE FORMING

PART 1 – GENERAL

1.01 OVERVIEW

A. Compliance with Division 1 – General Requirements.
B. Design, supply and installation of Insulating Concrete Forms (ICFs) having an insulation value of R-28 or more for structural cast-in-place concrete walls; installation of reinforcing steel bars, rough openings, embedded fasteners, sleeves and conduit; and placement of concrete within the ICFs.
C. Supply, install, and remove adequate temporary false work, bracing, and scaffolding complying with all applicable codes and regulations.

1.02 SCOPE OF WORK

Furnish all labor, materials, tools and equipment to perform:

A. Delegated Design:  ICF contractor shall be responsible for engineering of system to meet specified design loads.
B. Installation of ICFs for R-28 walls (or better),
C. Installation of reinforcing steel within ICFs,
D. Installation of rough openings, embedded anchors, conduit and similar in ICFs,
E. Installation, adjustment, and removal of temporary false work, bracing, scaffolding,
F. Placement of concrete into ICFs
G. Final cleanup & related tasks.

1.03 MATERIALS / PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

A. Reinforcing steel
B. Concrete
C. Hold-downs and anchors
D. Bolts, sleeves, inserts, and hangers
E. Sleeves, conduit, utility penetrations
F. Window and door opening bucks

1.04 ALTERNATES

Alternate materials are materials not complying with all the specifications within this Section. Alternate materials are to be approved by the architect and engineer of record prior to bidding.

1.05 RELATED SECTIONS

A. Section 032000 – Reinforcing Steel
B. Section 033000 – Cast-in-Place Concrete
C. Section 051200 – Structural Steel Framing

1.06 REFERENCES

A. Acronyms & Definitions:
   1.  ICF or ICFs: Acronym for “Insulating (or Insulated) Concrete Form(s)”
   2.  EPS: Acronym for “Expanded Polystyrene” treated with a flame-retardant when referring to the foamed plastic insulation boards of the ICF system.
3. **ICF Bracing System**: a concrete form alignment & scaffolding system designed specifically for use with Insulating Concrete Forms.

4. **Window or Door Opening Buck**: a pre-manufactured or site-built frame assembly used to form a rough opening within the ICF walls by restricting concrete. If left in place, the frame also provides subsequent anchorage and attachment surfaces for doors and windows within the wall assembly.

5. **ICF Installer**: a installation subcontractor responsible for the ICF system installation

B. **Reference Standards**:
   1. American Concrete Institute (ACI)
      a. ACI 301 - Standard Specification for Structural Concrete
      b. ACI 309 - Guide for Consolidation of Concrete
      c. ACI 318 - Building Code Requirements for Reinforced Concrete
      d. ACI 332 - Guide to Residential Cast-in-Place Concrete Construction
      e. ACI 347 - Guide to formwork for Concrete
   2. International Code Council (ICC & ICC-ES)
      a. International Building Code (IBC)
      b. International Energy Conservation Code (IECC)
      c. AC12 - Acceptance Criteria for Foam Plastic Insulation
      d. AC15 - Concrete Floor, Roof and Wall Systems
      e. AC353 - Acceptance Criteria for Stay-In-Place, Foam Plastic Insulating Concrete Form (ICF) Systems For Solid Concrete Walls
   3. National Fire Protection Association (NFPA)
      a. ASTM E2634 - Standard Specification for Flat Wall Insulating Concrete Form (ICF) Systems  
         [referencing various other ASTM Standards]
      b. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
         [referencing various other ASTM Standards]
      c. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials

1.07 **ADMINISTRATIVE REQUIREMENTS**

A. Contractor shall ensure that all materials listed under Sub-Section 1.03 are supplied to **ICF Installer** prior to starting work under this Section.

B. Contractor shall ensure that footings/slabs are within specifications (especially smooth and level to within ¼-inch, step-heights in consideration of ICF’s form size, sufficient widths) and that placement, spacing, and sizes of anchor dowels from concrete footings/slabs conform to design requirements and in consideration of ICF’s form size.

C. Pre-Construction Meeting:
   1. Prior to commencing footings/slab work, Contractor shall convene meeting(s) at the project site, to include the **ICF Installer** and trades responsible for installing footings/slabs, steel reinforcement, false work, scaffolding, concrete, and other trades responsible for installation work that interfaces with ICF walls (floors/roofs, windows/doors, interior and exterior finishes, damp/waterproofing, backfill) or involves ICF formwork modification (e.g. electricians, plumbers, HVAC).

1.08 **SUBMITTALS**

A. Conform to requirements of Section 013000.

B. Bid Submission Documents:
   1. With the bid proposal for this Section, Contractor shall submit written confirmation of:
a. Name of ICF Product proposed for the material & labor cost of the bid.
b. Credentials of the ICF Installer which shall include that ICF Installer:
   i. has a minimum of 2 years experience in ICF construction of projects similar in scope and complexity; or
   ii. is a qualified masonry or traditional concrete forming contractor with a minimum of 5 years experience in construction of projects similar in scope and complexity.

C. ICF Manufacturer’s Instructions: Prepare Shop Drawings under the supervision of a qualified Professional Engineer (licensed in the State of Oklahoma) detailing ICF Layout, details and installation procedures.

D. Delegated Design Submittal: For ICF system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the ICF Manufacturer’s professional engineer (licensed in the State of Oklahoma) responsible for their preparation. Show connections, types of reinforcement, including special reinforcement and concrete cover on reinforcement. Indicate location, type, magnitude and direction of loads imposed on the building foundation.

E. Test and Evaluation Reports:
   1. Contractor shall submit a copy of valid ICF Product’s evaluation report demonstrating compliance with this Section and applicable Codes.
   2. Upon request, submit relevant test data and reports which validate ICF Product’s compliance with the performance criteria of this Section.

F. ICF Bracing System Engineering:
   1. For unsupported wall heights of more than 12 feet (3.6m), Contractor shall submit scaffold engineering for support of the ICF assembly and ICF Bracing System during construction.

1.09 CLOSEOUT, WARRANTY, MAINTENANCE MATERIAL SUBMITTALS

A. Conform to requirements of Section 017800 Closeout Submittals.
B. Warranty Documentation: upon completion of work under this Section, ICF Installer shall submit to Contractor a written copy of specific warranties of the ICF product for subsequent provision to building owner.
C. Maintenance Documentation: upon completion of work under this Section, ICF Installer shall submit to Contractor a copy of documentation pertaining to post repair, renovation, modification or service work relating to the ICF walls after occupancy (for subsequent provision to building owner).

1.10 QUALITY ASSURANCE

A. Qualifications:
   1. Contractor shall engage the services of an ICF Installer, or of an experienced ICF Technical Consultant, who has been trained in procedures for the correct installation of the specified ICF Product, for the duration of the work under this Section.
   2. ICF Installer or ICF Technical Consultant shall submit written proof of ICF training to Contractor prior to starting work under this Section.

1.11 DELIVERY, STORAGE AND HANDLING

A. Keep solvents, high heat, open flames, and any other ignition sources away from ICFs at all times.
B. ICF Installer shall meet with Contractor on site prior to ICF Product delivery to co-ordinate provision of access, storage areas, protection of ICFs, and space requirements for ICF Bracing System installation, reinforcing steel storage, and forming.
C. Deliver ICFs in original factory packaging labeled with identification of product, manufacturer, and manufacturing batch/lot numbers.
D. Handle ICFs with care not to damage or soil any of the components.
E. Store ICFs in well-ventilated areas away from high heat, ignition sources, and soils that may contain insects, in manufacturer provided packaging/bundles to prevent damage & soiling and to protect ICFs from extended exposure to UV (sun)light (or provide similar protection for unpackaged ICFs).
F. In actual or potentially windy conditions, store ICF packages flat or secure them adequately.

1.12 SITE CONDITIONS
A. Ambient Temperatures: If construction is performed during periods when ambient temperatures are below minima specified by the applicable Building Code for concrete and masonry, Contractor shall provide adequate measures for protection and supplementary heating as required to ensure proper concrete curing conditions in accordance with manufacturer’s and concrete supplier’s recommendations.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

For the ICFs to be supplied under this section, ICF manufacturer shall provide upon request written documentation by an Accredited Third Party verifying the ICF’s compliance with the applicable building code and with either ASTM E2634 “Standard Specification for Flat Wall Insulating Concrete Form (ICF) Systems” or ICC-ES AC-353 “Stay-in-place, Foam Plastic Insulating Concrete Form (ICF) Systems for Solid Concrete”.

2.02 INSULATING CONCRETE FORMING SYSTEM DESCRIPTION

A. ICFs shall consist of two flame-retardant, expanded polystyrene (EPS) foamed plastic insulation boards connected by molded high-density polyethylene or polypropylene cross-ties.
B. The ICF’s EPS insulation boards shall be between 2 5/8” (inches) and 3¼” (inches) thick.
C. The ICF products shall be capable of forming all of the following concrete core thicknesses: 4”, 6”, 8”, 10”, or 12” (inches)
D. The ICF's cross-ties shall provide attachment points for exterior and interior wall finishes every 16” (inches) or less.

2.03 PERFORMANCE / DESIGN CRITERIA

A. ICF wall assembly’s insulation levels shall be a minimum of R-28 (hr.ft².F/Btu) as calculated using ASTM C578 values @ 75 degree F for EPS (and including R-2.66 for: inside air, ½-inch gypsum wallboard, 6-inches concrete, 5/8-inch T1-11 Finish & outside air).
B. The ICF’s EPS insulation boards shall either have a flame spread index of 25 or less and smoke developed index of 450 or less (per ASTM E84) or shall have passed a NFPA 286 test.
C. Finished ICF wall assemblies shall providing fire resistance ratings tested and documented by an Accredited Third Party as follows:
   i. for concrete core thickness of 4-inches: 2 hour fire resistance rating
   ii. for concrete core thickness of 6-inches: 3 hour fire resistance rating
   iii. for concrete core thickness of 8-inches or more: 4 hour fire resistance rating
D. Finished ICF wall assemblies shall provide a minimum sound transmission class (STC) sound attenuation performance of STC 50 for concrete core thicknesses of at least 6-inches (with regular ½-inch gypsum board on one or both sides)
E. ICFs' Cross-Ties' Fastener Withdrawal and Lateral Shear Resistance in accordance with ICC-ES AC353, Acceptance criteria for Stay-in-Place, Foam Plastic Insulating Concrete Form (ICF) Systems for Solid Concrete Walls and ASTM D1761, Standard Test Methods/or Mechanical Fasteners in Wood.

031119 - 4
2.04 MATERIALS

A. ICFs’ Expanded Polystyrene (EPS) Insulation Board as per ASTM C578 “Standard Specification for Rigid Cellular Polystyrene Thermal Insulation” (or MIL-P-19644):
   1. Compressive Resistance @ yield or 10% deformation ≥ 15psi (ASTM D1621)
   2. Thermal Resistance Value @ 75°F ≥ 4.0 per inch thickness (ASTM C177 or equiv./ MIL-P-19644)
   3. Flexural Strength ≥ 35psi (ASTM C203)
   4. Water Vapor Permeance ≤ 3.5 perm-in (ASTM E96)
   5. Water Absorption ≤ 3% by Vol. (ASTM C272)
   6. Dimensional Stability ≤ 2% change in dims. (ASTM D2126)
   7. Oxygen Index ≥ 24.0 % by Vol. (ASTM D2863)
   8. Density ≥ 1.35PCF (ASTM C1622 / C1622M or C303)

B. Incompatible Materials: ICFs should not come into contact with solvents or petroleum-based liquids as they will damage or dissolve the ICFs. Ensure that all sealants, primers, and other materials in contact with EPS and plastics are compatible (water-based).

C. Concrete: Concrete supplied for ICFs under Section 06 30 00:
   1. shall have a minimum compressive strength as specified by the engineer of record or 2500 psi (measured at 28 days), whichever is higher. Recommended maximum aggregate size shall be 3/8-inch for concrete core thicknesses of 4-inches and 6-inches and ½-inch for concrete core thicknesses of 8-inches and higher, and
   2. shall have a concrete slump of a minimum of 6-inches at time of placement into ICFs with a water/cement ratio less than 0.55 (subject to design revision to suit application).
   3. When permitted by the engineer of record, recommended slump specification shall be met with addition of super plasticizer/mid-range water reducing agents to achieve design mix strength and adequately high concrete flow characteristics.

D. Reinforcing Steel: Reinforcing steel grade, size, placement and spacing within ICFs shall be as specified in Section 032000 or by the engineer of record.

E. Sleeves, Hangers, Waterproofing, Parging, Finishes, etc.: all other materials coming into contact with ICFs in the course of construction shall be compatible with EPS foam

2.03 ACCESSORIES

A. ICF Bracing System, false work:
   1. ICF Installer shall supply and use an ICF Bracing System or equivalent false work to facilitate construction of the ICF walls and allow adjustments required to ensure plumbness and straightness of the ICF walls during construction, just prior to concrete placement, and immediately after concrete placement while the ICF wall is still adjustable to final finished position.
   2. The ICF Bracing System (or equivalent false work) shall be compliant with OSHA and all other applicable laws and regulations.
B. Anchor bolts, hangers, and other embeds
C. Sleeves for penetrations, Conduit
D. Window and Door Bucks: removable plastic or treated lumber buck-out materials.
PART 3 – EXECUTION

3.01 INSTALLERS

A. *ICF Installer* shall meet the requirements of sub-Section 1.08 B. Bid Submittal qualifications

3.02 EXAMINATION

Verification of Conditions:

A. Verify that site conditions are as set out in sub-Section 1.12 “Site Conditions”.
B. Verify adequate access for workers and equipment for all phases of work
C. Verify dimensions of lines, levels and centers against for-construction building plans before proceeding with formwork installation.
D. Verify footings/slabs are within specifications (especially smooth and level within +/- ¼-inch, footing steps in increments of ICFs form height, sufficient width).
E. Verify placement, spacing, and sizes of reinforcing steel dowels from concrete footings/slab as per design requirements and in consideration of ICFs form size.
F. Ensure reinforcing steel dowels have OSHA compliant protection installed until ICFs are stacked above dowel level.

3.03 PREPARATION

A. Clean top of footings and slabs prior to starting installation of ICFs.
B. Schedule installation of concrete formwork with related work specified in other Sections to ensure that ICF wall assembly, including window and door accessories, trim, utility penetrations, transition changes, and mechanical service provisions are protected against damage from weather, corrosion, and adjacent construction activity.

3.04 INSTALLATION – GENERAL

A. Install ICF formwork, reinforcing steel, and concrete per design requirements and in strict accordance with ICF manufacturer’s installation manual (as supplied under sub-Section 1.08 C.) and all applicable codes and standards including, but not limited to, ACI 301, ACI 309, ACI 318, and ACI 347.
B. Install and adjust *ICF Bracing System* and/or all false work to ensure stability and alignment of ICFs and formwork during all phases of work. Provide additional support for ICFs, Window and Door Opening Bucks and formwork where necessary.
C. Ensure all required and recommended installation procedures are followed. Specifically the *ICF Installer* shall assure cross checks with respect to layout, level and vertical alignment are performed adequately and regularly.

3.05 INSTALLATION - FORMWORK

A. Install the ICFs in accordance with ICF manufacturer’s installation instructions, in a running bond pattern assuring placement and alignment of cross-ties / attachment strips.
B. Install and secure *Window and Door Opening Bucks*. If specified, assure that the bucks have been prepared for anchoring to concrete as specified.
C. Secure bottom layer of ICFs against displacement from footing or slab.
D. Install horizontal reinforcing steel, as specified, within ICFs. Assure reinforcement diameter, grade and positioning complies with engineering specifications and is installed in correct position of wall for each course placed and with lap-splices as specified.
E. Install *ICF Bracing System* and/or other false work in strict accordance with *ICF Bracing System* manufacturer’s installation instructions. Regularly check everything for crew safety, anchorage to ICF system as recommended by manufacturers, and for vertical alignment.
F. Install reinforcing steel for lintels, as specified, over all wall openings.
G. Install all sleeves, conduit, anchor bolts, hangars, embeds, and similar as specified.
H. Install vertical reinforcing steel, as specified, within ICFs. Assure reinforcement diameter, grade and positioning complies with engineering specifications and is installed in correct position of wall with lap-splices as specified.
I. Secure ICF corners, angles, T-walls and similar as necessary
J. Secure top layer of ICFs against lateral movement along top edges
K. Clean formed cavities of all debris, snow, and ice prior to placing concrete. Flush with water above freezing-levels or use compressed air or other methods to remove remaining foreign matter. Ensure that water and debris drains to exterior through clean-out ports.
L. Inspection before Concrete Placement: ICF Installer shall assure string lines are placed at top of all walls and the wall system is aligned for concrete placement; cross check and assure that all required service penetration sleeves, embed plates, anchor bolts, fittings, beam pocket preparations, as specified on drawings, are in place and secured prior to concrete placement.
M. Concrete Placement: ICF Installer shall assure that slump, strength and aggregate size are as specified per sub-Section 2.04 C and that concrete tickets are retained for Contractor’s records. ICF Installer to assure truck deliveries are timed for rate of placement and that placement rate does not exceed ACI recommended practices. ICF Installer shall also assure that all concrete is mechanically and internally vibrated per ACI standards after each concrete lift to assure full consolidation of concrete.
N. ICF Bracing System, false work, and scaffolding adjustment & removal: ICF Installer shall assure entire wall lengths are aligned to vertical plumb by string line and screeded to horizontal level for finished wall height as required prior to concrete set. After the initial concrete cure, Contractor shall assure that scaffolding, ICF Bracing System, and false work remain in place until the engineer of record permits removal.

3.06 CONSTRUCTION

A. Interface with Other Work
   1. Locate and set items to be cast directly into concrete.
   2. Provide formed openings, sleeves, pockets where required for items to be embedded in or to pass through concrete work.
   3. Coordinate with work of other trades in placing bolts, anchors, hangers, sleeves and any other inserts.
   4. Install components for wall, roof and/or floor connections as specified
   5. Install all accessories in accordance with their manufacturer’s instructions, straight, level and plumb. Secure items against displacement during the concrete pour.

B. Site Tolerances
   1. Construct ICFs and formwork within tolerances of ACI 301 or as otherwise specified

3.07 FIELD QUALITY CONTROL

A. Conformance to design drawings and specifications
B. Plumb, Straight, Square, and Level of all formwork and walls, before, during and after the concrete pour
C. Damaged ICFs
   1. Installer shall clearly mark and segregate any damaged ICFs or ICF components to prevent their use in the project (unless adequate remedies are used).
D. Reinforcing Steel
   1. Per Section 032000 – Reinforcing Steel
   2. The installer shall check and document specifications and placement of all reinforcing steel placed into ICFs and how it is secured against displacement during the concrete pour
E. Concrete
   1. Per Section 033000 – Cast-in-Place Concrete
   2. The installer shall check and document specifications, age, additives, placement, and consolidation of all concrete placed into ICFs along with environmental conditions during concrete pours.
   3. Site Tests: per Section 033000 – Cast-in-Place Concrete
      or specify special requirements (e.g. slump tests after additives, core samples)

F. Regularly inspect & verify stability of erected ICF, formwork, Window and Door Opening Bucks, ICF Bracing System, false work, and scaffolding to ensure that elements are secure and that work is in accordance with design specifications and all laws and regulations.

3.08 CLEANUP

A. Clean formwork as installation proceeds and remove foreign matter within formwork.
B. ICF Installer to remove ICF Bracing System and ICF related false work when permitted by the engineer of record
C. Clean up and properly dispose of all debris remaining on job site related to work under this Section

3.09 PROTECTION

A. In case the final exterior finish application happens more than 8 weeks after erection of ICFs, provide temporary cover for installed ICFs to reduce EPS degradation from UV-light, or sufficiently rasp down all EPS areas affected by UV-degradation.
B. For ICF walls’ intermediate concrete pours, prior to concrete placement, the tops of the ICFs shall be protected with track or tape or other means to ensure no concrete soils the ICFs’ interlocking mechanisms.

END OF SECTION
SECTION 032000
REINFORCING STEEL

PART 1 GENERAL

1.01 SECTION INCLUDES
   B. Products Furnished, Not Installed Under This Section

1.02 RELATED SECTIONS
   A. Section 031119 – Insulating Concrete Forming
   B. Section 033000 – Cast In Place Concrete

1.03 REFERENCES
   A. American Concrete Institute (ACI)
      1. ACI 301, Specifications for Structural Concrete for Buildings.
      3. ACI 318, Building Code Requirements for Reinforced Concrete.
   B. American Society for Testing Materials (ASTM)
      1. ASTM A185, Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement.
   D. Concrete Reinforcing Steel Institute (CRSI)
      2. CRSI 63 – Recommended Practice for Placing Reinforcing Bars
      3. CRSI 65 – Recommended Practice for Placing Bar Supports

1.04 SUBMITTALS
   A. Shop Drawings: Submit detailed shop and installation drawings showing material grades, spacing, length, size and quantities of bars, bending diagrams, installation instructions and details of bar support and their spacing.
      1. Requirement for Submittals
         a. Review of shop drawings is for bar sizes, spacing, details and general compliance with the Contract Drawings only.
         b. Reproduction of Contract Drawings shall not be used for shop drawings.
         c. Do not begin fabrication of materials prior to review of shop drawings.
d. Material quantities, fit, verification of job conditions and coordination with other trades are the responsibility of the contractor.

1.05 DELIVERY, STORAGE AND PROTECTION

A. Deliver materials in tagged bundles grouped in bar size and length.
B. Store bars on skids off of the ground and stacked to permit drainage. Prevent buildup of rust and dirt on bars. Protect bars from contamination that would prevent bonding of concrete.
C. Do not bend, twist or warp bars during handling.

PART 2 PRODUCTS

2.01 MATERIALS

A. Reinforcing Steel
   1. Deformed bars: new billet steel conforming to ASTM A615 of required grades.
   2. Welded wire mesh: conform to ASTM A185.
   3. Reinforcing bars to be welded: conform to ASTM A706 Grade 60.
   4. Spirals: smooth bars conforming to ASTM A615 Grade 60.

2.02 ACCESSORIES

A. Bar Supports: Comply with ACI 315.
   1. Provide plastic-tipped chairs of suitable color where concrete soffits will be exposed to view.
   2. Provide continuous supports with spacers for slab reinforcement.

2.03 FABRICATION

A. Shop Fabrication
   1. Cut bars to required length.
   2. Bend bars cold with suitable equipment. Do not heat or stretch material. Bend radii and extension shall comply with ACI 318.
   3. Do not use bars with kinks or un-required bends.
   4. Do not re-straighten bars bent more than 30 degrees.

A. Tolerances: comply with ACI 318.

B. Marking: mark bars to correspond with shop drawings.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean reinforcing of rust, mill scale, dirt, oil and grease.

3.02 PLACEMENT

A. Place reinforcement of required sizes and quantities in proper position. Use sufficient supports and spacers to maintain position during placement of concrete. Comply with ACI 301.
   1. Do not place bar supports against exposed faces of precast panels, beams, walls or
copings.

B. Secure reinforcement in position with wire ties complying with ACI 318.
   1. Clip or bend tails or tie wire away from exposed faces, do not leave tie wire within 1 ½" of any exposed surface.

C. Maintain position of reinforcing mats in walls with metal spacers between the mats.

D. Place reinforcing in conformance with ACI 318 and ACI 301 to provide required concrete cover over reinforcement.

3.03 TOLERANCES

A. Placement of top bars in slabs and beams:
   1. Members 8 inches deep or less: ± ¼ inch.
   2. Members more than 8 inches but not over 2 feet deep: ± ½ inch.
   3. Members more than 2 feet deep: ± one inch.

B. Lengthwise of members: ± 2 inches.

C. Concrete cover to formed surfaces: ± ¼ inch.

D. Minimum spacing between bars: ± ¼ inch.

3.04 FIELD QUALITY CONTROL

A. Testing Laboratory Services
   1. Inspect bar sizes, quantities and placement.
   2. Inspect support and securement of reinforcing.
   3. Inspect condition of reinforcing.

END OF SECTION
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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Piers.
   2. Grade Beams
   3. Foundation walls.
   4. Retaining walls.
   5. Pit walls.
   6. Slabs-on-grade.
   7. Slabs on metal deck.
   8. Concrete toppings.
   9. Concrete formwork.
  10. Steel reinforcement.

B. Related Sections:
   1. Section 013000 – Submittal Procedures
   2. Section 014000 – Quality Requirements
   3. Section 031119 – Insulating Concrete Forming
   4. Section 051200 – Structural Steel Framing
   5. Section 316329 – Drilled Concrete Piers and Shafts

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s data in accordance with specifications indicating product compliance to these specifications.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Indicate the following for each mix design submittal:
   1. Building element designation.
   2. Proportions of cement, fine and coarse aggregates, and water.
   3. Water-cement ratio, design strength, slump and air content.
   4. Type of cement and aggregates.
   5. Type and dosage of admixtures.
6. Documentation of average strength for each type of concrete.

D. Construction Joints: Submit drawings indicating proposed locations of construction joints and joint configuration.

E. Steel Reinforcement Shop Drawings: Submit detailed shop and installation drawings showing material grade, spacing, length, size and quantities of bars and bending diagrams. The reinforcement shop drawings shall be prepared showing all beams, pedestals and walls in elevation view. Reinforcement schedules alone are not acceptable. The reinforcement shop drawings shall also include sections and details showing reinforcement placement. Other installation instructions and details of bar support and their spacing shall be provided.

1. Submit three bond sets of shop drawings for review by the Structural Engineer-of-Record. The Structural Engineer-of-Record will mark three sets with red and will return one set to the contractor through the architect. The contractor shall make the number of photocopies required of the approved shop drawings for distribution to other parties, and the contractor shall be responsible for transmitting the original red-marked set to the fabricator for corrections.

2. Requirements for Submittals:
   a. Review of shop drawings is for bar sizes, spacing, details and general compliance with the Contract Drawings only.
   b. Only complete shop drawing submittals will be reviewed. Shop drawings not in compliance with the Submittal portion of this document will be rejected. Time required by Wallace Engineering Structural Consultants, Inc. to review shop drawing submittals a second or third time will be billed to the General Contractor at Wallace Engineering Structural Consultants, Inc. hourly rates.
   c. Reproduction of Contract Drawings shall not be used for shop drawings.
   d. Do not begin fabrication of materials prior to review of shop drawings.
   e. Material quantities, fit, verification of job conditions and coordination with other trades are the responsibility of the General Contractor.

F. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

G. Formwork Product Data:
   1. Form oil.
   2. Form release agent.
   3. Form sealer.
   4. Void forms: Provide data for materials and installation requirements.
   5. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

H. Samples: For waterstops and vapor retarder.

I. Welding certificates.

J. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Form materials and form-release agents.
   4. Steel reinforcement and accessories.
   5. Fiber reinforcement.
   6. Waterstops.
   7. Curing compounds.
   8. Floor and slab treatments.
10. Adhesives.
11. Vapor retarders.
12. Semirigid joint filler.
15. Geosynthetic fill material

K. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

L. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

M. Field quality-control test and inspection reports.

N. Minutes of preinstallation conference.

1.5 ALLOWANCE
A. Include an allowance in bid price for 2,000 pounds of reinforcing steel to be fabricated and placed as directed by Architect or Engineer. Allowance is to include, but not limited to, material, detailing, fabrication, shipping, installation, overhead and profit.

1.6 QUALITY ASSURANCE
A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code - Reinforcing Steel."
F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301, “Specifications for Structural Concrete.”

G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation.

H. Mockups: Cast concrete formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.
1. Build panel approximately 100 sq. ft. for formed surface in the location indicated or, if not indicated, as directed by Architect.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

I. Preinstallation Conference: Conduct conference at Project site.
1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
   d. Concrete subcontractor.
   e. Special concrete finish subcontractor.
2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

J. Concrete Formwork:
1. Design and construct forms to withstand stresses due to weight of fresh concrete, vibration during consolidation and loads of equipment and workmen. Comply with ACI 318.
2. Limit deflection of forms to provide smooth, straight surfaces without unsightly bulges and deformations.
3. Limit deformations of forms for architecturally exposed surfaces to 0.0025 times the span of each component (facing materials, studs and walers).

1.7 DELIVERY, STORAGE, AND HANDLING

A. Transporting: Ready-mixed concrete supplier shall have sufficient capacity and adequate facilities to provide continuous delivery at the rate required for continuous placement throughout any sequence of placement.

B. Storage of Concrete Materials:
1. Store cement in weather tight buildings or bins which prevent intrusion of moisture or contaminants. Store different types of cement in separate facilities.
2. Stockpile aggregates to prevent segregation and contamination with other materials. Thaw frozen aggregates before use.
3. Sand shall be drained to a uniform moisture content before use.
4. Store admixtures securely to prevent contamination, evaporation damage or temperature variation in excesses of the range recommended by the manufacturer.

C. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

D. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

E. Formwork:
   1. Store materials off of the ground and protected from weather.
      a. Prevent warpage, twisting and excessive moisture gain of wood materials.
      b. Discard damaged or deformed materials.
   2. Protect smooth faces of form liner materials from abrasion, denting or scarring during handling.
   3. Deliver void forms and installation instructions in manufacturer’s packaging.

PART 2 PRODUCTS

2.1 FORM-FACING MATERIALS

A. Architectural Appearance Quality Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints. Coordinate snap-tie hole layout and spacing with architect.
   1. Plywood, metal, or other approved panel materials.
   2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      a. High-density overlay, Class 1 or better.
      b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
      c. Structural 1, B-B or better; mill oiled and edge sealed.
      d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.


F. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

G. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
H. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Coordinate snap-tie hole layout and spacing with architect.
   2. Furnish units that will leave no corrodbile metal closer than 1 inch to the plane of exposed concrete surface.
   3. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
   4. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706, deformed.

C. Steel Bar Mats: ASTM A 184, fabricated from ASTM A 615, Grade 60, or A706, deformed bars, assembled with clips.

D. Plain-Steel Wire: ASTM A 82, as drawn.

E. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.


2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type I, II or III. Cement shall be supplied from a single manufacturer. Supplement with the following:
      a. Fly Ash: ASTM C 618, Class C or F. Use only one type and source throughout project.
   2. Blended Hydraulic Cement: ASTM C 595, Type IP, portland-pozzolan, or Type I (PM), pozzolan-modified portland cement.

B. Silica Fume: ASTM C 1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C 33 coarse aggregate or better, graded. Provide aggregates from a single source.
1. Maximum Coarse-Aggregate Size: As noted in “Concrete Mixtures for Building Elements.” Coarse aggregate shall conform to applicable requirements of ASTM C 33 gravel or crushed stone, suitably processed, washed and screened, consisting of hard, durable particles without adherent coatings.

2. Fine Aggregate: conform to applicable requirements of ASTM C 33, natural bank or river sand, washed and screened, consisting of hard, durable, uncoated particles free of deleterious matter, free of materials with deleterious reactivity to alkali in cement, and graded from coarse to fine to produce a minimum percentage of voids.

D. Water: ASTM C 94 and potable.

2.5 ADMIXTURES


B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494, Type A.
   2. Retarding Admixture: ASTM C 494, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.
   7. Water-Reducing Admixture shall be compatible with flooring products and adhesives.

2.6 WATERSTOPS

A. Preformed Plastic Adhesive Waterstops: Provide preformed, non-expansive, self-sealing, plastic adhesive waterstop. Representative product:

2.7 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E 1745, Class A, single or multi-layer, not less than 15 mils thick:
   1. Maximum perm rating of 0.01 perms (U.S.) per ASTM E 96 or F 1249.
   2. Puncture resistance of 2200g or greater per ASTM D 1709, B.
   3. Include manufacturer’s recommended adhesive or pressure-sensitive joint tape, and include manufacturer’s proprietary penetration flashing for all through-slab penetrations.
   4. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Vapor Block 15; Raven Industries Inc.
      b. Stego Wrap, 15 mil; Stego Industries, LLC.
      c. Moistop Ultra 15; Fortifiber Corporation.
      d. Viper II 15 mil; Insolation Solutions, Inc.

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.8 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
   b. BASF Construction Chemicals - Building Systems; Confilm.
   c. ChemMasters; SprayFilm.
   d. Conspec by Dayton Superior; AquaFilm.
   e. Dayton Superior Corporation; Sure Film (J-74).
   f. Edoco by Dayton Superior; BurkeFilm.
   g. Euclid Chemical Company (The), an RPM company; Eucobar.
   h. Kaufman Products, Inc.; Vapor-Aid.
   i. Lambert Corporation; LAMBCO Skin.
   j. L&M Construction Chemicals, Inc.; E-CON.
   k. Meadows, W. R., Inc.; EVAPRE.
   l. Metalcrete Industries; Waterhold.
   m. Nox-Crete Products Group; MONOFILM.
   n. Sika Corporation; SikaFilm.
   o. SpecChem, LLC; Spec Film.
   p. Symons by Dayton Superior; Finishing Aid.
   q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
   r. Unitex; PRO-FILM.
   s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
   b. BASF Construction Chemicals - Building Systems; Kure 200.
   c. ChemMasters; Safe-Cure Clear.
   d. Conspec by Dayton Superior; W.B. Resin Cure.
   e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
   f. Edoco by Dayton Superior; Res X Cure WB.
   g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
   i. Lambert Corporation; AQUA KURE - CLEAR.
   j. L&M Construction Chemicals, Inc.; L&M Cure R.
   k. Meadows, W. R., Inc.; 1100-CLEAR.
   l. Nox-Crete Products Group; Resin Cure E.
m. Right Pointe; Clear Water Resin.

n. SpecChem, LLC; Spec Rez Clear.

o. Symons by Dayton Superior; Resi-Chem Clear.

p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.

q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Anti-Hydro International, Inc.; AH Clear Cure WB.
   b. BASF Construction Chemicals - Building Systems; Kure-N-Seal WB.
   c. ChemMasters; Safe-Cure & Seal 20.
   d. Conspec by Dayton Superior; Cure and Seal WB.
   e. Cresset Chemical Company; Crete-Trete 309-VOC Cure & Seal.
   f. Dayton Superior Corporation; Safe Cure and Seal (J-18).
   g. Edoco by Dayton Superior; Spartan Cote WB II.
   h. Euclid Chemical Company (The), an RPM company; Aqua Cure VOX; Clearseal WB 150.
   j. Lambert Corporation; Glazecote Sealer-20.
   k. L&M Construction Chemicals, Inc.; Dress & Seal WB.
   m. Metalcrete Industries; Metcure.
   n. Nox-Crete Products Group; Cure & Seal 150E.
   o. Symons by Dayton Superior; Cure & Seal 18 Percent E.
   p. TK Products, Division of Sierra Corporation; TK-2519 WB.
   q. Vexcon Chemicals, Inc.; Starseal 309.

2.9 RELATED MATERIALS


B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
   1. Types I and II, non-load bearing for bonding hardened or freshly mixed concrete to hardened concrete.

E. Non-Shrink Grout: Pre-mixed, non-shrinking, minimum compressive strength of 5000 psi in 28 days, conforming to U.S. Army Corps of Engineers specifications No. CRD-C621. Grout exposed to view shall be non-oxidizing.
2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
   4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
   4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109.

2.11 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixtures, strength test records, or field test data, according to ACI 301.
   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
   2. Required Average Strength for each type of concrete:
      a. Where suitable test records for the concrete production facility are available, design strength may be tested on the standard deviation in accordance with ACI 318.
      b. Where strength test records are not available, design strength and documentation of average strength as noted in ACI 318, Chapter 5.

B. Cementitious Materials:
   1. Minimum cement content:
      a. Cementitious Materials content shall not be less than 520 pounds per cubic yard, unless noted otherwise in Contract Documents.
   2. Use fly ash and pozzolan as needed to reduce the total amount of portland cement, which would otherwise be used. If used, limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
      a. Fly Ash: 25 percent maximum, 15 percent minimum.

C. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing or plasticizing admixture in pumped concrete, and concrete with a water-cementitious materials ratio below 0.50.
4. Slump limits noted in the following building elements are values before adding water-reducing admixtures. Slump limits shall be no more than 8” after adding the water-reducing admixture.

D. For concrete exposed to freeze thaw, air content shall be 6 percent plus or minus 1.5 percent, unless noted otherwise in Contract Documents. For concrete not exposed to freeze thaw, do not add air-entraining agents.

E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup. Reference Contract Drawings for locations.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Piers and Grade Beams: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 4000 psi at 28 days.
   2. Maximum Water-Cementitious Materials Ratio: 0.44.
   3. Slump Limit: 4 inches plus or minus 1 inch.
   4. Maximum Coarse Aggregate Size: 1 1/2 inch.
   5. Minimum Cementitious Materials Content: 470 pounds per cubic yard.

B. Foundation Walls and Pedestals: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 4000 psi at 28 days.
   2. Maximum Water-Cementitious Material Ratio: 0.44.
   3. Slump Limit: 4 inches plus or minus 1 inch
   4. Maximum Coarse Aggregate Size: 1 inch.

C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 3000 psi at 28 days.
   2. Maximum Water-Cementitious Material Ratio: 0.51.
   3. Slump Limit: 4 inches plus or minus 1 inch.
   4. Maximum Coarse Aggregate Size: 1 inch.

D. Slabs on Composite Steel Floor Deck: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 3000 psi at 28 days.
   2. Maximum Water-Cementitious Material Ratio: 0.44.
   3. Slump Limit: 4 inches, plus or minus 1 inch.
   4. Maximum Coarse Aggregate Size:
      a. Suspended Slabs: 1 inch.
      b. Composite Deck: ¾ inch.

E. Steel Stair Pans and Slabs on Non-Composite Form Deck: Proportion normal weight concrete mixture as follows:
   1. Minimum Composite Strength: 3000 psi at 28 days.
   2. Maximum Water-Cementitious Material Ratio: 0.58.
   3. Slump Limit: 4 inches, plus or minus 1 inch.

F. Concrete Toppings: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 3000 psi at 28 days.
   2. Maximum Water-Cementitious Material Ratio: 0.51.
   3. Slump Limit: 4 inches, plus or minus 1 inch.
G. Exterior Structural Concrete: Proportion normal weight concrete mixture as follows:
1. Minimum Compressive Strength: 4500 psi at 28 days.
2. Maximum Water-Cementitious Material Ratio: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Maximum Coarse Aggregate Size: 1 inch.
5. Air Content: 6 percent, plus or minus 1.5 percent.

2.13 FABRICATING REINFORCEMENT
A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING
A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION
3.1 FORMWORK
A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
C. At Architectural Appearance Quality Smooth-Formed Finished Concrete Walls coordinate snap-tie hole layout and spacing with Architect.
D. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
2. Class C, 1/2 inch for rough-formed finished surfaces.
E. Construct forms tight enough to prevent loss of concrete mortar.
F. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.
G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
I. Install void forms in accordance with manufacturer’s written recommendations. Protect forms from moisture and crushing.

J. Chamfer exterior corners and edges of permanently exposed concrete.

K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

L. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

M. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

N. Coat contact surfaces of forms with form-release agent, according to manufacturer’s written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC’s "Code of Standard Practice for Steel Buildings and Bridges."

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 75 percent of its 28-day design compressive strength.

2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions. Reference Contract Drawings for locations requiring vapor retarder placement.

1. Lap vapor retarder over footings and seal to foundation walls.

2. Lap joints 6 inches and seal with manufacturer’s recommended tape.
3. Seal penetrations (including pipes) per manufacturer’s instructions.
4. Repair damaged areas by cutting patches of vapor retarder, overlapping damaged area 6 inches and taping all four sides with manufacturer’s recommended tape.

B. Place vapor retarder on top of the drainage course material and directly below slab at all interior slabs.

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI’s “Manual of Standard Practice” for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
   1. Weld reinforcing bars according to AWS D1.4, where indicated on Contract Drawings.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete or as indicated on Contract Drawings.
   3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   4. Do not locate construction joints between lateral bracing elements of walls and columns.
   5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   6. Space vertical joints in walls as indicated on the Contract Drawings or on the approved submittals. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
   7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
8. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction (Control) Joints in Slabs-on-Grade: Within 12 hours of pouring slabs, form weakened-plane contraction joints, sectioning concrete into areas as indicated on the Contract Drawings. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
   a. Primary Method: Soft-Cut System method, by Soff-Cut International, Corona, CA (800) 776-3328. Finisher must have documented successful experience in the use of this method prior to this project. Install cuts within 2 hours after final finish at each saw cut location. Use 1/4 inch thick blade, cutting 1-1/4 inch into slab.
   b. Optional Method (Where Soft-Cut System Method Equipment is Not Available): Properly time cutting with the set of the concrete. Saw-Cut control joints within 12 hours after finishing. Start cutting as soon as the concrete has hardened sufficiently to prevent aggregates being dislodged by the saw. Complete cutting before shrinkage stresses become sufficient to produce cracking. Use 1/4 inch thick blade, cutting 1-1/4 inch into slab.

2. Spacing: Provide joints at locations as noted on Contract Drawings.
   a. Placement of saw joints must be coordinated with the tile joints and this requirement governs over locations shown on the Contract Drawings.

D. Doweled Joints: Install dowel bars and support assemblies at joints as noted on the Contract Drawings. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint. In lieu of dowels, plate dowel system approved by the Engineer of Record may be used at Contractor's option.

3.7 WATERSTOPS

A. Preformed Plastic Adhesive Waterstops: Install in construction joints and at other locations indicated on Contract Drawings, according to manufacturer’s written instruction, bonding or mechanically fastening and firmly pressing into place. Install in longest lengths practicable.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Precautions to protect fresh concrete from developing plastic shrinkage cracks must be taken in advance of concrete placement when evaporation rate due to any combination of temperature, humidity, and wind velocity is expected to approach 0.2 lb./sq. ft./hr. as determined by ACI 305R. Acceptable precautions to reduce the rate of evaporation include use of wind breaks, fog spray, covering with polyethylene sheeting, or wet cover.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by the Structural Engineer-of-Record.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or
planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Lack of Slope: Confirm with Architect before proceeding when Contract Drawings show exterior flatwork without a specific slope.
6. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1, ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When the average of the highest and lowest ambient temperature from midnight to midnight is expected to be less than 40 degrees F for more than three successive days, deliver concrete to meet the following minimum temperatures immediately after placement:
   a. 55 degrees F for sections less than 12 inches in the least dimension;
   b. 50 degrees F for sections 12 to 36 inches in the least dimension;
   c. 45 degrees F for sections 36 to 72 inches in the least dimension; and
   d. 40 degrees F for sections greater than 72 inches in the least dimension.
2. The temperature of concrete as placed shall not exceed these values by more than 20 degrees F.
3. The minimum requirements may be terminated when temperatures above 50 degrees F occur during more than half of any 24 hour duration.
4. When the outdoor temperature is less than 40 degrees F, maintain temperature of placed concrete at not less than 50 degrees F for required curing time.
5. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
6. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301, ACI 305.1, ACI 305R, and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3. Precautions to protect fresh concrete from developing plastic shrinkage cracks must be taken in advance of concrete placement when evaporation rate due to any combination of temperature, humidity, and wind velocity is expected to approach 0.2 lb./sq. ft./hr. as determined by ACI 305R. Acceptable precautions to reduce the rate of evaporation include use of wind breaks, fog spray, covering with polyethylene sheeting, or wet cover.

H. Windy Weather Placement: Comply with ACI 301, ACI 305.1, ACI 305R and as follows:

1. Precautions to protect fresh concrete from developing plastic shrinkage cracks must be taken in advance of concrete placement when evaporation rate due to any combination of temperature, humidity, and wind velocity is expected to approach 0.2 lb./sq. ft./hr. as determined by ACI 305R. Acceptable precautions to reduce the rate of evaporation include use of wind breaks, fog spray, covering with polyethylene sheeting, or wet cover.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities. Fill holes and honeycombs.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated on Contract Documents:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

3. Cork-Float Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated on the Contract Drawings.
3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
   1. Apply scratch finish to surfaces as indicated on the Contract Drawings.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
   1. Apply float finish to surfaces of all slabs.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   1. Apply a trowel finish to surfaces of all floor slabs unless noted otherwise on Contract Drawings.
   2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.
   3. Where floor drains occur, slope slabs uniformly to drains as indicated on Contract Drawings, or if not indicated at 1/4 inch per 12 inch in small areas and 1/8 inch per 12 inch in large areas.
   4. Trowel finish shall be by plastic blades to prevent a hard mirror finish.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated on Contract Drawings. While concrete is still plastic, slightly scarify surface with a fine broom.
   1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated on Contract Drawings.
   1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Contract Drawings. Set anchor bolts for machines and
equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Contract Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing. Curing shall be continued for a period of 7 days for Type I cement, or 3 days for Type III cement, or until tests indicate that the concrete has attained 75 percent of required strength.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h as determined by ACI 305R before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, and 308R by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water – Ponding or continuous sprinkling.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
      d. Application of sand kept continuously wet.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
      a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
      b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
      c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
   3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period. If used, Contractor is responsible for verifying that compound is compatible with and will have no
detrimental effect on adhesives and final finishes specified over the concrete surface.

a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recove areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Notify Architect and Engineer of Record if structural repairs are necessary. Perform structural repairs with prior approval of method and materials from Architect and Engineer of Record. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer’s written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer’s written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
8. Repair shrinkage cracks by filling cracks with pressure epoxy grout. Perform repairs with prior approval of method and materials from Architect and Engineer of Record.

E. Perform structural repairs of concrete, subject to Architect’s approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect’s approval.

3.15 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections as noted below along with inspection schedule items included in the Contract Drawings. Testing agency shall prepare tests and inspection reports and submit to Owner and Owner’s Consultants.

B. Inspections:
1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Anchor rods.
5. Verification of use of required design mixture.
6. Concrete placement, including conveying and depositing.
7. Curing procedures and maintenance of curing temperature.
8. Verification of concrete strength before removal of shores and forms from beams and slabs.
9. All other special inspection items as noted on the Contract Drawings.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 150 cu. yd. or fraction thereof of each concrete mixture placed each day. For slabs, obtain at least one composite sample for the minimum of each 150 cu. yd. or each 5,000 square feet of slab placed each day. For shotcrete mixtures, obtain at least one composite sample for each 50 cu. yd. or fraction thereof placed each day.
   a. One composite sample shall consist of a minimum of four cylinders.
   b. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
   a. Cast and laboratory cure four standard cylinder specimens for each composite sample of 6x12” cylinder specimens or cast and laboratory cure five standard cylinder specimens for each composite sample of 4x8” cylinder specimens.
   b. Cast and field cure four standard cylinder specimens for each composite sample of 6x12” cylinder specimens or cast and field cure five standard cylinder specimens for each composite sample of 4x8” cylinder specimens.
6. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
8. Test results shall be reported in writing to Architect, Structural Engineer, Owner, Owner's consultant, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests. Inspection reports shall include items inspected, inspection locations and verification of compliance or deviations from the Contract Documents.
9. Concrete strength tests made and tested by testing laboratory shall be the sole criteria of concrete strength unless in-situ tests are made in accordance with Building Code by a qualified independent testing laboratory. Concrete for which strength tests do not meet criteria for acceptance shall be considered inadequate until proven otherwise.
10. In any case, where strength tests of concrete fail to meet criteria specified herein, Structural Engineer of Record shall be the sole judge of structural adequacy of concrete. In such case, burden of proof of structural adequacy shall be the responsibility of Contractor. Strength evaluation shall conform to requirements of ACI 318. If strength evaluation testing indicates, in opinion of Structural Engineer of Record, that structure is of inadequate strength; portions of structure in questions shall be repaired or removed and replaced as directed by the Structural Engineer of Record at no additional expense to Owner. If strength test falls below specified strength, but not so low as to cause concern for structural adequacy, Architect may request improved conditions curing or modifications of design mixes to improve strength.

11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION
SECTION 035210
LIGHTWEIGHT CONCRETE DECK & INSULATION SYSTEM

PART 1 - GENERAL

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

1.2 SUMMARY
A. This Section includes cast-in-place cellular type lightweight insulating concrete for roof decks.
B. Related Sections include the following:
   1. Section 033000 - Structural Concrete

1.3 DEFINITIONS
A. Lightweight Insulating Concrete: Low-density concrete, with an oven-dry unit weight not exceeding 50 lb/cu. ft. placed with or without embedded rigid insulation board.

1.4 SUBMITTALS
A. Product Data: For each type of product indicated. Include mixing and application instructions for each type of lightweight insulating concrete.
B. Shop Drawings: Include plans, sections, and details showing roof slopes, lightweight insulating concrete thicknesses, embedded insulation board, roof penetrations, roof perimeter terminations and curbs, control and expansion joints, and roof drains.
C. Design Mixtures: For each lightweight insulating concrete mix.
D. Qualification Data: Submit manufacturer’s literature.
E. Material Certificates: For each of the following, signed by manufacturers:
   1. Foaming agents.
   2. Admixtures.
   3. Molded-polystyrene insulation board.
F. Field quality-control test reports.
G. Research/Evaluation Reports: For lightweight insulating concrete.
1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm that is approved by lightweight insulating concrete manufacturer with five year’s experience installing light-weight insulating concrete in accordance with the manufacturer’s instructions.

B. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

C. Fire-Test-Response Characteristics: Where lightweight insulating concrete is part of a fire-resistance-rated roof-deck assembly, provide lightweight insulating concrete identical to that used in assemblies tested for fire resistance per ASTM E 119 by a testing agency acceptable to authorities having jurisdiction.


D. FMG Listing: Provide lightweight insulating concrete evaluated by FMG as part of a roof assembly and listed in FMG's "Approval Guide" for Class 1 fire and noncombustible rating.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer’s original undamaged packages or acceptable bulk containers.

B. Store packaged materials to protect them from elements or physical damage.

C. Do not use cement that shows indications of moisture damage, caking, or other deterioration.

1.7 PROJECT CONDITIONS

A. Do not place lightweight insulating concrete unless ambient temperature is 32 deg F and rising.

B. Do not place lightweight insulating concrete during rain or snow or on surfaces covered with standing water, snow, or ice.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Foaming Agent: ASTM C 869.

B. Water: Clean, potable.


D. Cementitious Material: Portland cement, ASTM C 150, Type I or III.
E. Molded-Polystyrene Insulation Board: ASTM C 578, provide units with keying slots of approximately 3 percent of board’s gross surface area, type I, 0.90-lb/cu. ft. minimum density.

2.2 DESIGN MIXTURES

A. Prepare design mixtures for each type and strength of lightweight insulating concrete by laboratory trial batch method or by field-test data method. For trial batch method, use a qualified independent testing agency for preparing and reporting proposed mixture designs.

B. Limit water-soluble chloride ions to the maximum percentage by weight of cement or cementitious material permitted by ACI 301.

2.3 CELLULAR LIGHTWEIGHT INSULATING CONCRETE

A. Produce cellular lightweight insulating concrete with the following minimum physical properties using cementitious materials, air-producing liquid-foaming agents, and the minimum amount of water necessary to produce a workable mix.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Elastizell Corporation of America.
   b. Siplast Insulcel

3. As-Cast Unit Weight: 42 to 50 lb/cu. ft., at point of placement, when tested according to ASTM C 138/C 138M.
4. Oven-Dry Unit Weight: 36 ± 3 lb/cu. ft., when tested according to ASTM C 495.
5. Compressive Strength: Minimum 200 psi, when tested according to ASTM C 495.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Mix and place lightweight insulating concrete according to manufacturer’s written instructions, using equipment and procedures to avoid segregation of mixture and loss of air content.

B. Install insulation board according to lightweight insulating concrete manufacturer’s written instructions. Place insulation board in wet, lightweight insulating concrete slurry poured a minimum of 1/8 inch over the structural substrate. Ensure full contact of insulation board with slurry. Stagger joints and tightly butt insulation boards.

   1. Roof R-Value (insulation board and insulating concrete deck combined) shall be equal to 30.

   2. Install insulation board in a stair-step configuration with a maximum step-down of 1 inch, where structure is flat.

C. Deposit and screed lightweight insulating concrete in a continuous operation until an entire panel or section of roof area is completed. Do not vibrate or work mix except for screeding or floating. Place to depths and slopes indicated.
D. Finish top surface smooth, free of ridges and depressions, and maintain surface in condition to receive subsequent roofing system.

E. Roofing membrane installation may begin 2-3 days after the roof deck is cast. Protect the insulating concrete roof deck from construction traffic. The roof deck should not be left exposed for longer than 5-7 days, weather permitting. The applicator cannot be responsible for precipitation entering the roof deck after the deck is cast. The general contractor and roofing contractor are responsible for removing excess water in the system.

F. Insulating concrete should be placed when temperatures are 32 deg F and rising. If temperatures fall below 32 deg F, please refer to the manufacturers recommendations for the installation of an acceptable deck. Coordinate the roofing membrane application to avoid prolonged exposure of the roof deck.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform field tests and inspections, and prepare test reports.

B. Testing Procedures: Check the cast density at the point of placement and adjust the mix design to obtain the required cast density. A minimum of 4 test specimens (3”x6” cylinders) shall be sampled at the point of placement daily of for each 100 cubic yards of material placed. Protect samples from damage and temperature extremes and test according to ASTM C796. Compressive test samples shall NOT be oven-dried prior to testing. Manufacturer shall conduct and report test results.

3.1 DEFECTIVE WORK

A. Refinish, or remove and replace, lightweight insulating concrete if surfaces are excessively scaled or too rough to receive roofing according to roofing membrane manufacturer’s written requirements.

B. Remove and replace lightweight insulating concrete that fails to comply with requirements.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY
A. Section Includes
   1. Grout for steel baseplates

1.02 RELATED SECTIONS
A. Section 033000 – Structural Concrete
B. Section 051200 – Structural Steel Framing

1.03 REFERENCES
A. Comply with provisions of the latest editions of the following codes, standards and specifications, except as otherwise shown and specified.
C. American Society for Testing and Materials (ASTM):

1.04 SUBMITTALS
A. Product Data: submit manufacturer’s data including product compliance for grout.

1.05 DELIVERY, STORAGE AND HANDLING
A. Store grout materials in dry condition above ground.

PART 2 PRODUCTS

2.01 MATERIALS
A. Non-Shrink, Pre-mixed, High Strength Grout:
   1. Compressive strength in 28 days: 5000 psi minimum but not less than specified strength of base concrete.
   2. Comply with CRD-C621 and ASTM C1107.
   3. Non-oxidizing, if grout will be permanently exposed to view.
   4. Acceptable products:
      b. Masterflow 713, manufactured by Master Builders Co.
      c. Supreme Grout, Manufactured by Gifford-Hill co.
PART 3 EXECUTION

3.01 PREPARATION

A. Surface preparation:
   1. Remove dirt and loose material down to sound concrete.
   2. Remove oil, grease, and paint from areas of base plates or foundations to be grouted.
   3. Roughen adjacent concrete surfaces where possible.
   4. Thoroughly wet concrete contact area at least 4 hours prior to grout placement, or as instructed by grout manufacturer. Keep wet, and remove excess water prior to placement.

B. Mixing:
   1. Use mechanical mortar mixer.
   2. Use the minimum amount of mixing water needed for placement.
   3. Comply with manufacturer's recommendations, including the following:
      a. Quantity of water used in mix.
      b. Length of mixing time.
   4. Do not mix more grout than can be placed within 15 minutes. Do not retemper grout.

C. Forms:
   1. Use side forms if grout space is thicker than 1-1/2 inches.
   2. When forms are required, use strong, securely anchored forms, sealed to prevent grout leakage.
   3. Remove forms only after grout is completely self-supporting.

3.02 APPLICATION

A. Placement:
   1. Comply with manufacturer's recommendations for placement.
   2. Place grout continuously, and from one side to avoid entrapment of air pockets and to ensure good consolidation.
   3. Remove voids by rodding and vibrating during placement. Do not overwork grout.

B. Curing:
   1. Comply with manufacturer's recommendations for curing.
   2. Avoid vibrating or disturbing grout while curing.

END OF SECTION
PART 1  GENERAL

1.01  SECTION INCLUDES

A. Mortar and Grout for masonry construction.

1.02  RELATED SECTIONS

1. Section 042200 – Concrete Unit Masonry

1.03  REFERENCES

A. American Concrete Institute (ACI):

1. ACI 530, Building Code Requirements for Masonry Structures.
2. ACI 530.1, Specification for Masonry Structures.

B. American Society for Testing and Materials (ASTM)

2. ASTM C144, Aggregate for Masonry Mortar.
3. ASTM C150, Portland Cement.
5. ASTM C270, Mortar for Unit Masonry.
6. ASTM C404, Aggregates for Masonry Grout.
7. ASTM C476, Mortar and Grout for Reinforced Masonry.
8. ASTM C780, Construction Evaluation of Mortars.


1.04  SUBMITTALS

A. Product Data: Submit in accordance with Specification. Include product data sheets for each named product.

B. Test Reports: Submit independent laboratory test reports of initial mortar and grout tests, including design mix proportions, for each mortar and grout.

C. Certification: Submit manufacturer's certification that materials meet specification requirements.

1.05  PRODUCT DELIVERY, STORAGE AND PROTECTION

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. Stockpile and protect aggregates to prevent contamination from foreign materials.

1.06 ENVIRONMENTAL REQUIREMENTS

PART 2 PRODUCTS

2.01 MATERIALS
A. Portland cement: ASTM C150, Type I, II or III. Provide natural color or white cement as required to produce required mortar color.

B. Hydrated Lime: ASTM C207, Type S.

C. Sand: ASTM C144, standard masonry type; clean, dry, protected against dampness, freezing and foreign matter.

D. Aggregate for Grout: ASTM C404, maximum size 3/8 in. for fine grout and 1/2 in. for coarse grout.

E. Water: Clean and potable, free of organic matter.

F. Mortar Color: Finely ground mineral pigment of high purity, non-fading, lime-proof, not detrimental to mortar; color as selected by architect from manufacturer standards.

2.02 MORTAR MIXES
A. Mortar for Concrete Unit Masonry Walls and Partitions: Proportion and mix in accordance with ASTM C270, Type S.

1. Minimum compressive strength of 1800 psi in 28 days.

2. Maximum air content 12%.

B. Mortar for Brick Veneer Masonry: ASTM C270, Type N.

C. Pointing Mortar: ASTM C270, Type S, with a maximum of 2% ammonium stearate or calcium stearate per cement weight.

D. Mortar for Glass Unit Masonry: ASTM C270, Type S.

E. Mortar Color for exposed to view masonry as required to produce mortar as established by mock-up panel.

2.03 MORTAR MIXING
A. Measure materials by volume, use approved container or equivalent weight. Maintain sand uniformly damp immediately before the mixing process for all colored mortar.
B. Thoroughly mix ingredients in accordance with ASTM C270 in quantities needed for immediate use.
C. For facing work add Mortar Color as selected, and white cement to produce mortar as established by mock-up panel.
D. If water is lost by evaporation, retemper only within two hours of initial mixing.
E. Use mortar within 2-1/2 hours of initial mixing.
F. Do not use mortar after it has begun to set.
G. Do not use anti-freeze compounds.

2.04 GROUT MIXES
A. Proportion and mix grout in accordance with ASTM C476.
B. Minimum compressive strength of 2000 psi in 28 days.
C. Use fine or coarse grout as appropriate for grout pour height and width of grout space. Conform to ACI 530.1, Table 5 for grout space requirements.

2.05 GROUT MIXING
A. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and course grout.
B. Add admixtures in accordance with manufacturer's instructions; mix uniformly.
C. Do not use anti-freeze compounds to lower the freezing point of grout.
D. Grout shall have a slump of 8 to 10 inches at time of placement.
E. Use grout within 2-1/2 hours of initial mixing.

PART 3 EXECUTION

3.01 INSTALLATION
A. Install mortar and grout as specified in Sections 042200.

3.02 FIELD QUALITY CONTROL
A. Masonry Mortar Testing
   1. Conduct strength tests in accordance with the following:
      a. Spread mortar on the masonry units 1/2 inch to 5/8 inch thick, and allow to stand for one minute.
      b. Remove mortar and place in a 2 inch by 4 inch cylinder in two layers, compressing the mortar into the cylinder using a flat end stick or fingers. Lightly tap mold on opposite sides level off and immediately cover molds and keep them damp until taken to the laboratory.
      c. After 48 hours set, have the laboratory remove molds and place them in the fog room until tested in damp condition.
2. Execute one mortar test specimen for each 5,000 square feet of masonry wall constructed and a minimum of one mortar test specimen for each day that masonry construction is performed. Test specimens at 28 days.

3. Strength of mortar will be considered satisfactory if each mortar test equals or exceeds 1500 psi (this corresponds with Type S, 2000 psi mortar mix as specified in Contract Drawings.)

4. In addition to required information noted previously in this Section, record the following information on mortar compression reports:
   a. Mix design or mix designation.
   b. Test sample number.
   c. Specific wall areas covered by test.
   d. Description of units used to form sample.
   e. Tested compressive strength.

B. Masonry Grout Testing

1. Conduct strength tests in accordance with ASTM C1019.
   a. Take two strength samples for each 5000 square feet of masonry wall surface for each type of grout placed each day.
   b. Create test samples by forming with wood surface on bottom and concrete block on sides. The samples shall be 3 inches square and 8 inches high.
   c. Initial cure during first 48 hours. Protect samples from loss of moisture by covering with wet cloth and keeping moist. Protect from freezing and variations in temperature. Record maximum and minimum temperatures by using a max/min thermometer.
   d. Remove masonry units that form samples after 48 hours and transport grout samples to laboratory. Keep samples protected from vibration, freezing, and moisture loss during transportation.
   e. Test samples at 28 days. Compressive strength shall be the average, of the two samples and shall be adequate if it equals f'm as defined on Contract Drawings but not less than 2000 psi.

2. Conduct slump test at time compressive test samples are taken in accordance with ASTM C143.

3. In addition to required information noted previously in this Section record the following information on grout compression reports.
   a. Mix design or mix designation. Test sample number.
   b. Test sample number.
   c. Specific wall areas covered by test.
   d. Description of sample dimensions, amount out of plumb in percent.
   e. Description of units used to form sample.
   f. Curing history with max/min temperature, age when transported to lab, and age when tested.
   g. Tested compressive strength.
   h. Description of failure.

END OF SECTION
SECTION 042200
CONCRETE UNIT MASONRY

PART I - GENERAL

1.01 SECTION INCLUDES
   A. Unit Masonry Construction, including Reinforced Masonry Construction

1.02 RELATED SECTION
   A. Section 041000 - Mortar and Grout

1.03 REFERENCES
   A. American Concrete Institute (ACI)
      2. ACI 530, Building Code Requirements for Masonry Structures.
      3. ACI 530.1, Specifications for Masonry Structures.
   B. American Society for Testing and Materials (ASTM)
      1. ASTM A153, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
      2. ASTM A615, Specification for Deformed and Plain Billet-Steel Hardware.
      3. ASTM C90, Specification Load-Bearing Concrete Masonry Units.
      4. ASTM C140, Test Methods of Sampling and Testing Concrete Masonry Units.

1.04 SUBMITTALS
   A. Certificates: Prior to delivery, submit certificates attesting compliance with applicable specifications for grades, types, classes, and strengths of concrete masonry units.
   B. Product Data: Submit manufacturer’s product data sheets, in accordance with specifications, for each proprietary product.
   C. Shop Drawings
      1. Submit an elevation drawing of each reinforced CMU wall that shows:
         a. Reinforcing bar size, quantity, spacing, length, and grade of steel.
         b. Horizontal and vertical location of all bearing plates and embedded plates.
c. Location of each control joint.
d. Horizontal and vertical location of all anchor bolts.

2. Submit details showing proper location of reinforcing bars (vertical and horizontal), bearing plates, embedded plates, and anchor bolts.

3. Include masonry notes that concern construction means and methods, grouting procedures, and proper alignment of reinforcing bars (vertical and horizontal), bearing plates, embedded plates, and anchor bolts.

4. Prepare shop drawings in accordance with ACI 315 – do not use reproductions of Contract Drawings as shop drawings.

1.05 QUALITY ASSURANCE

A. Sample Wall

1. Build sample wall, size 4 ft. x 4 ft., of concrete masonry for Architect’s approval of workmanship. Sample wall to include each type of masonry; selected bonding, tooled joints, quality of workmanship, typical reinforcement, ties, and grouting of reinforced masonry.

2. Do not start work until Architect or Owner has accepted sample panel.

3. Use approved sample panel as standard to judge quality and workmanship of completed masonry work. Do not remove panel until work is completed and accepted.

B. Perform work in accordance with ACI 530.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store masonry materials off ground.

B. Protect masonry units, reinforcement, and accessories with tarpaulins or other suitable material from elements.

1.07 JOB CONDITIONS

A. Coordination:

1. Coordinate opening sizes and locations of items and equipment built into masonry work.

2. Coordinate and make provisions for installation of anchor, bolts, hangers, frames, insulation, dampproofing, and other items built into masonry work.

PART 2 - PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Load Bearing Concrete Masonry Units: ASTM C 90, Type 1, with a minimum 28-day compressive strength over net area of 1900 psi, unless noted otherwise on the Contract Drawings.

B. Nominal Face Dimensions: 8" x 16".
C. Special Shapes: Furnish required sizes, shapes, lintels, pilasters, bond beams and miscellaneous shapes shown on Contract Drawings or required to complete bond.

D. Special Features: Furnish required face finishes and scorings shown on Contract Drawings.

E. Color:
   1. Interior Smooth Face CMU: Standard CMU to be painted
   2. Exterior Split-Face CMU: Standard CMU to be painted

2.02 RELATED MATERIAL

A. Joint Reinforcement: Horizontal joint reinforcement shall be ladder design, minimum 9 gage welded steel wire: hot dipped galvanized to 1.5 oz. ASTM A153, Class B2. Width to be 1 1/2 to 2 inches less than wall thickness. Provide prefabricated corner and tee ties.

B. Bar positioners for Vertical Wall Bars: Minimum 9 gauge, galvanized wire.
   1. AA Wire Products Co., Dallas, TX (214) 637-1511.
   3. Wire•Bond; Charlotte, NC (704) 525-5554.

C. Mortar and Grout: As specified in Section 041000

2.03 ACCESSORIES

A. Control Joints: Regular and No. 8 Wide Flange Rapid Control Joint by Dur-O-Wall, Inc. or equal.

B. Premolded Filler: Fibrous mastic strips containing 35% to 50% asphaltic impregnation, ASTM D1751.

C. Building Felt: No. 15 Asphalt Saturated Felt ASTM D-226.

D. Cleaner: Deox Chemical Cleaner by National Chemsearch Corp.; or Sure Kleen 600 by Process Solvent Co., Inc.

PART 3 - EXECUTION

3. 01 INSPECTION

A. Examine other construction which is to support or interface with masonry work. Where construction such as footings and shelves are not sound or level, where anchorage devices have not been installed, where interferences exist or where there are other conditions unsuitable for proper installation or performance of masonry, do not start masonry work until other construction has been corrected.

3. 02 BRACING

A. Provide adequate temporary bracing of masonry CMU wall has cured and permanent structural braces (i.e.: floor and roof diaphragms, etc.) are in place. Bracing of masonry walls is a means and method of construction and is the sole responsibility of the General Contractor and his masonry sub-contractors. As a minimum, provide bracing in accordance with the Mason Contractor’s Association of America’s “Standard Practice for Bracing Masonry Walls Under Construction”.

042200-3
B. Allow 16 hrs. to elapse after completion of masonry walls and columns before allowing uniform floor or roof loading construction.
C. Allow an additional 48 hrs. before allowing construction of concentrated loads on masonry walls and columns.

3. 03 JOINT REINFORCEMENT AND ANCHORS
A. Joint reinforcement: Provide continuous reinforcement in mortar joints as shown on Contract Drawings.
B. Anchors: Install anchors and ties as shown on Contract Drawings. Extend anchors through the sheathing and fasten to metal studs, unless shown otherwise on the Contract Drawings.
C. Provide ladder joint reinforcement tee ties at intersections of interior walls and exterior walls at 16” o.c.

3. 04 COURSING AND JOINING
A. Lay up units with 3/8 in. bed and head joints, uniformly adjusted to produce specified coursing.
B. Lay units in stacked bond to match existing Multi-Purpose Building.
C. Tightly tool joints to a smooth, hard concave joint.
D. Provide sealant and caulking in recessed joints around outside perimeter of door and glazing frames and other wall openings. Rake joints to depths of 3/4 in. and width of 1/4 in.

3. 05 INSTALLATION
A. Lay block plumb and true to lines, with level courses, head joints lined up vertically. Use no more than one cut closure in a length of wall. Line up closures vertically.
B. Tap each unit to line and level as it is placed. Do not disturb units once in place, except to remove completely and set in fresh mortar.
C. Do not pound corner and jambs to fit stretcher units after they have been set in position. Where an adjustment must be made after mortar has started to harden, remove mortar and replace with fresh mortar.
D. Stop off horizontal run by raking back in each course; toothing is not permitted.
E. Make cuts with a power masonry saw. Do not use saw-cut-faces in exposed work.
F. Lay up only block which have no chipped, cracked or discolored exposed faces. Lay up with good face showing.
G. Adjust shelf angles to keep work level and at proper elevation.
H. All units shall be laid with full mortar beds on the face shells. All head joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of longitudinal face shells. All head joints for bond beams and lintels shall be filled solid with grout. Cross webs of all 4 inch units shall be fully mortared.
I. End walls and cross webs framing cells to be filled shall be full bedded in mortar to prevent leakage of grout unless the wall is to be poured solid.
J. Properly install lintels, pilaster units and other special units.
K. Use only dry concrete masonry units.
L. Keep cavities and grout spaces free of mortar droppings. As work progresses, trowel protruding mortar in cavity flat on the inner face of wythe.
M. Make cuts tight around items to be recessed into block face. Carefully chip block faces as required for fit acceptable to Architect and Owner.

3.06 PROTECTION

A. Protection of Work:

1. During erection, cover top of wall with strong waterproof membrane at end of each day or shutdown.
2. Cover partially-completed walls when work is not in progress.
3. Extend cover minimum of 24 in. down both sides and hold cover securely in place
4. Protect door jambs and corners from damage during construction.

B. Staining:

1. Prevent grout or mortar from staining face of masonry.
2. Immediately remove grout or mortar from staining face of masonry.
3. Protect sills, ledges and projections from droppings of mortar.

C. Cold Weather Protection: (Air Temperature 40°F to 20°F):

1. Preparation:
   a. Remove ice or snow formed on masonry bed by carefully applying heat until top surface is dry.
   b. Remove frozen or damaged masonry.
2. Product:
   a. Use dry masonry units.
   b. Do not use wet or frozen units.
3. Protection requirements completed masonry and masonry being worked on.
   a. Heat sand and mixing water to produce mortar temperatures between 40 ° and 120 °F.
   b. Maintain temperatures of mortar on boards above freezing.
   c. Use salamanders or other heat sources on both sides of walls under construction (below 25 °F).
   d. Use windbreaks when wind is in excess of 15 mph (below 25 °F).
4. Protection requirements for completed masonry and masonry not being worked on.
   a. Mean daily air temperature 40°F to 32°F - protect masonry from rain or snow for 24 hrs. by covering with weather-resistive membrane.
   b. Mean daily air temperature 32°F to 25°F completely cover masonry with weather-resistive membrane for 24 hours.
   c. Mean daily air temperature 25°F to 20°F completely cover masonry with insulating blankets or equal protection for 24 hours.
d. Mean daily air temperature 20°F and below - maintain masonry temperature above 32°F for 24 hours by electric heating blankets or other approved heating method.

3. 07 ALLOWABLE TOLERANCES

A. Maximum variation from plumb in vertical lines and surfaces of walls:
   1. 1/4 in. in 10 ft.
   2. 3/8 in. in a story height not to exceed 20 feet.
   3. 1/2 in. in 40 ft. or more.

B. Maximum variation from plumb for external corners, expansion joints and other conspicuous lines:
   1. 3/8 in. in 20 ft.
   2. 1/2 in. in 40 ft. or more.

C. Maximum variation from level of grades for exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines:
   1. 3/8 in. in 20 ft.
   2. 1/2 in. in 40 ft. or more.

D. Maximum variation from plan location of related portions of columns, walls and partitions.
   1. 3/8 in. in a bay, or 20 ft. maximum.
   2. 3/4 in. in 40 ft. or more.

E. Maximum variation in cross-sectional thickness of walls from dimensions shown on drawings:
   1. minus 1/8 in. from standard dimensions.
   2. plus 1/8 in. from standard dimensions.

3. 08 REINFORCED MASONRY

A. Forms and Shores:
   1. Provide substantial and tight forms.
   2. Leakage of mortar or grout is not permitted.
   3. Brace or tie forms to maintain position and shape.
   4. Do not remove forms and shores until masonry has hardened sufficiently to carry its own weight and other temporary loads that may be placed on it during construction.
      a. For girders, beams and arches: Minimum 10 days.
      b. Under brick slabs or soffits: Minimum 7 days.

B. Steel Reinforcement: Place steel reinforcement, grouted spaces and bond beams as work progresses, as follows:
1. Accurately position and secure against displacement from locations shown. Horizontal reinforcement may be placed as work progresses. All vertical reinforcing shall be in place prior to grouting and shall be held in position by means of bar positioners 8” from top and bottom and at 48” o.c. max.

2. Provide clear distance between vertical bars not less than 1-1/2 times bar diameter, nor less than 1-1/2 in.

3. Provide not less than 1/4 in. thickness of grout between masonry units and reinforcement.

4. Provide minimum width of collar joints containing both horizontal and vertical reinforcement of 1/2 in. larger than sum of diameters of horizontal and vertical reinforcement.

5. Make splices in bars as shown on Contract Drawings. Lapped splices for reinforcement shall not be less than 48 bar diameters. Provide lap slices of greater lengths when indicated on the Contact Drawings. Welded or mechanical splices shall develop the strength of the reinforcement.

C. Grouting

1. Fully grout cavities, pilasters and vertical cells of concrete masonry containing steel reinforcement. Fully grout bond beams and lintels, including head joints. Grouting of bond beams, lintels, etc shall be placed as work progresses; when bond beam is fully exposed, and not from masonry courses above bond beam. Fully grout all cells in retaining walls, and all cells below grade in all walls. In addition fully grout cavities and cells as directed by the Contact Drawings. Remaining cells shall not be grouted unless noted on Contact Drawings.

2. Wherever possible, place grout from inside face of masonry.

3. Exercise extreme care to prevent grout from staining on face and top of masonry. Clean spillage immediately. Remove stains at completion of work.

4. Use coarse grout where grout space is 4 in. or more in width.

5. Keep grout space clean of mortar and droppings.

6. Vertical cells to be filled shall have vertical alignment sufficient to maintain a clear, unobstructed continuous vertical cell measuring not less than 2 inches by 3 inches.

7. Provide cleanouts when required by grouting procedures specified below. Cleanout opening shall be provided at all cells to be filled at each pour of grout where such pour is in excess of four feet. Any overhanging mortar or other obstructions or debris shall be removed from the inside of such cell walls. Cleanouts shall be sealed after inspections and before grouting.

8. Expanded metal mesh or other suitable material that will not interfere with bond may be laid on top of unit to permit bond beams and other horizontal members to be grouted without fully grouting the wall.

D. Low-Lift Grouting: (Hollow Units)

1. Units may be laid to a height not to exceed eight feet. If the height exceeds five feet, cleanouts must be used.

2. Place vertical steel in cells with enough steel extending to provide proper lap splice.
3. Grout cells in five feet high maximum lifts.

4. Stop grout 1-1/2" below top of masonry when grout is to be stopped for 1 hour or more. All horizontal steel shall be fully embedded in grout.

5. Consolidate pours exceeding 12 inches in height by mechanical vibration and reconsolidate by mechanical vibration after initial water loss and settlement has occurred.

6. The grouting of any section of wall shall be completed in one day with no interruptions greater than one hour.

3. 09 CONTROL OF MOVEMENT

A. At control joints, insert preformed control joint material and leave joint free of masonry and reinforcement. Reinforcing and grout for bond beams at floor or roof shall not be continuous through the control joints.

B. Build non-bearing partitions to a distance 3/8 to 3/4 in. from structural soffit above. When structure above has deflected from building loads placed upon it, wedge partition to structural soffit above, unless specifically noted otherwise on Contract Drawings.

C. Do not bond units to steel members unless specifically required on Contract Drawings. Wrap steel members enclosed in masonry with building felt. Maintain 1/2 in. clearance. Fill vertical clearances with premolded filler.

D. At expansion joints, leave full width of joint free of masonry, mortar and reinforcement. Install joint filler material, recessed from face for sealant.

E. Locate 3/8" wide control joints as indicated on the Contract Drawings. Control joints shall be 3/8" wide unless otherwise undicated on Construction Documents. Keep vertical joints straight, true and continuous from top to bottom of masonry.

F. Use sash units to form control joints and install continuous control joint filler with sash units tightly butted to compress neoprene flanges and completely seal joint. Where masonry abuts structural concrete or steel and control joint filler cannot be used, keep joint clean of mortar as work progresses.

3. 10 BUILDING IN OTHER WORK

A. Build in lintels, door frames, windows, flashing, reglets, inserts, anchors, blocking, sleeves, wall plugs, boxes, cabinets, piping, conduit and other items, whether provided as part of masonry work, as preparation for other work or furnished in other Sections.

B. Full grout hollow metal door frames in masonry walls with mortar.

C. Provide passage for electrical and mechanical lines. Chase CMU in unexposed work, allow placement in walls where exposed. Cut neat holes for in-wall switches and cabinets. Make provisions for passage of lines, and other chases and openings, during laying up of masonry, so that later cutting is not necessary. Fill holes after lines and boxes are in place.

D. Provide special jamb units where required to execute window and control joint details. Maintain sealant clearances at door, window and other openings.

E. Provide lintels at opening of masonry work as necessary to form opening for in-wall equipment, through-wall ducts and piping, and as otherwise needed to support openings over 8 in. wide.
F. All insulated bolts embedded in masonry shall be grouted solidly in place with not less than 2” of grout surrounding the bolt.

3.11 CLEANING AND POINTING

A. At completion of masonry work, inspect masonry for defective joints and damaged masonry units.

B. Cut out and repaint defective joints. Fill holes and tool smooth.

C. Remove stained and damaged masonry units and replace with new units in fresh mortar bed, of color and tooling to match adjacent joints.

D. Dry brush masonry surface after mortar has set, at end of each day's work and after final pointing.

E. Apply cleaning agent to 20 square feet sample wall in location acceptable to Architect.

F. Work small sections at a time; work form top to bottom.

G. Thoroughly rinse with clean water.

H. Protect adjacent material which may corrode.

I. Leave work and surrounding surfaces clean and free of mortar spots, droppings and broken masonry.

3.12 QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

Inspections: Level 1 special inspections according to the "International Building Code."

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.

2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.

3. Place grout only after inspectors have verified proportions of site-prepared grout.

B. Concrete Unit Masonry Testing by Testing Laboratory:

1. Conduct strength tests in accordance with ASTM C 140.

2. Select 3 units from each lot of 10,000 units or less, 6 units for each lot of 10,000 to 100,000 units. For lots greater than 100,000 select 3 units for every 50,000 units.

3. Strength of concrete masonry units will be considered satisfactory if calculated test compressive strength conforms to requirements of ASTM C 90 for hollow units and solid units.

C. Masonry Wall Inspections by Testing Laboratory Inspector:

1. Inspect wall for compliance with drawings and specifications. Report on the following:
a. Placement of concrete masonry units (joint space, level and plumb).
b. Horizontal reinforcing, spacing, and lap.
c. Vertical bar size, spacing and placement (spacing across width of wall) at walls and control joints.
d. Vertical bar laps.
e. Lift heights, placement, and vibration of grout.
f. Spacing and grouting of embedded plates for joist bearing.
g. Spacing and grouting (or installation of anchors) of embedded plates for continuous angle attachment at roof perimeter.

2. Inspect bond beams for compliance with drawings and specifications. Report on the following:
   a. Location.
   b. Size, placement, and lap of reinforcing bars.
   c. Placement and vibration of grout.

3. Inspect openings for compliance with drawings and specifications. Report on the following:
   a. Types of concrete masonry units used to form lintels.
   b. Reinforcing bar size and placement at lintel.
   c. Stirrup size and spacing at lintel.
   d. Vertical reinforcing size and placement at door jambs.
   e. Placement and vibration of grout in lintels and jambs.

4. Inspect pilasters for compliance with drawings and specifications. Report on the following:
   a. Vertical reinforcing size and placement.
   b. Tie size and placement.
   c. Placement and vibration of grout.

END OF SECTION
SECTION 047200
ARCHITECTURAL CAST STONE

PART 1 GENERAL

1.1 SCOPE
A. All labor, materials and equipment to provide the Cast Stone shown on architectural drawings and as described in this specification.
B. Manufacturer shall furnish Cast Stone covered by this specification.
C. Installing contractor shall unload, store, furnish all anchors, set, patch and clean the Cast Stone as required.

1.2 RELATED SECTIONS
A. Section 016000 – Product Requirements
B. Section 041000 – Mortar and Grout
C. Section 048100 – Brick Unit Masonry
D. Section 079000 – Joint Protection

1.3 REFERENCES

1.4 DEFINITIONS
A. Cast Stone - a refined architectural concrete building unit manufactured to simulate natural cut stone, used in unit masonry applications.
   1. Dry Cast Concrete Products – manufactured from zero slump concrete.
      a. Vibrant Dry Tamp (VDT) casting method: Vibratory ramming of earth moist, zero-slump concrete against a rigid mold until it is densely compacted.
   2. Wet Cast Concrete Products – manufactured from measurable slump concrete.
      a. Wet casting method: manufactured from measurable slump concrete and vibrated into a mold until it becomes densely consolidated.

1.5 SUBMITTALS
A. Comply with Section 016000 – Product Requirements.
B. Samples: Submit pieces of the Cast Stone that are representative of the general range of finish and color proposed to be furnished for the project.
C. Test results: Submit manufacturers test results of Cast Stone previously made by the manufacturer.
D. Shop Drawings: Submit manufacturers shop drawings including profiles, cross-sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, annotation of stone types and their location.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. Manufacturer shall have sufficient plant facilities to produce the shapes, quantities and size of Cast Stone required in accordance with the project schedule.
2. Manufacturer shall submit a written list of projects similar in scope and at least three (3) years of age, along with owner, architect and contractor references.

B. Standards: Comply with the requirements of the Cast Stone Institute Technical Manual and the project specifications. Where a conflict may occur, the contract documents shall prevail.

PART 2 PRODUCTS

2.1 ARCHITECTURAL CAST STONE

A. Physical properties: Provide the following:
1. Compressive Strength - ASTM C 1194: 6,500 psi (45 Mpa) minimum for products at 28 days.
2. Absorption - ASTM C 1195: 6% maximum by the cold water method, or 10% maximum by the boiling method for products at 28 days.
3. Air Content – ASTM C173 or C 231, for wet cast product shall be 4-8% for units exposed to freeze-thaw environments. Air entrainment is not required for VDT products.

B. Job site testing – One (1) sample from production units may be selected at random from the field for each 500 cubic feet (14 m$^3$) delivered to the job site.
1. Three (3) field cut cube specimens from each of these samples shall have an average minimum compressive strength of not less than 85% with no single specimen testing less than 75% of design strength as allowed by ACI 318.
2. Three (3) field cut cube specimens from each of these samples shall have an average maximum cold-water absorption of 6%.
3. Field specimens shall be tested in accordance with ASTM C 1194 and C 1195.

2.2 RAW MATERIALS

A. Portland cement – Type I or Type III, white and/or grey, ASTM C 150.

B. Coarse aggregates - Granite, quartz or limestone, ASTM C 33, except for gradation, and are optional for the VDT casting method.

C. Fine aggregates - Manufactured or natural sands, ASTM C 33, except for gradation.

D. Colors - Inorganic iron oxide pigments, ASTM C 979 except that carbon black pigments shall not be used.

E. Admixtures- Comply with the following:
1. ASTM C 260 for air-entraining admixtures.
2. ASTM C 494 for water reducing, retarding or accelerating admixtures.
3. Other admixtures: integral water repellents and other chemicals, for which no
ASTM Standard exists, shall be previously established as suitable for use in concrete by proven field performance or through laboratory testing.
4. ASTM C 618 mineral admixtures of dark and variable colors shall not be used in surfaces intended to be exposed to view.
5. ASTM C 989 granulated blast furnace slag may be used to improve physical properties. Tests are required to verify these features.

F. Water – Potable

G. Reinforcing bars:
1. ASTM A 615/A 615M. Galvanized or epoxy coated when cover is less than 1-1/2 inches (37 mm).
2. Welded Wire Fabric: ASTM A 82 where applicable for wet cast units.

H. All anchors, dowels and other anchoring devices and shims shall be standard building stone anchors commercially available in a non-corrosive material such as zinc plated, galvanized steel, brass, or stainless steel Type 302 or 304.

2.3 COLOR AND FINISH

A. Match existing cast stone on adjacent building areas.

B. All surfaces intended to be exposed to view shall have a fine-grained texture similar to natural stone, with no air voids in excess of 1/32 in (0.8 mm) and the density of such voids shall be less than 3 occurrences per any 1 in.² (25 mm²) and not obvious under direct daylight illumination at a 5 ft (1.5m) distance.

C. Units shall exhibit a texture approximately equal to the existing units when viewed under direct daylight illumination at a 10 ft (3 m) distance.
1. ASTM D 2244 permissible variation in color between units of comparable age subjected to similar weathering exposure.
   a. Total color difference – not greater than 6 units.
   b. Total hue difference – not greater than 2 units.

D. Minor chipping resulting from shipment and delivery shall not be grounds for rejection. Minor chips shall not be obvious under direct daylight illumination from a 20-ft (6 m) distance.

E. The occurrence of crazing or efflorescence shall not constitute a cause for rejection.

F. Remove cement film, if required, from exposed surfaces prior to packaging for shipment.

2.4 REINFORCING

A. Reinforce the units as required by the drawings and for safe handling and structural stress.

B. Minimum reinforcing shall be 0.25 percent of the cross section area.

C. Panels, soffits and similar stones greater than 24 in. (600 mm) in one direction shall be reinforced in that direction. Units less than 24 in. (600 mm) in both their length and width dimension shall be non-reinforced unless otherwise specified.

D. Welded wire fabric reinforcing shall not be used in dry cast products.
2.5 CURING

A. Cure units in a warm curing chamber approximately 100°F (37.8°C) at 100 percent relative humidity for approximately 12 hours, or cure in a 100 percent moist environment at a minimum 70°F (21.1°C) for 16 hours after casting. Additional yard curing at 95 percent relative humidity shall be 350 degree-days (i.e. 7 days @ 50°F (10°C) or 5 days @ 70°F (21°C)) prior to shipping. Form cured units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.

2.6 MANUFACTURING TOLERANCES

A. Cross section dimensions shall not deviate by more than ±1/8 inch (3 mm) from approved dimensions.

B. Length of units shall not deviate by more than length/360 or ±1/8 inch (3 mm), whichever is greater, not to exceed ±1/4 inch (6 mm).
   1. Maximum length of any unit shall not exceed 15 times the average thickness of such unit unless otherwise agreed by the manufacturer.

C. Warp, bow or twist of units shall not exceed length/360 or ±1/8 inch (3 mm), whichever is greater.

D. Location of dowel holes, anchor slots, flashing grooves, false joints and similar features – On formed sides of unit, 1/8 inch (3 mm), on unformed sides of unit, 3/8 inch (9 mm) maximum deviation.

2.7 PRODUCTION QUALITY CONTROL

A. Testing.
   1. Test compressive strength and absorption from specimens selected at random from plant production.
   2. Samples shall be taken and tested from every 500 (14 m³) cubic feet of product produced.
   3. Perform tests in accordance ASTM C 1194 and C 1195.
   4. New and existing mix designs shall be tested for strength and absorption compliance prior to producing units.

2.8 DELIVERY, STORAGE AND HANDLING

A. Mark production units with the identification marks as shown on the shop drawings.

B. Package units and protect them from staining or damage during shipping and storage.

C. Provide an itemized list of product to support the bill of lading.

PART 3 EXECUTION

3.1 EXAMINATION

A. Installing contractor shall check Cast Stone materials for fit and finish prior to installation. Do not set unacceptable units.

3.2 SETTING TOLERANCES


B. Set stones 1/8 inch (3 mm) or less, within the plane of adjacent units.
C. Joints, plus - 1/16 inch (1.5 mm), minus - 1/8 inch (3 mm).

3.3 JOINTING

A. Joint size:
   1. At stone/brick joints 3/8 inch (9.5 cm).
   2. Stone/stone joints exposed on top 3/8 inch (9.5 mm).

B. Joint materials:
   1. Mortar, Type N, ASTM C 270.
   2. Use a full bed of mortar at all bed joints.
   3. Flush vertical joints full with mortar.
   4. Leave all joints with exposed tops or under relieving angles open for sealant.
   5. Leave head joints in copings and projecting components open for sealant.

C. Location of joints:
   1. As shown on shop drawings.
   2. At control and expansion joints unless otherwise shown.

3.4. SETTING

A. Drench units with clean water prior to setting.
B. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.
C. Set units in full bed of mortar, unless otherwise detailed.
D. Rake mortar joints 3/4 inch (18 mm) for pointing.
E. Remove excess mortar from unit faces immediately after setting.
F. Tuck point unit joints to a slight concave profile.

3.5 JOINT SEALANT

A. Comply with requirements of Section 07900.
B. Prime ends of units, insert properly sized backing rod and install required sealant.

3.6 REPAIR AND CLEANING

A. Repair chips with touchup materials furnished by manufacturer.
B. Saturate units to be cleaned prior to applying an approved masonry cleaner.
C. Consult with manufacturer for appropriate cleaners.

3.7 INSPECTION AND ACCEPTANCE

A. Inspect finished installation according to Bulletin #36.
B. Do not field apply water repellant until repair, cleaning, inspection and acceptance is completed.

END OF SECTION
SECTION 048100
BRICK UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Clay Facing Brick.
   B. Mortar and Grout.
   C. Reinforcement and Anchorage.
   D. Flashings.
   E. Accessories.

1.02 SUBMITTALS
   A. See Section 013000 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar.
   C. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.
   D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.03 QUALITY ASSURANCE
   A. Comply with provisions of ACI 530/ASCE 5/TMS 402 and ACI 530.1/ASCE 6/TMS 602, except where exceeded by requirements of the contract documents.

1.04 MOCK-UP
   A. Construct a masonry wall as a mock-up panel sized 4 feet long by 2 feet 8 inches high, which includes mortar and accessories, wall openings, and flashings.
   B. Locate where directed.
   C. Mock-up may not remain as part of the Work.

1.05 ENVIRONMENTAL REQUIREMENTS
   A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
   B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.
PART 2 PRODUCTS

2.01 BRICK UNITS

A. Manufacturers:
   1. Acme Brick Company.
   2. Substitutions: Only permitted if approved by Architect prior to bidding.

B. Facing Brick:
   1. To match Architect’s sample.

2.02 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I; color as required to produce approved color sample.
   1. Hydrated Lime: ASTM C 207, Type S.

B. Water: Clean and potable.

2.03 REINFORCEMENT AND ANCHORAGE

   1. Anchor plates: Not less than 0.0747 inch thick, designed for fastening to backup through sheathing by two fasteners.
   2. Wire ties: triangular shape, 0.1875 inch thick.
   3. Vertical adjustment: Not less than 2 inches.

2.04 FLASHINGS

A. Plastic Flashings: Nervastral HD as manufactured by Nervastral, Inc., or approved equal; thickness as indicated on drawings.

B. Galvanized Steel: ASTM A 653/A 653M, with G90/Z275 coating, 24 gage total thickness.

2.05 ACCESSORIES

A. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; 3 inch wide by maximum lengths available.

B. Cavity Vents: Molded polyvinyl chloride grilles; insect resistant.
   1. Manufacturers:
      a. Dur-O-Wal, Inc.
      b. Hohmann & Barnard, Inc.
      c. Mortar Net Solutions.
      d. Substitutions: See Section 016000 - Product Requirements.

C. Cavity Wall Mortar Screen: WallDefender by Mortar Net Solutions or equivalent. Trapezoidal Shape, 90% open weave mesh, dual levels, installed per manufacturer’s instructions.

D. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.06 MORTAR AND GROUT MIXES

A. Mortar for Unit Masonry: ASTM C 270, using the Proportion Specification.
   1. Masonry below grade and in contact with earth: Type S.
   2. Exterior, non-loadbearing masonry: Type N.
B. Grout: ASTM C 476. Consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

C. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Brick Units:
   1. Bond: Running.
   2. Coursing: Three units and three mortar joints to equal 8 inches.

3.02 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar as work progresses.

E. Interlock intersections and external corners.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.03 WEEPS

A. Install weeps in cavity walls at 24 inches on center horizontally above through-wall flashing and at bottom of walls.

3.04 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Lap joint reinforcement ends minimum 6 inches.

D. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically, and horizontally at each stud, but not to exceed (24 inches on center horizontally.). Place additional anchors at perimeter of openings.
and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.05 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 4 inches into adjacent masonry or turn up at least 4 inches to form watertight pan at non-masonry construction.
   2. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Extend flashings to within 1/4 inch of exterior face of masonry.

C. Lap end joints of flashings at least 4 inches and seal watertight with mastic or elastic sealant.

D. Plastic Flashings to be installed per manufacturer’s directions.

3.06 LINTELS

A. Install loose steel lintels over openings unless indicated otherwise on drawings.

B. Maintain minimum 8 inch bearing on each side of opening.

C. Notch brick as indicated on drawings to conceal edge of lintels.

3.07 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control and expansion joints.

B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

C. Size control joint in accordance with Section 079000 for sealant performance.

D. Form expansion joint as detailed.

3.08 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout.
   1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

D. Do not build into masonry construction organic materials that are subject to deterioration.

3.09 CUTTING AND FITTING

A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.
3.10 CLEANING

A. Remove excess mortar and mortar smears as work progresses.
B. Replace defective mortar. Match adjacent work.
C. Clean soiled surfaces with cleaning solution.
D. Use non-metallic tools in cleaning operations.

END OF SECTION
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. Structural steel.
   2. Miscellaneous angles and plates.
   3. Bolts and anchor rods.
   4. Steel assemblies to be embedded in concrete or masonry.
   5. Supplementary parts and members necessary to complete and erect structural steel frame.
   7. Grout.

B. Related Sections:
   1. Section 013000 – Submittal Procedures
   2. Section 014000 – Quality Requirements
   3. Section 052100 – Steel Joist Framing
   4. Section 053100 – Steel Decking
   5. Section 055000 – Metal Fabrications

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear, axial and moment connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer, to withstand LRFD loads indicated and comply with other information and restrictions indicated.

B. Detail bolted connections using bolts conforming to ASTM A325N, Bearing Type Connections with threads allowed in shear plane, unless noted otherwise on Contract Drawings.

C. Moment Connections: Type FR, fully restrained.
1.5 SUBMITTALS

A. Product Data: Submit manufacturer’s data in accordance with specifications indicating product compliance to these specifications.

B. Shop Drawings: Show fabrication of structural-steel components.

   1. Submit three bond sets of shop drawings and calculations for review by the Structural Engineer-of-Record. The Structural Engineer-of-Record will mark three sets with red and will return one set to the contractor through the Architect. The contractor shall make the number of photocopies required of the approved shop drawings for distribution to other parties, and the contractor shall be responsible for transmitting the original red-marked set to the fabricator for corrections.

   2. Only complete shop drawing submittals will be reviewed. Shop drawings not in compliance with the Submittal portion of this document will be rejected. Time required by structural engineer to review shop drawing submittals a second or third time will be billed to the Structural Steel Contractor at engineer’s hourly rates.

   3. Include details of cuts, connections, splices, camber, holes, and other pertinent data.

   4. Include embedment drawings.

   5. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.

   6. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

   7. Do not begin fabrication of materials prior to review of shop drawings.

   8. Review of shop drawings is for member sizes, spacings, details, and general compliance with the Contract Drawings only.

   9. Material quantities, lengths, fit, verification of job conditions and coordination with other trades are responsibility of Contractor.

   10. Reproductions of Contract Drawings shall not be used for shop drawings.

   11. For structural-steel connections indicated to comply with design loads, include structural analysis data and design calculations prepared by and signed and sealed by the qualified professional engineer responsible for their preparation and licensed in the state where the project is located.

   12. Coordination of the structural-steel connection calculations with the structural-steel shop drawings is the responsibility of the structural-steel connections calculations engineer.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:

   1. Power source (constant current or constant voltage).

   2. Electrode manufacturer and trade name, for demand critical welds.

D. Qualification Data: For qualified installer and fabricator.

E. Welding certificates.

F. Mill test reports for structural steel, including chemical and physical properties.

G. Product Test Reports: For the following:

   1. Bolts, nuts, and washers including mechanical properties and chemical analysis.

   2. Direct-tension indicators.

   3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.

1.6 ALLOWANCE

A. Include an allowance in the bid price for 2,000 pounds of miscellaneous structural steel to be fabricated and placed as directed by Architect or Engineer. Allowance is to include, but not limited to, material, detailing, fabrication, shipping, installation, overhead and profit.

1.7 QUALITY ASSURANCE AND QUALITY CONTROL

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD. Not less than 5 years of experience in fabrication of structural steel.

B. Installer Qualifications: A qualified installer with not less than 5 years of experience in installation of structural steel.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

D. Quality Control Welding Inspector Qualifications: Qualified to the satisfaction of the fabricator’s or erector’s Quality Control Program, as applicable, and in accordance with either of the following:
   1. Associate welding inspectors (AWI) or higher as defined in AWS B5.1, Standard for the Qualification of Welding Inspectors.
   2. Qualified under the provisions of AWS D1.1 subclause 6.1.4.

E. Quality Control Bolting Inspector Qualifications: Qualified on the basis of documented training and experience in structural bolting inspection.

F. Quality Assurance Welding Inspector Qualifications: Qualified to the satisfaction of the quality assurance agency’s written practice, the requirements of the Authority Having Jurisdiction, and either of the following:
   1. Welding inspectors (WIs) or senior welding inspectors (SWIs) as defined in AWS B5.1, Standard for the Qualification of Welding Inspectors, except associate welding inspectors (AWIs) are permitted to be used under the direct supervision of WIs, who are on the premises and available when weld inspection is being conducted.
   2. Qualified under the provisions of AWS D1.1, subclause 6.1.4.

G. Quality Assurance Bolting Inspector Qualifications: Qualified on the basis of documented training and experience in structural bolting inspections.

H. Nondestructive Testing (NDT) Personnel Qualifications: Qualified in accordance with their employer’s written practice, which shall meet or exceed the criteria of AWS D1.1 Structural Welding Code – Steel, subclause 6.14.6 and either of the following:
   2. ASNT CP-189, Standard for the Qualification and Certification of Nondestructive Testing Personnel.
I. Comply with applicable provisions of the following specifications and documents:
   1. AISC 303.
   2. AISC 360.
   3. RCSC's “Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.”

J. Preinstallation Conference: Conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
   1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
   1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
   2. Clean and relubricate bolts and nuts that become dry or rusty before use.
   3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.9 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 PRODUCTS

1.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992.

B. Channels, Angles, M-Shapes and S-Shapes: ASTM A 36.

C. Plate and Bar: ASTM A 36.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B structural tubing.

E. Steel Pipe: ASTM A 53, Type E or S, Grade B.
   1. Finish: Black except where indicated to be galvanized.

F. Steel Castings: ASTM A 216, Grade WCB with supplementary requirement S11.

G. Steel Forgings: ASTM A 668.
H. Welding Electrodes: 70 ksi low-hydrogen.

1.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
   1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head assemblies consisting of steel structural bolts with splined ends, ASTM A 563 heavy-hex carbon-steel nuts, and ASTM F 436 hardened carbon-steel washers.

C. Shear Stud Connectors:
   1. Provide shear stud connectors with proper ferrules and accessories especially designed to create composite deck action by mating of shear connectors, concrete deck and supporting beam, and capable of providing shear forces shown on Contract Drawings when welded through deck used on the project.
   2. Comply with ASTM A 108, Grades C1010-1020, with minimum tensile strength of 60,000 psi.
   4. Head: Concentric with and normal to shaft.
   5. Weld Ends: Chamfered and solid flux.
   6. Height: At least 1-1/2 inch above top of deck after installation, with at least 3/4 inch clear concrete cover above top of stud, unless noted otherwise on Contract Drawings.

D. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
   4. Washers: ASTM F 436, Type 1, hardened carbon steel.
   5. Finish: Plain, except where indicated to be galvanized.

   2. Washers: ASTM F 436, Type 1, hardened carbon steel.
   3. Finish: Plain, except where indicated to be galvanized.

F. Headed Stud Anchors for Embedded Assemblies:
   1. Steel shall conform to ASTM A 108 grades C1010-1020, minimum tensile strength of 60,000 psi.
   2. Studs shall be of uniform diameter, heads concentric and normal to shaft, and weld end chamfered and solid flux.

1.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat, unless noted otherwise in Division 09 painting Sections.

B. Galvanizing Repair Paint: ASTM A 780.
1.4 GROUT
A. Compressive strength in 28 days: 5000 psi minimum but not less than specified strength of base concrete. Non-oxidizing, if grout will be permanently exposed to view.
   1. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
   2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      b. Masterflow 713, manufactured by Master Builders Co.
      c. Supreme Grout, manufactured by Gifford Hill Co.

1.5 FABRICATION
A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
   1. Camber structural-steel members where indicated.
   2. Fabricate beams with rolling camber up.
   3. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
   4. Mark and match-mark materials for field assembly.
   5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Steel Bearing Plates: Fabricate steel bearing plates with headed stud anchors of sizes and thicknesses indicated on Contract Drawings.

C. Headed Stud Anchors:
   1. Comply with AWS D1.1, Section 7.
   2. Clean surfaces to be welded of rust, oil, grease, paint and dirt. Remove mill scale by scraping or sandblasting.
   3. Weld headed studs with appropriate equipment properly adjusted for climatic conditions.
   4. Remove ceramic ferrules after welding.

D. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

E. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces. Short-slotted holes shall not be used for primary frame connections (members connecting to columns), trusses and wind bracing unless specifically allowed by the Engineer of Record. Where used, short slotted holes shall be oriented normal to the direction of load.

F. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

G. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."
H. Shear Connectors: Do not paint steel surfaces that receive welded shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer’s written instructions.

I. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.

J. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches o.c. unless otherwise indicated.

K. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces. Holes for anchor rods in base plates may be oversized in accordance with AISC Specifications. Provide washers as indicated on Contract Drawings.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

1.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC’s “Specification for Structural Joints Using ASTM A 325 or A 490 Bolts” for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened, unless indicated otherwise on Contract Documents.
      a. High strength bolts for bearing connections shall be tightened in accordance with RCSC Specifications to a snug-tight condition. Provide hardened washers as required by the RCSC specification.
      b. High strength bolts for pretensioned or slip-critical joints, as noted on the Contract Drawings, shall be tightened in accordance with the RCSC specifications by turn-of-nut with matchmarking, twist-off type tension control bolt assemblies (ASTM F1852) or direct tension indicators (ASTM F959) methods of installation. Provide hardened washers as required by the RCSC specification.
         1) High strength bolts for pretensioned or slip-critical joints, as noted on the Contract Drawings, may be tightened in accordance with the RCSC specifications by calibrated wrench method in an AISC-Certified Plant.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
   2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

1.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.
6. Top flanges of beams with shear connectors to support metal deck.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

D. Prepare faying surfaces of slip critical connections in accordance with RCSC.

1.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.
1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize with a minimum G60 coating lintels, shelf angles, plates and welded door frames attached to structural-steel frame and located in exterior walls.

PART 3 EXECUTION

1.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

1.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
   1. Set plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of baseplate as required on Contract Drawings.
   3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
   4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure.
   2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Stud Connectors:
   1. Prepare steel surfaces as recommended by manufacturer of shear connectors.
   2. Use automatic end welding of headed-stud shear connectors according to ASW D1.1 and manufacturer's written instructions.
   3. Remove ceramic ferrules after welding.

1.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened unless noted otherwise on Contract Drawings.
      a. High strength bolts for bearing connections shall be tightened in accordance with RCSC Specifications to a snug-tight condition. Provide hardened washers as required by the RCSC specifications.
      b. High strength bolts for pretensioned or slip-critical joints, as noted on the Contract Drawings, shall be tightened in accordance with the RCSC specifications by turn-of-nut with matchmarking, twist-off type tension control bolt assemblies (ASTM F1852) or direct tension indicators (ASTM F959) methods of installation. Provide hardened washers as required by the RCSC specification.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth if radiographic testing (RT) of the welds is required by the testing agency of the engineer or record.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

1.5 FIELD QUALITY CONTROL

A. Contractor shall retain a duly designated person who acts for, and in behalf of, the Contractor on all inspection and quality matters within the scope of AISC 360-10, AWS D1.1 and of the Contract Documents.

1.6 FIELD QUALITY ASSURANCE

A. Owner will engage a qualified independent testing and inspecting agency to perform testing and verification inspections as noted below along with inspection schedule items included in the Contract Drawings. Testing Agency shall prepare test and inspection reports and submit in writing to Owner, Authority Having Jurisdiction, Engineer of Record, and Owner's consultants within 48 hours of testing or inspections. Reports shall contain Project identification name and number, date of inspection, name of testing and inspecting agency and location of inspected or tested work. In addition, reports shall include verification of compliance or deviations from the Contract Documents.

B. In addition to the above, the Testing Agency shall submit the following to the fabricator and erector:
   1. Inspection reports
   2. Nondestructive testing reports
   3. Nonconformance reports
   4. Reports of repair, replacement or acceptance of nonconforming items

C. Bolted Connections: Bolted connections will be tested and inspected according to RCS's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
   1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:
      a. Liquid Penetrant Inspection: ASTM E 165.
      b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
      c. Ultrasonic Inspection: ASTM E 164.
      d. Radiographic Inspection: ASTM E 94.
   2. In addition to visual inspections, field complete penetration groove welds shall be tested by either of the following, at testing agency's option or as specified on the Contract Documents:
      a. Ultrasonic Inspection: ASTM E 164
      b. Radiographic Inspection: ASTM E 94
   3. In addition to visual inspections, ultrasonic testing (UT) of welds shall be performed as specified on the Contract Documents. The percentage of required testing may be reduced or shall be increased according to the following:
      a. The rate of UT is permitted to be reduced if approved by the Engineer of Record and the Authority Having Jurisdiction. Where the initial rate of UT is 100%, the nondestructive testing (NDT) rate for an individual
welder or welding operator is permitted to be reduced to 25%, provided the reject rate, the number of welds containing unacceptable defects divided by the number of welds completed, is demonstrated to be 5% or less of the welds tested for the welder or welding operator. A sampling of at least 40 completed welds for a job shall be made for such reduction evaluation. For evaluating the reject rate of continuous welds over 3 feet in length where the effective throat is 1 inch or less, each 12 inch increment of fraction thereof shall be considered as one weld. For evaluating the reject rate on continuous welds over 3 feet in length where the effective throat is greater than 1 inch, each 6 inches of length or fraction thereof shall be considered one weld.

b. For structures in Risk Category II, where the initial rate for UT is 10%, the NDT rate for an individual welder or welding operator shall be increased to 100% should the reject rate, the number of welds containing unacceptable defects divided by the number of welds completed, exceeds 5% of the welds tested for the welder or welding operator. A sampling of at least 20 completed welds for a job shall be made prior to implementing such an increase. When the reject rate for the welder or welding operator, after a sampling of at least 40 completed welds, has fallen to 5% or less, the rate of UT shall be returned to 10%. For evaluation the reject rate of continuous welds over 3 feet in length where the effective throat is 1 inch or less each 12 inch increment or fraction thereof shall be considered as one weld. For evaluating the reject rate on continuous welds over 3 feet in length where the effective throat is greater than 1 inch, each 6 inches of length or fraction thereof shall be considered one weld.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents at no additional cost to owner.

1.7 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces, unless noted otherwise in Division 09 painting Section.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

END OF SECTION
SECTION 052000
STEEL JOISTS

PART 1  GENERAL

1.01  SECTION INCLUDES:
A. Pre-engineered steel joists
B. Bridging
C. Ceiling Extensions
D. Bearing plates
E. Side wall anchors
F. Extended ends

1.02  RELATED SECTIONS:
A. Section 031119 – Insulating Concrete Forming
B. Section 035210 – Lightweight Concrete Deck & Insulation System
C. Section 051000 - Structural Steel
D. Section 053100 - Metal Roof Deck

1.03  REFERENCES
A. American Society for Testing and Materials (ASTM):
   1. ASTM A36, Specification for Structural Steel.
   2. ASTM A242, Specification for High-Strength, Low-Alloy Structural Steel.
   5. ASTM A572, Specification for High-Strength, Low-Alloy Columbium Vanadium Steels of Structural Quality.
   7. ASTM A606, Specification for Steel Sheet and Strip, Hot-Rolled and Cold-Rolled, High-Strength, Low-Alloy with Improved Corrosion Resistance.
   8. ASTM A607, Specification for Sheet Steel and Strip, Hot-Rolled and Cold-Rolled, High-Strength, Low-Alloy, Columbium and or Vanadium.
B. American Welding Society (AWS):

2. AWS D1.1, Structural Welding Code - Steel.

C. Steel Joint Institute (SJI):

1. Standard Specifications for Open Web Steel Joists, K-Series; and Standard Load Table Open Web Steel Joists, K-Series.

D. Underwriters Laboratory Inc. (UL):


1.04 SUBMITTALS

A. Shop drawings: Submit shop and erection drawings to include member marks, number, type, location, and spacing of members, details of bridging, extended ends and attachments at supports. Indicate safe load carrying capacity of each joist or girder by standard joist designations or by special loads in accordance with the requirements of Contract Drawings. Indicate all special loadings, axial loads and concentrated loads on shop and erection drawings.

B. Mill test reports: Submit certified mill test report showing compliance with requirements of ASTM and SJI Specifications.

C. Indicate on shop drawings where special designs have been provided.

D. Requirements:

1. Reproductions of Contract Drawings shall not be used for shop drawings.
2. Joist design and shop drawings shall be prepared under the direction of a Registered Professional Engineer. Shop Drawings shall be signed and sealed by a professional engineer licensed in the State of Oklahoma.
3. Delegated-Design Submittal: For pre-engineered steel joists indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer, licensed in the State of Oklahoma, responsible for their preparation.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Members of Steel Joist Institute.
2. Fabrications, handling, erection and connections of steel joists shall be in accordance with latest editions of SJI Specifications.

B. Welding Operator Qualifications:
1. Certified within 6 months previous.

1.06 DELIVERY, STORAGE AND HANDLING

A. Mark pieces for identification during erection
B. Deliver to site in proper sequence for erection.
C. Store materials above ground: prevent corrosion, warpage and twisting.
D. Do not bend or damage members during handling.
E. Take precautions breaking bundles to prevent damage to materials and injury to workmen.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel bridging, bearing plates and wall anchors: comply with ASTM A36.
B. Bolts: comply with ASTM A325.
C. Welding Electrodes: comply with AWS A5.5, E70 or submerged arc Grade SAW-2.
D. Steel Joists: comply with SJI Specifications.
   1. Provide double angle bottom chords.
   2. Provide extended ends where required.

2.02 DESIGN AND FABRICATION

A. Design and fabricate joists and girders in accordance with SJI Specifications.
B. Design joists for all loads indicated on Contract Drawings, including: dead load, live load, wind uplift, concentrated loads, axial loads, and any other special loads indicated.
C. Design and fabricate joists and girders for any special camber or deflection requirements as indicated on Contract Drawings. If no requirements are indicated, meet or exceed the requirements of SJI Specifications.
D. Accessories: Provide required sag rods, bridging, extended bottom chords and top chords, side wall anchors, wall connectors, headers, and ceiling extensions.
E. Shop Paint: After fabrication, clean joists, bridging and anchors of rust, mill scale, dirt and other foreign material. Remove grease and oil with solvents. Apply once coat of paint, minimum thickness of 2 mils.
F. Extended Ends: Design to cantilever from the main span of the joist, provide load capacity at least equal to that of joist.
G. Provide horizontal and x-bridging as required, minimum bridging requirements per SJI Specifications, unless Contract Drawings indicate a larger bridging size is required.
PART 3  EXECUTION

3.01 ERECTION

A. Replace joists damaged by bending or warping during handling and erection.

B. Bridging shall comply with SJI Specifications.

C. Minimum bearing and anchorage shall comply with SJI specifications and Contract Drawings as related to particular type of support.

D. Provide erection bolts for joists located on or near column centerlines to provide lateral stability during construction.

E. Set joists to lines, levels, and spacing as indicated. Provide bearing plates as indicated or required to carry out structural requirements.

F. Execute handling and erection in accordance with SJI Specifications.

G. Joists shall be permanently fastened to supports, and all bridging and anchorage installed before any construction loads, other than one workman, are placed on joists. One end of all joists shall be attached to its support before allowing the weight of an erector on the joists. Extreme caution must be exercised since the unbridged joists may exhibit some degree of instability under the erector's weight.

H. Welding shall be performed in accordance with AWS D1.1.

I. Electrodes shall be properly stored and protected to prevent deterioration or damage by moisture and climate.

J. After erection, field connections and abraded places of shop paint shall be touched up with same kind of paint as shop coat.

K. Bottom chords of joists shall not be welded to supports until full dead load is applied. Joists and supporting structure shall be braced for safety and stability until permanent bracing structures are in place.

L. Bridging shall not be used to support conduit, piping, duct work, or other equipment.

M. Hangers supporting loads in excess of 150 pounds shall not be attached directly to joist chords. See details on Contract Drawings for methods of supporting loads in excess of 150 pounds on joists.

N. All joists forty feet and longer shall have a row of bolted bridging in place before hoist lines are slackened.

3.02 ADJUSTING

A. Touch-up abrasions and welds with shop paint.

B. Joists in crawl space: paint all connections with special paint.

C. Correct or replace damaged materials at no additional cost to the Owner.

3.03 FIELD QUALITY CONTROL

A. Laboratory Testing Inspection:
1. Inspect condition of each joist, and each girder, and all bridging after erection. Identify and report any bent or damaged members or broken welds.

2. Inspect connections to supporting structure for conformance with Contract Drawings and report deficiencies.

3. Inspect a representative sample of bridging (20 locations minimum) and bracing (20 locations minimum) welds and connections for conformance with Contract Drawings and Joist Manufacturer's requirements. Report deficiencies.

END OF SECTION
SECTION 053100
METAL ROOF DECK

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Metal Roof Deck and Accessories
B. Framing for Openings up to and including 18 inches

1.02  RELATED SECTIONS
A. Section 035210 – Lightweight Concrete Deck & Insulation System
B. Section 051000 - Structural Steel Framing
C. Section 052000 - Steel Joists and Joist Girders

1.03  REFERENCES
A. American Iron and Steel Institute (AISI)
   1. Specification for the Design of Cold-Formed Steel Structural Members.
B. American Society for Testing and Materials (ASTM)
   1. ASTM A36, Specification for Carbon Structural Steel.
   5. ASTM B117, Standard Salt Spray (Fog) Test.
   6. ASTM D714, Evaluating Degree of Blistering of Paints.
   7. ASTM D1654, Evaluation of Painted or Coated Specimens Subject to Corrosive Environments.
C. American Welding Society (AWS)
   2. AWS D1.3, Structural Welding Code - Sheet Steel.
D. Steel Deck Institute (SDI)
   1. Specifications and Commentary for Steel Roof Deck.
E. Steel Structures Painting Council (SSPC)
   1. Painting Manual
1.04 PERFORMANCE REQUIREMENTS

A. Metal deck units shall comply with the specifications of the Steel Deck Institute.

B. Design units for required spans and conditions of continuity, generally for 3 continuous spans, except as required by layout.

C. Stresses under construction loads, gravity loads and wind loading shall not exceed recommendations of the Steel Deck Institute.

1.05 SUBMITTALS

A. Shop Drawings: Submit shop drawings for review prior to fabrication or installation of materials.

1. Indicate erection layouts, details, steel deck dimensions, profile, gage, and section properties, coatings and installation instructions. Show supporting framing, lengths, and markings of deck to correspond with sequence and procedure to be followed in installing and fastening deck. Show size and number of holes to be cut in deck.

2. Indicate allowable diaphragm shear capacity corresponding to pattern and type of connections provided.

3. Indicate method of installing and connecting accessories.

4. Indicate methods of fastening deck. Show fastener locations, types, sizes and sequence of connections for deck units.
   a. Welds: use standard AWS welding symbols.
   b. Screws: use type, size and manufacturer as noted on the Contract Drawings.
   c. Powder Actuated: use type, size and manufacturer as noted on the Contract Drawings.

B. Certificates:

1. Certify that all deck and accessories provided meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Member Steel Deck Institute.

2. Minimum 5 years experience.

B. Erector Qualifications:

1. Minimum 5 years experience.

2. Welders certified within previous 6 months.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver deck in bundles and store on pallets, sloped to drain, above the ground, protect from corrosion and damage. Rusted, crimped or bent deck shall not be installed in the work.
B. Do not store materials on installed deck prior to connecting the deck to the supporting structure.

C. Do not overload deck during construction by workmen or storage of materials.

PART 2 PRODUCTS

2.01 MATERIALS

A. Sheet Steel:
   1. ASTM A446/A446M Grade A, B, C, D, E, or F for galvanized deck, as indicated on Contract Drawings. Provide G60 coating unless noted otherwise on Contract Drawings.
   2. ASTM A611 Grade C, D or E for painted deck, as indicated on Contract Drawings.

B. Galvanizing: Coating shall conform to ASTM A123. Provide G60 coating unless noted otherwise on Contract Drawings.

C. Welding Rods: AWS A5.1, E70

D. Shop and Touch-up Primer: SSPC15, Type 1, red or gray oxide.
   1. Resistant to solvents used to clean deck.
   2. Resistant to corrosion and blistering in accordance with ASTM B 117, D714 and D1654.
   3. Must be compatible to spray on fire-proofing where deck requires fire proofing.

E. Touch-up Primer for galvanized surfaces: SSPC20, Type 1 – inorganic.

F. Screws or powder actuated fasteners as shown on Contract Drawings.

2.02 FABRICATION

A. Fabricate in lengths as long as practical and piece-mark bundles for identification during erection.

B. Roof Sump Pan: Fabricated of sheet steel, flat bottom, sloped sides, bearing flange 3” wide, sealed watertight.

PART 3 EXECUTION

3.01 INSTALLATION

A. Do not lay deck units in place until supporting structure is secured in place and final connections are complete.

B. Erect metal deck in accordance with manufacturer’s written instructions.
C. Layout deck units in accordance with shop drawings. Do not stretch or bend units.

D. Overlap ends a minimum of 2 inches. Interlock side laps as shown on shop drawings.

E. Connections: as indicated on Contract Drawings.

F. Reinforce steel deck openings from 6 to 18 inches in size with 2x2x1/4 inch steel angles. Place framing angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and mechanically attach to deck at each flute.

G. Install 6 inch minimum wide sheet steel cover plates, of same thickness as deck, where deck changes direction. Mechanically attach at 6 inches o.c. maximum.

H. Position roof sump pans with flange bearing on top surface of deck. Mechanically attach at each deck flute.

I. Place metal cant strips in position and mechanically attach.

3.02 FIELD QUALITY CONTROL

A. Laboratory Testing and Inspection:

1. Inspect condition of deck units for damage and corrosion. Report deficiencies.

2. Inspect size, spacing and quality of connections of deck to structure and at side laps for conformance with Contract Drawings. Report deficiencies.

3.03 ADJUSTING

A. Immediately after connecting deck in place, touch up welds, burned areas and coating damage with touch-up primer.

B. Repair blow-holes at welds with 18 gage plates welded in place. Replace entire sections of deck where holes cannot be satisfactorily repaired.

3.04 HANGERS FOR MISCELLANEOUS EQUIPMENT

A. Do not attach hangers for ceiling grids, ductwork, and mechanical piping directly to metal roof deck.

END OF SECTION
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. Exterior non-load-bearing wall framing.
   2. Roof rafter framing.
   4. Any other cold-formed framing system noted on Structural Contract Drawings.

B. Related Requirements:
   1. Section 048100 – Brick Unit Masonry
   2. Section 053100 – Metal Roof Deck
   3. Section 055000 – Metal Fabrications
   4. Section 092116 – Gypsum Board Assemblies

1.3  SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory indicated on the Contract Drawings, provide the following:
   1. Section Properties: Submit section properties, material strengths and ASTM specification compliance verification for each size member, strap or brace of each gage used.
   2. Connections: Submit manufacturer’s data for each type of manufactured connector, screw, or fastener verifying conformance with the Contract Drawings.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
   1. Submit three bond sets of shop drawings and calculations for review by the Structural Engineer-of-Record. The Structural Engineer-of-Record will mark three sets with red and will return one set to the contractor through the Architect. The contractor shall make the number of photocopies required of the approved shop drawings for distribution to other parties, and the contractor shall be responsible for transmitting the original red-marked set to the fabricator for corrections.
   2. Only complete shop drawing submittals will be reviewed. Shop drawings not in compliance with the Submittal portion of this document will be rejected. Time required by structural engineer to review shop drawing submittals a second or third time will be billed to the Contractor at engineer’s hourly rates.
   3. For cold-formed steel framing indicated to comply with design loads, include complete structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation and licensed in the state where the
project is located. Design calculations will be reviewed by the Engineer-of-Record.

C. Qualification Data: For testing agency.

D. Welding certificates.

E. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
   1. Steel sheet.
   2. Expansion anchors.
   4. Mechanical fasteners.
   5. Adhesive anchors.
   7. Horizontal drift deflection clips
   8. Miscellaneous structural clips and accessories.

F. Research Reports: For non-standard cold-formed steel framing, from ICC-ES.

1.4 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer licensed in the state where the project is located.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed steel framing that are similar to those indicated on this Project in material, design and extent.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 for testing indicated.

D. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

E. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code - Steel."
   2. AWS D1.3, "Structural Welding Code - Sheet Steel."

F. Fire-Test-Response Characteristics: Where indicated, provide cold-formed steel framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

G. Comply with current AISI Specifications and Standards.

H. Preinstallation Conference: Conduct conference at Project site.
1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

B. During construction, adequately distribute all loads applied to framing members so as not to exceed the carrying capacity of any one member.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. AllSteel & Gypsum Products, Inc.
   2. California Expanded Metal Products Company.
   3. ClarkDietrich Building Systems, Inc.
   4. Consolidated Fabricators Corp.; Building Products Division.
   5. Craco Mfg., Inc.
   6. Custom Stud Inc.
   7. Design Shapes in Steel.
   8. Formetal Co. Inc. (The).
   9. MarinoWARE.
  10. Nuconsteel; a Nucor Company.
  11. Olmar Supply, Inc.
  12. Quail Run Building Materials, Inc.
  13. SCAFCO Corporation.
  15. State Building Products, Inc.
  17. Steel Network, Inc. (The).
  18. Steel Structural Systems.
  19. Steeler, Inc.
  21. Telling Industries, LLC.
  22. United Metal Products, Inc.
  23. United Steel Manufacturing.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
   2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
      a. Exterior Non-Load-Bearing Framing – Horizontal deflections:
         a) Masonry Veneer: l/600 of the wall height.
         b) Brittle Finishes: l/360 of the wall height.
         c) Flexible Finishes: l/240 of the wall height.
      b. Roof Rafter Framing: Vertical deflection of 1/360 for live loads and l/240 for total loads of the span.
3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.

4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
   a. Roof Framing: Downward movement of 3/4 inch and upward movement of 1/2 inch, unless noted otherwise on Contract Documents.
   b. Floor Framing: Downward movement of 3/4 inch, unless noted otherwise on Contract Documents.

5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Comply with current AISI Specifications and Standards, unless more stringent requirements are indicated.

D. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL’s “Fire Resistance Directory” or from the listings of another qualified testing agency.

### 2.3 COLD-FORMED STEEL FRAMING, GENERAL

A. Manufacturing Standard: All cold form framing shall be equivalent to SSMA (Steel Stud Manufacturers Association) published standards and installation recommendations, which will be used as a quality standard reference in the event the Contractor furnishes materials in which the submitted manufacturer does not have a published installation manual.

B. Steel Sheet: ASTM A 1003, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   1. Grade: ST33H or ST50H as indicated or as required by structural performance
   2. Coating: G60.

C. Steel Sheet for Vertical Deflection Clips: ASTM A 653, structural steel, zinc coated, of grade and coating as follows:
   1. Grade: 50, Class 1.
   2. Coating: G90.

### 2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: The physical and structural properties listed by SSMA shall be the minimum permitted. Manufacturer’s standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0329 inch or as indicated on Contract Drawings.

B. Steel Track: The physical and structural properties listed by SSMA shall be the minimum permitted. Manufacturer’s standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0329 inch or as indicated on Contract Drawings, but shall match wall stud thickness when heavier than 0.0329 inch.

C. Vertical Deflection Clips: Manufacturer's standard bypass and head clips as noted on Contract Drawings, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. AllSteel & Gypsum Products, Inc.
   b. ClarkDietrich Building Systems, Inc.
   c. MarinoWARE.
   d. SCAFCO Corporation.
   e. Steel Network, Inc. (The).
   f. Steeler, Inc.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track as noted on the Contract Drawings; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch or as indicated on Contract Drawings.
2. Minimum Flange Width: 3/4 inch plus the design gap.
3. Row of bridging to be located 12 inches from top of studs.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
   a. Minimum Base-Metal Thickness: 0.0428 inch or as indicated on Contract Drawings.
   b. Minimum Flange Width: 3/4 inch plus the design gap.
2. Inner Track: Of web depth indicated, and as follows:
   a. Minimum Base-Metal Thickness: 0.0329 inch or as indicated on Contract Drawings.
   b. Minimum Flange Width: Equal to sum of outer deflection track flange width plus 1 inch.

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.5 ROOF-RAFTER FRAMING

A. Steel Rafters: The physical and structural properties listed by SSMA shall be the minimum permitted. Manufacturer’s standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch or as indicated on Contract Drawings.

B. Built-Up Members: The physical and structural properties listed by SSMA shall be the minimum permitted. Built-up members of manufacturer’s C-shaped steel section, with
stiffened flanges, nested into a U-shaped steel section joist track, with unstiffened flanges; unpunched; of web depths as indicated on the Contract Drawings; and as follows.
1. Minimum Base-Metal Thickness: 0.0428 inches, or as indicated on Contract Drawings.

2.6 SOFFIT FRAMING
A. Exterior Soffit Frame: The physical and structural properties listed by SSMA shall be the minimum permitted. Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0329 inch or as indicated on Contract Drawings.

2.7 FRAMING ACCESSORIES
A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
9. Joist hangers and end closures.

2.8 ANCHORS, CLIPS, AND FASTENERS
A. Steel Shapes and Clips: ASTM A 36, zinc coated by hot-dip process according to ASTM A 123.
B. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
   4. Washers: ASTM F 436, Type 1, hardened carbon steel.
   5. Finish: Plain, except where indicated to be galvanized.
C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
D. Powder-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
   1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.9 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.10 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
   1. Fabricate framing assemblies using jigs or templates.
   2. Cut framing members by sawing or shearing; do not torch cut.
   3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.
   4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
   5. Do not begin fabrication of work prior to receiving approval of shop drawings and calculations. Fabricate per manufacturer's current printed instructions.
   6. Shop Fabrication: Fabricate items in shop to greatest extent possible so as to minimize field assembly of units at project site. Clearly mark units for assembly and coordinated installation.
B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
   2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200 and to manufacturer’s written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
   1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
   a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 072100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

J. All structural joists and studs shall have a minimum of 10 inches of unpunched steel at bearing or support points.

K. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
   1. Stud Spacing: As indicated on Contract Drawings or Shop Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
   1. Connect vertical deflection clips to bypassing and infill studs and anchor to building structure.
E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Contract Drawings or Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
   1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
      a. Install solid blocking at 96-inch centers.
   2. Bridging:
      a. Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
      b. Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
      c. Proprietary bridging bars installed according to manufacturer’s written instructions.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 FIELD QUALITY CONTROL

A. Testing: Contractor will retain a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor, owner and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION
SECTION 055000
METAL FABRICATIONS

PART 1  GENERAL

1.01 DESCRIPTION
A. Includes ferrous metal items, galvanized and prime painted scheduled at end of this Section.

1.02 REFERENCES
A. ASTM – American Society for Testing and Materials
B. AWS D1.1 – Structural Welding Code

1.03 SUBMITTALS
A. See section 013000 – Administrative Requirements, for submittal procedures.
B. Product Data: Provide field dimensions, profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners and accessories.
C. Shop Drawings: Include erection drawings, elevations and details where applicable. Indicate welded connections using standard AWS welding symbols. Indicate net weld lengths.

1.04 DELIVERY AND STORAGE
Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well-ventilated areas, and protected from extreme changes in temperature and humidity.

PART 2  PRODUCTS

2.01 MATERIALS
A. Steel Sections: ASTM A36.
B. Steel Tubing: ASTM A500, Grade B.
D. Welding Materials: AWS D1.1; type required for materials being welded.
E. Primer: FS TT-P-31, red or brown for shop application and field touch-up.
F. Touch-up for Galvanized Surfaces: Organic Zinc Rich Paint; DOD-P-21035; 4 mils thick.

2.02 FABRICATION
A. Fabricate items with joints .020" tightly fitted and secured. Fit and shop assemble in largest practical sections, for delivery to site.
B. Grind exposed welds flush and smooth with adjacent finished surface. Ease exposed edges to small uniform radius.
C. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of structure, except where specifically noted otherwise.

D. Supply components required for anchorage of metal fabrications. Fabricate anchorage and related components of same material and finish as metal fabrication, except where specifically noted otherwise.

2.03 FINISHES

A. Prime paint items scheduled with one coat. Clean surfaces of rust, scale, grease and foreign matter before finishing. Do not prime surfaces in direct contact bond with concrete or where field welding is required.

B. Fabrication practices for assemblies to be galvanized in accordance with ASTM A385.

C. Galvanize items to "Minimum Coating Thickness Grade" in accordance with ASTM A123.

PART 3 EXECUTION

3.01 PREPARATION

A. Obtain Architect / Engineer approval before site cutting or making adjustments not scheduled.

B. Make provision for erection loads with temporary bracing. Keep work in alignment.

C. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate trades.

3.02 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Perform field welding in accordance with AWS D1.1.

C. After installation, touch-up field welds, scratched or damaged surfaces with primer.

3.03 SCHEDULE

A. The Schedule is a list of principal items only. Refer to Drawings details for items not specifically scheduled.
1. Ledge and Shelf Angles and Channels and Plates: not attached to structural framing, for support of masonry: galvanized finish.
2. Lintels: galvanized finish
5. Fabricated Frames and Grating, Plate Covers for Manholes, Catch Basins, Sump Trenches, Pits: prime paint or galvanize finish as directed.
7. Steel Plates: necessary for erection of structural members, natural finish.

END OF SECTION
SECTION 061000
ROUGH CARPENTRY

PART 1  GENERAL

1.01  DESCRIPTION
A. Includes, but is not limited to, wood framing and blocking, concealed fire-retardant wood backing for wall mounted items, cants, nailers sleepers, utility shelving, sleepers and plywood backing panels.

1.02  REFERENCES
A. AFPA – American Forest and Paper Association
C. PS 1 – Construction and Industrial Plywood.

1.03  DELIVERY AND STORAGE
A. Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well-ventilated areas, and protected from extreme changes in temperature and humidity.
B. Stack lumber flat with spacers beneath and between each bundle.

PART 2  PRODUCTS

2.01  GENERAL LUMBER
Comply with PS 20 and applicable grading rules of inspection in accordance with AFPA Grading Rules.
A. Provide seasoned lumber with 19 percent moisture content at time of dressing and shipment, for sizes 2” or less in thickness.
B. Provide lumber with 15 percent moisture content at time of dressing and shipment, for sizes 2” or less in thickness.
C. All concealed lumber shall be fire-retardant.

2.02  PANELS
For types of concealed applications indicated below, provide wood panel products complying with PS 1 where applicable, and with “APA Performance Standard and Policies for Structural Use Panels” (Form E445) for requirements indicated.

For following types of applications where exposure durability classification or span rating is not given, provide EXPOSURE 1 and rating required to suit support spacing indicated.
A. Plywood Backing for Electrical and Telephone Equipment: APA C-D PLUGGED INT with exterior glue, fire-retardant treated, 1/2" thick except as otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION:

A. ROUGH CARPENTRY
Install rough carpentry work to comply with recommendations of American Plywood Association (APA), unless otherwise indicated. For sheathing, underlayment and other products not covered in above standards, comply with recommendations of manufacturer of product involved for use intended. Set carpentry work to required levels and lines, with members plumb and true and cut to fit.

B. ATTACHMENTS
Securely attach carpentry work to substrates and supporting members using fasteners of size that will not penetrate members where opposite side will be exposed to view or receive finish materials. Install fasteners without splitting wood; fasten panel products to allow for expansion at joints unless otherwise indicated.

3.02 PROTECTION:

A. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Fiberglass-mat faced, moisture and mold resistant gypsum sheathing.
B. Related Sections:
   1. Section 054000 – Cold Formed Metal Framing
   2. Section 061000 - Rough Carpentry
   3. Section 092116 - Gypsum Board Assemblies

1.2 REFERENCES

A. ASTM International (ASTM):
   3. ASTM C1002 Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
   10. ASTM C1396 Standard Specification for Gypsum Board


1.3 SUBMITTALS

A. Product Data: Manufacturer’s specifications and installation instructions for each product specified.

1.4 WARRANTY

A. Provide products that offer twelve months of coverage against in-place exposure damage (delamination, deterioration and decay) commencing with the date of installation of the product in such structure.

B. Manufacturer’s Warranty:
1. Five years against manufacturing defects from the date of purchase of the product for installation
2. 12 years against manufacturing defects when used as a substrate in architecturally specified EIFS.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Georgia-Pacific Gypsum LLC:
   2. Fiberglass-Mat Faced Gypsum Sheathing, Type X for Fire Rated Designs: DensGlass Fireguard Sheathing.

B. Other manufacturers meeting or exceeding the product requirements specified herein.

2.2 MATERIALS

A. Fiberglass-Mat Faced Gypsum Sheathing: ASTM C1177:
   1. Thickness: 1/2 inch.
   2. Width: 4 feet.
   3. Length: [8 feet] [9 feet] [10 feet].
   4. Weight: 1.9 lb/sq. ft.
   5. Edges: Square.
   6. Surfacing: Fiberglass mat on face, back, and long edges.
   7. Racking Strength (Ultimate, not design value) (ASTM E72): Not less than 540 pounds per square foot, dry.
   11. R-Value (ASTM C518): 0.56.
   14. Acceptable Products:
       a. 1/2 inch DensGlass Sheathing, Georgia-Pacific Gypsum LLC.

B. Fire-Rated Fiberglass-Mat Faced Gypsum Sheathing: ASTM C1177, Type X:
   1. Thickness: 5/8 inch.
   2. Width: 4 feet.
   3. Length: [8 feet] [9 feet] [10 feet].
   4. Weight: 2.5 lb/sq. ft.
   5. Edges: Square.
   6. Surfacing: Fiberglass mat on face, back, and long edges.
   7. Racking Strength (Ultimate, not design value) (ASTM E72): Not less than 654 pounds per square foot, dry.
2.3 ACCESSORIES

A. Screws: ASTM C1002, corrosion resistant treated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Inspection: Verify that project conditions and substrates are acceptable, to the installer, to begin installation of work of this section.

3.2 INSTALLATION

A. General: In accordance with GA-253, ASTM C1280 and the manufacturer’s recommendations.

1. Manufacturer’s Recommendations:

3.3 PROTECTION

A. Protect gypsum board installations from damage and deterioration until date of Substantial Completion.

END OF SECTION
SECTION 062000
FINISH CARPENTRY

PART 1  GENERAL

1.01  SECTION INCLUDES

A. Solid surfacing window sills
B. Wood Moldings
C. Hardware and attachment accessories.

1.02  RELATED SECTIONS

A. Section 061000 – Rough Carpentry
B. Section 099000 – Paints and Coatings

1.03  REFERENCES

A. AWI/AWMAC (QSI) – Architectural Woodwork Quality Standards Illustrated; Architectural
   Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada;
   2003

1.04  SUBMITTALS

A. See Section 013000 – administrative Requirements for submittal procedures.
B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing
   details accessories, to a minimum scale of 1-1/2 inch to 1 ft.
C. Samples:
   1. Solid Surface Material: Two 3” x 3” min. of each color and finish specified. One
      sample 6-inch length showing the edge detail.
   2. Wood Moldings: two 18-inch long samples of each shape as specified in the
      wood type.

1.05  QUALITY ASSURANCE

A. Protect work in accordance with AWI Architectural Woodwork quality Standards
   Illustrated Custom Grade.

1.06  DELIVERY, STORAGE, AND PROTECTION

A. Protect work from moisture damage

1.07  PROJECT CONDITIONS

A. Sequence installation to ensure utility connections are achieved in an orderly and
   expeditious manner.

PART 2  PRODUCTS

2.01  SOLID SURFACING SILL MATERIAL

A. Polyester/acrylic type with integral coloring
1. Surface finish: Satin
2. Color: As indicated on the drawings.
3. Thickness ½” and edging as indicated on drawing. If not on drawing, provide options for approval.

2.02 LUMBER MATERIALS

A. Lumber
   1. Red oak species plain sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.
   2. Wood species to match existing wood species in renovation projects. Verify species with architect prior to fabrication.

2.03 ADHESIVE

A. Adhesive: Type recommended by AWI to suit application.

2.04 FABRICATION

A. Shop assembled work for delivery to site, permitting passage through building openings.
B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.
B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work

3.02 INSTALLATION

A. Set and secure materials and components in place, plumb and level.

3.03 SCHEDULE

A. Interior:
   1. Window Sills: solid surfacing.
   2. Moldings and Miscellaneous Trim: Verify with drawings; prepare for stain finish.

END OF SECTION
SECTION 064000
ARCHITECTURAL WOODWORK

PART 1  GENERAL

1.01  SUMMARY
A. Section includes special fabricated cabinet units, countertops, cabinet hardware, prefinished surfaces, and preparation for installing utilities.
B. Related Sections:
   1. Section 061000 – Rough Carpentry.
   2. Section 062000 – Finish Carpentry.
   3. Divisions 15 and 16 – Mechanical and Electrical: Rough-in and connection.

1.02  REFERENCES
A. ANSI A135.4 – Basic Hardboard.
B. ANSI A208.1 – Mat Formed Wood Particleboard.
C. AWI (Architectural Woodwork Institute) – Quality Standards.
D. BHMA A156.9 – Cabinet Hardware.
E. FS MMM-A-130 – Adhesive, Contact.
F. NEMA (National Electric Manufacturers Association) LD3 – High Pressure Decorative Laminates.
G. PS 1 – Construction and Industrial Plywood.
I. WIC (Woodwork Institute of California) – Manual of Millwork.
J. APA (American Plywood Association).

1.03  SUBMITTALS FOR REVIEW
A. Section 013000 – Administrative Requirements: Procedures for submittals.
B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.
C. Product Data: Provide data for hardware accessories and edging.
D. Samples: Submit two: 12 x 12 inch size samples, illustrating each cabinet finish; 12 inch long size samples, illustrating each edging strip.
E. Samples: Submit two samples of drawer pulls, hinges and closures, illustrating hardware finish.

1.04  QUALITY ASSURANCE
A. Perform work in accordance with AWI Premium Quality.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.05  MOCKUP
A. Arrange meeting with Owner/TPS where units will be examined to ascertain quality and conformity to AWI standards. These units shall establish a minimum standard of quality for this work.
B. Mockup may be used as part of the Work.

1.06  DELIVERY, STORAGE AND PROTECTION
A. Delivery: Materials shall be delivered to the site by the casework fabricator in undamaged dry condition.
B. Protection: Protect units by covering completed work with 4-mil polyethylene film protective enclosure, applied in a manner which will allow easy removal and without damage to woodwork or adjoining work. Architectural woodwork contractor shall remove cover immediately before date of substantial completion.

PART 2  PRODUCTS

2.01 MATERIALS

A. Laminate Materials:
1. High Pressure Laminate (HPL): AWI 0.045 inch (1.1 mm) General Purpose quality; color, pattern and surface texture as scheduled.
2. Melamine: General Purpose quality; color, pattern and surface texture as scheduled.
3. Manufacturers:
   a. Formica.
   b. Wilsonart.

B. Epoxy Resin: Chemical and abrasion resistant, durable top of 1 inch thick cast material of epoxy resins and inert products.

C. Wood MDF board: PS 1; AWI standard, of grade to suit application; thickness as noted below by application.

D. Hardboard: Pressed wood fiber with resin binder, standard grade, 1/4 inch (6 mm) thick, smooth on one side, located as noted below by application.

E. Hardwood Plywood: PS 51; graded in accordance with AWI core materials of lumber, type of glue recommended for application; face veneer and cuts as noted below by application.

F. Backs:
1. Exposed finished backs shall be 3/4 inch thick with HPL on inside surface.
2. Unexposed backs shall be 1/4 inch thick MDF board core with melamine laminate on inside surface for upper and lower cabinets. Use 3/4 inch thick on full height cabinets.

G. Ends: Finished ends shall be 3/4 inch thick with melamine laminate on inside surface. Exposed edges to be banded with PVC.

H. Partitions: Partitions shall be 3/4 inch thick with melamine laminate on inside surface.

I. Bottoms and Bases:
1. Bottoms shall be 3/4 inch thick MDF board core. Interior surfaced with melamine laminate and exposed surfaced with HPL on the top side.
2. Base, storage and shelving units shall have a separate framed and reinforced base attached to the bottom of the cabinets forming a 4 inch high base that shall be recessed 2 inches in the front (unless noted otherwise on the drawings).

J. Shelves:
1. All shelves shall be 1 inch thick MDF board core.
2. Interior shelves shall be surfaced with white melamine laminate surface on two sides. All sides to be banded with white melamine laminate.
3. Exposed shelves shall be surfaced with HPL on two sides with PVC edge banding.
4. All adjustable shelves to be on metal shelf pegs inserted into shop drilled holes at 2 inches on center vertically.

K. Countertops:
1. HPL covered countertops shall be 1 inch thick laminated exterior grade fir plywood with plastic laminate surface on one side. Backsplashes as indicated on drawings, laminate to match countertop w/ 3mm PVC banding on tops and ends to match plastic laminate. Include end curb where top abuts end wall.
2. Face edge of countertops shall be banded with 3mm PVC (hot mill glued) to match plastic laminate tops. Colors to match plastic laminate color shall be selected by TPS.
L. Drawers:
1. Drawer fronts shall be 3/4 inch thick with HPL exterior surface and white melamine interior surface.
2. Exposed edges to be banded with 3mm PVC (hot mill glued), color to match plastic laminate.
3. Drawer boxes shall be plywood.

M. Doors:
1. Doors shall be 3/4 inch thick with HPL exterior surface and white melamine interior surface.
2. Exposed edges shall be banded with 3mm PVC (hot mill glued).

N. Hardware:
1. Adjustable shelf hardware shall be as specified above.
2. Pulls: Drawer and Door pulls shall be 4 inch “U” shaped, wire loop type pull with brushed nickel satin finish.
3. Hinges: Hinges shall be Blum concealed type, 125 degree opening. Provide four (4) hinges on full-height doors.
4. Drawer slides: Drawer slides shall be side-mount Blum type, full extension, 100 lb.

O. Accessories:
1. Adhesive: Type recommended by laminate manufacturer to suite application.
2. Counter tops, Ends, and Partition Edging: Semi-rigid PVC Vinyl Edge Trim; 3mm thickness; extruded convex shaped; smooth finish; of width to match component thickness/height; color to match adjacent surface.
3. Door and Drawer Edging: PVC Vinyl Edge; 3mm inch thick; smooth finish; of width to match component thickness; color to match adjacent surface.
4. Fasteners: Size and type to suite application.
5. Wireways: Provide 3 inch diameter plastic wireways at 48” o.c. at worksurfaces; color shall be black.

P. Finish Wood: Shall be as identified on plans.

Q. Epoxy Resin Sinks:
1. All sinks indicated in epoxy resin countertops shall be constructed of similar epoxy resin material and shall be “lipped” in design.
2. All sinks in Handicap Sink Units and Prep Rooms shall be ADA compliant with minimum inside dimensions of 25” (side-to-side) x 15” (front-to-back) x 5” (deep).
3. All sinks in Pods and Teacher Stations shall have a minimum inside dimension of 8” (side-to-side) x 12” (front-to-back) x 6” (deep).

R. Epoxy Resin Countertops:
1. Epoxy resin countertops to be 1 inch thick, cast flat, with a uniform non-glare black matte finish. Backsplashes of heights as indicated on drawings, butt-jointed and cemented to top. Include end curb where tops abut end walls.

S. Solid Surface Countertops:
1. Solid surface countertops to be 1/2 inch nominal thickness. Backsplashes of heights as indicated on drawings, butt-jointed and cemented to top. Include end curb where tops abut end walls.
2. Tensile Strength = 3,400 psi
3. Hardness (Barcol Impressor) = 60
4. Fungi and Bacterial Resistant
5. Boiling Water and High Temperature Resistant
6. Methacrylate-based adhesive for chemically bonding seams
7. Form joint seams between solid surfacing components so joints are inconspicuous in appearance and without voids.

2.02 FABRICATION

A. Shop assemble casework in one unit easily handled and to permit passage through building openings.

B. Fit shelves, doors and exposed edges to be banded with PVC trim.

C. Cap exposed plastic laminate finish edges with material of same finish and pattern.
D. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners.
E. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
F. Glue and fasten backsplash with screws to countertop at a minimum of 12 inches on center.
G. Millwork contractor to provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes, fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal cut edges.
H. Millwork shall be custom fabricated as identified on drawings. Manufacturer's standard millwork may only be substituted if it matches the sizes, configurations and styles indicated on drawings. Any substitutions shall be approved by TPS prior to bidding. If not approved prior to bidding, contractor shall not be allowed to substitute during fabrication.

2.03 FINISH FOR MILLWORK

A. General: The entire finish of millwork is work of this section.
B. Shop Finishing: To the greatest extent possible, finish millwork at shop or factory. Defer only final touch-up, cleaning and polishing for time after delivery and installation.
C. Preparations for Finishing: Comply with AWI Quality Standards for sanding, filling countersunk fasteners, back priming and similar preparations for finishing of architectural woodwork as applicable to each unit of work.
D. Transparent Finish:
   1. AWI Finish System #3.
   2. Grade: Premium.

E. Exterior surfaces of finish wood on millwork shall have the following finish system.
   1. A first sealer coat shall be applied, thoroughly dried, sanded and dusted.
   2. A second sealer coat shall be applied and thoroughly dried.
   3. A double coat of chemical resistant synthetic varnish shall then be applied and thoroughly dried, providing a semi-gloss finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Coordinate unit models, quantities and delivery dates with Architect prior to start of work.

3.02 INSTALLATION

A. Installation shall be performed by personnel trained in the installation of architectural woodwork.
B. Set and secure casework in place rigid, plumb and level.
C. Use purpose designed fixture attachments at concealed locations for wall mounted components.
D. Use threaded steel concealed joint fasteners to align and secure adjoining cabinet units and countertops.
E. Secure cabinet and counter bases to floor using appropriate angles and anchorages.
F. Use purpose designed color matching sealant at all countertop and backsplash joints at laminate clad countertops.
G. Install a clear silicon sealant at joint between wall and top of backsplash at laminate clad countertops.
H. Provide and install wire management grommets in worksurfaces where indicated on drawings. Where grommet are not shown in worksurfaces on drawings, provide grommets at 48" o.c, verify exact locations with TPS.
3.03 ADJUSTING

A. Adjust work before delivery. Test work to be delivered for rigidity and ability to support loads.
B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings and fixtures.
B. Protect millwork to ensure that work will be without damage or deterioration at the time of delivery and acceptance.

END OF SECTION
SECTION 072100

THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Thermal, air and water resistive barrier wall system for cold-formed metal exterior wall assemblies:
   1. Exterior wall steel stud cavity batt insulation.
   2. Exterior wall insulating sheathing.
   3. Taped joint seal on insulating sheathing.

B. Related Sections:
   1. Section 054000 – Cold Formed Metal Framing
   2. Section 092116 - Gypsum Board Assemblies

1.2 REFERENCES

A. Materials shall meet the property requirements of one or more of the following specifications as applicable to the specific product or end use:


   2. National Fire Protection Association (NFPA):


      a. AAMA 711: Voluntary Specification for Self-Adhering Flashing Used for Installation of Exterior Wall Fenestration Products.
1.3 SYSTEM DESCRIPTION

A. Provide and install cold formed steel stud exterior wall framing system, with water resistive barrier layer over the exterior gypsum, with fiberglass batt insulation in the stud cavity with a vapor retarding facer on the fiberglass, that effectively controls thermal, air and water performance and provides continuous insulation and continuity of the building envelope. The system shall include the following:
   1. Steel stud framing independently braced to resist vertical and transverse structural loading.
   2. Fiberglass batt insulation in the steel stud framing cavity.
   3. Joint sealing tape over the insulating joints and penetrations.

B. All joints, penetrations and gaps of the insulating and air barrier wall system shall be made water and air tight.

C. Code Compliance: Exterior wall system and component materials shall comply with the following requirements:
   1. The complete exterior wall assembly shall comply with the passing criteria defined in NFPA 285 for exterior wall limited fire spread performance.
   2. Wall and floor joints shall be fire stopped as required in International Building Code, at fire-rated construction.

1.4 SUBMITTALS

A. Product Data: Submit data on product characteristics, performance criteria, and limitations, including installation instructions.

B. Sustainable Design: Submit manufacturer’s sustainable design certifications as indicated.

C. Warranty: Submit documentation for limited product warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer’s original packaging.

B. Store and protect products in accordance with manufacturer’s instructions. Store in a dry area and protect from water, direct sunlight, flame, and ignition sources. Do not install insulation that has been damaged or wet.
   1. In the event the batt or blanket insulation becomes wet, remove it from jobsite.
      a. An exception may be allowed in cases where the contractor is able to demonstrate that wet insulation when fully dried out (either before installation or afterward following exposure to system operating temperatures) will provide installed performance that is equivalent in respects to new, completely dry insulation. In such cases, consult the insulation manufacturer for technical assistance.

PART 2 - PRODUCTS

2.1 FIBERGLASS BATT INSULATION

A. Stud Cavity Batts: Fiberglass batt insulation (faced at exterior walls, unfaced at interior walls), complying with ASTM C665 and meeting the following criteria:
   1. ASTM C 665 type I (batt without facing), or II Class A (batt with nonreflective facing, flame spread 25 or less), or III Class A (batt with reflective facing, flame spread 25 or less).
   2. Full width batt for use with steel studs spaced 16” on center.
3. Thermal Resistance: Measured in accordance with ASTM C 518, R-value 19
4. Factory-applied facing:
   a. FSK (foil-scrim-kraft, Type III Class A, Category 1, facer is a vapor retarder with 0.02 water vapor permeance)
   b. Surface burning characteristics, ASTM E 84, flame spread 25 or less.
5. Water Vapor Permeance: Permeance of vapor retarding facings measured in accordance with ASTM E 96.
6. Indoor Air Quality: Verified to be formaldehyde free by independent third party such as GreenGuard Environmental Institute, Indoor Air Quality and/or GreenGuard Children and Schools Certified
7. Recycle Content: Minimum 50%, certified by independent third party such as Scientific Certification Systems
9. Renewable Materials: Verified to contain renewable ingredients to meet or exceed the biobased content criteria for the USDA Certified Biobased Product Label

B. Manufacturers: Subject to compliance with product criteria, the manufacturers whose products may be incorporated into the work include but are not limited to:
   1. CertainTeed Corporation.
   2. Guardian Building Products.
   4. Owens Corning.

C. Acceptable Products: Subject to compliance with product criteria, the products that may be incorporated into the work include but are not limited to:
   1. EcoTouch™ Thermal Batt, unfaced;
      a. ASTM C 665 Type I; thickness [ 3-1/2" R-11, 3-1/2" R-13, 6-1/4" R-19 ]; full width for steel stud framing 16” or 24” on center; 48” or 96” long ]
   2. EcoTouch™ Flame Spread 25, FSK faced;
      a. ASTM C 665 Type III, Class A, reflective FSK faced, flame spread 25, 0.02 perm; thickness [ 3-1/2" R-11, 3-1/2" R-13, 6-1/4" R-19, 9-1/2" R-30 ]; full width for steel stud framing 16” or 24” on center; 48” or 96” long ]

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that steel wall studs, opening framing, bridging and structural bracing and other framing support members and anchorage have been installed in accordance with good construction practice and are compliant with this specification.

B. Verify that adjacent materials are dry and ready to receive insulation. Verify mechanical and electrical services within walls have been tested and inspected.

C. Report unacceptable conditions in writing. Do not proceed with work until unsatisfactory conditions have been corrected.

D. Installation of products specified in this section constitutes acceptance of existing conditions and assumption of responsibility for satisfactory performance.
3.2 INSTALLATION OF FIBERGLASS BATT STEEL STUD CAVITY INSULATION

A. Install fiberglass batt insulation in accordance with manufacturer's recommendations and not before the exterior sheathing has been installed on one side of the stud cavity and sealed to be water resistant.

B. Protect insulation from damage due to weather and physical abuse until protected by permanent construction.

C. Fit batt insulation tightly into exterior wall steel stud cavity spaces and framing voids to create a continuous insulation layer without gaps. Trim to fill spaces and voids neatly. Fluff insulation to full thickness for specified R-value before installation. Do not compress insulation.

D. Within exterior wall framing, install insulation between pipes, mechanical services, electrical boxes, and backside of sheathing. Cut or split insulation material as required to fit around wiring and plumbing.

E. Install factory applied facing with vapor retarder membrane facing warm side of building spaces. Facing flanges (tabs) may be left unfolded for friction fit installation, or they may be unfolded and lapped over or between framing members.

F. Maintain vapor retarder integrity by tightly abutting adjacent insulation. Repair punctures or tears in vapor retarder facing by taping with a vapor retarding tape. Follow tape manufacturer's application recommendations.

G. Fiberglass batt support in steel stud cavities:
   1. Unfaced and faced batt: Tightly friction fit full width 16”, batt insulation to fill the interior of the cavities between steel studs, and to completely fill the voids inside the steel stud flanges.
   2. Factory faced batt insulation: Support by taping or adhering the facing flanges to the face of the steel stud. Gypsum board wall finish is applied after the facing is secured. No additional support is required.
   3. When Unfaced batt insulation, completely filled cavity depth, both sides of the stud cavity closed: Friction fit is adequate if the insulation completely fills the depth of the stud cavity, and the cavity is enclosed on both sides. No additional support is required.
   4. When Unfaced batt insulation, completely fills cavity depth, and one side of the stud cavity open: Friction fit, supplement with straps or wires, described below, installed starting 4’ above the floor and every 2’ on center above 4’.
   5. When Unfaced batt insulation, does not completely fill depth of stud cavity: Friction fit, supplement with straps or wires, described below, installed starting 4’ above the floor and every 2’ on center above 4’.
   6. Supplemental wire or strap supporting devices: Multiple types of support devices may be used. Wires can be inserted through the batts extending from stud to stud. The wires may be installed continuously through the punch outs of the steel stud framing. Or, heavy gauge wire may be cut slightly larger than each stud space and wedged into place between studs. When the insulation is less than the depth of the stud cavity, the wires should be positioned to hold the batt against the sheathing (gypsum or foam plastic) on the opposite side of the cavity. Another option is the use of punched metal straps attached to the face of the framing. The punched pronged tabs are bent 90 degrees pointing into the stud cavity and are pushed into the insulation after installation. The punched prongs impale the insulation batt and hold it in place.

END OF SECTION
SECTION 072500
FLUID-APPLIED WEATHER BARRIERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fluid-applied, vapor permeable weather barrier membrane.

B. Joint Treatment:
   1. Joint Tape.
   2. Joint Compound.

C. Flashing:
   2. Flexible Flashing.
   3. Sheet Flashing.

D. Sealant.

E. Primers for flexible flashing and sheet flashing.

1.2 REFERENCES

A. ASTM International
   6. ASTM E 96 - Test Method for Water Vapor Transmission of Materials
   7. ASTM E 283 – Standard Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences Across the Specimen.

B. AATCC – American Association of Textile Chemists & Colorists

C. TAPPI

1.3 SUBMITTALS

B.A. Product Data: Submit manufacturer’s current technical literature for each component.

C.B. 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.
3. Manufacturer’s Field Service Reports: Provide site reports from authorized field service representative, indicating observation of weather barrier system installation.

D.C. Closeout Submittals:
2.1. Weather Barrier Warranty: Manufacturer’s executed warranty form with authorized signatures and endorsements indicating date of Substantial Completion.

1.4 QUALITY ASSURANCE

A. Qualifications:
1. Installer shall have experience with installation of commercial fluid-applied weather barrier assemblies under similar conditions.
2. Installer shall be trained and certified for installation by manufacturer.

B. Installation shall be in accordance with manufacturer’s installation guidelines and recommendations.

C. Source Limitations: Provide weather barrier and accessory materials produced by single manufacturer.

D. Mock-up:
1. Install mock-up using approved weather barrier system including membrane, flashing, joint and detailing compound and related weather barrier accessories according to weather barrier manufacturer’s current printed instructions and recommendations.
a. Mock-up size: 10 feet by 10 feet.
b. Mock-up Substrate: Match wall assembly construction, including window opening.
c. Mock-up may remain as part of the work.

2. Contact manufacturer’s designated representative prior to weather barrier system installation, to perform required mock-up visual inspection and analysis as required for warranty.

E. Pre-installation Meeting

1. Hold a pre-installation conference, two weeks prior to start of weather barrier installation. Attendees shall include Contractor, Architect, certified installer, Owner’s Representative, and weather barrier manufacturer’s designated field representative.

2. Review all related project requirements and submittals, status of substrate work and preparation, areas of potential conflict and interface, availability of weather barrier system materials and components, installer’s training requirements, equipment, facilities and scaffolding, and coordinate methods, procedures and sequencing requirements for full and proper installation, integration and protection.

1.5 DELIVERY, STORAGE AND HANDLING

B.A. Deliver weather barrier materials and components in manufacturer’s original, unopened, undamaged containers with identification labels intact.

C.B. Store weather barrier materials as recommended by manufacturer.

1.6 SCHEDULING

A. Review requirements for sequencing of installation of weather barrier system with installation of windows, doors, louvers and flashings to provide a weather-tight barrier system.

B. Schedule installation of exterior cladding within nine months of weather barrier system installation.

1.7 WARRANTY

B.A. Limited Warranty

1. Manufacturer’s warranty for weather barrier for a period of ten (10) years from date of Purchase.

2. Pre-installation meeting and jobsite observations by weather barrier manufacturer for warranty are required.

PART 2 - PRODUCTS

2.1 WEATHER BARRIER

A. Manufacturer:

DuPont Building Innovations
4417 Lancaster Pike
Chestnut Run Plaza 728
1. **Description:** A single-component, low VOC, 25 mil thick synthetic polymer fluid-applied product with superior elasticity and flexibility providing resistance to air flow, bulk water and wind driven rain yet allows moisture vapor to escape.

2. **Basis of Design:** DuPont™ Tyvek® Fluid Applied WB System; including DuPont™ Tyvek® Fluid Applied WB, DuPont™ Tyvek® Fluid Applied Flashing and Joint Compound, DuPont™ Tyvek® Fluid Applied Flashing – Brush Grade and DuPont™ Sealant for Tyvek® Fluid Applied Systems.

**B. Performance Characteristics:**

1. **Air Penetration Resistance (Material):**
   a. 0.0002 cfm/ft² at 75 Pa, when tested in accordance with ASTM E 2178.
   b. Air infiltration greater than 10,000 seconds per 100cc, when tested in accordance with TAPPI Test Method T-460.

2. **Air Penetration Resistance (System / Assembly):**
   a. \(\leq 0.01\) cfm/ft² at 75 Pa, when tested in accordance with ASTM E 2357.
   b. \(\leq 0.01\) cfm/ft² at 75 Pa, Type I Air Barrier, when tested in accordance with ASTM E 1677.

3. **Water Vapor Transmission:** 25 perms, when tested in accordance with ASTM E 96, Method B at 25 mils DFT (Dry Film Thickness).

4. **Water Penetration Resistance:** Greater than 1000 cm when tested in accordance with AATCC Test Method 127. No leakage at 15 psf when tested in accordance with ASTM E 331.

5. **Tensile Strength:** Minimum 169 lbs/in², when tested in accordance with ASTM D 412.

6. **Estimated Elongation:** 420% in accordance with ASTM D 412.

7. **Hardness:** Passes at a Shore A hardness of 71, when tested in accordance with ASTM D 2240.

8. **Surface Burning Characteristics:** Class A, when tested in accordance with ASTM E 84. Flame Spread: 25, Smoke Developed: 25.

9. **UV Resistance:** 9 months

10. **Volatile Organic Content (VOC):** Less than 2% (25-30 g/L) when measured in accordance with ASTM C 1250.

11. **Adhesion Strength (Concrete):** Greater than 33 psi when measured in accordance with ASTM D 4541.

12. **Low Temperature Crack Bridging:** Pass, when tested in accordance with ASTM C 1305.

**2.2 ACCESSORIES**

B.A. **Flashing:**

1. Vapor permeable fluid-applied elastomeric flashing:
   a. Product: DuPont Tyvek Fluid Applied Flashing and Joint Compound.
2. Sheet flashing with butyl adhesive layer.

C-B. Sealant: Elastomeric; non-vapor permeable sealant; compatible with weather barrier.

D-C. Primers for flexible flashing and sheet flashing:
   1. Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.

PART 3 - 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 PREPARATION

A. Complete surface preparation, priming, flashing and detailing of openings, cracks, and material transitions prior to beginning installation of fluid-applied weather barrier system.

B. Surfaces shall be clean and free of frost, oil, grease, mold and efflorescence prior to application of fluid-applied weather barrier system.

3.3 INSTALLATION - DETAILING

A. Corners: Apply fluid-applied joint compound, 25 mil thick, to outside and inside corners. Joint compound shall extend 2 inches from corner for full height of corner

  2.1. Non-movement joints in masonry and transitions to columns and beams:
     a. Joints 1/4 inch wide or less: Apply fluid-applied joint compound a minimum of 2 inches wide by 60 mils thick to each side of joint or crack.
     b. Joints 1/4 to 1/2 inch: Apply joint tape to joint, then apply joint compound to joint 2 inches wide by 60 mils thick.

B. Apply fluid-applied joint compound to cladding anchors prior to installation of weather barrier membrane per manufacturer’s instructions.

C. Apply fluid-applied joint compound around penetrations in exterior walls forming a fillet bead minimum ½ inch onto each surface.

D. Installation – Vapor permeable fluid-applied elastomeric flashing at openings:
   1. At jambs and head of rough opening: Apply 25 mil thickness of fluid-applied flashing to full depth of opening and 2 inches onto outside face of opening.
   2. At sills: Apply primer to substrates as recommended by manufacturer. Cut sheet flashing to fit directly between jambs of opening. Install sheet flashing to full width
of sill opening and down onto outside face of opening a minimum of 2 inches. Cover sheet flashing with 25 mil thickness of vapor permeable fluid-applied elastomeric flashing per fluid-applied weather barrier manufacturer’s instructions.

E. Allow Fluid-Applied Flashing, Joint Compound and Sealant to cure for minimum 24 hours before coating with Fluid-applied Weather Barrier.

3.4 INSTALLATION - FLUID-APPLIED WEATHER BARRIER

A. Install fluid-applied weather barrier prior to installation of windows, doors, and louvers.
B. Mask and protect any adjacent finished surfaces from fluid-applied weather barrier material.
C. Install fluid-applied weather barrier over exterior face of required exterior wall substrates in accordance with weather barrier manufacturer recommendations and instructions.
D. Install fluid-applied weather barrier by power-rolling method or spray and backrolling method to achieve 25 mils providing a consistent and uniform thickness.
E. Repair any voids, holidays, or non-uniform installations or damage by other trades to proper mil thickness prior to installation of final cladding assemblies.
F. Fluid-Applied Weather Barrier is not required at 10” thick pre-cast concrete panels.

3.5 FIELD QUALITY CONTROL

A. Notify weather barrier manufacturer’s designated representative to obtain periodic observations of weather barrier system installation.
B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections as required in Contract Documents.
C. Inspections: Weather barrier materials, accessories, and installation are subject to inspection for compliance with performance requirements.
D. Weather barriers assemblies will be considered defective upon failure of inspections and specific project testing required.
   1. Apply additional fluid-applied weather barrier material, in accordance with manufacturer’s instructions, where inspection results indicate insufficient thickness, voids, skips, pinholes or other defects as recommended by weather barrier manufacturer.
   2. Remove and replace deficient weather barrier system components for retesting as specified above.
E. Repair damage to weather barriers caused by destructive testing; follow manufacturer’s written instructions.

3.6 PROTECTION AND CLEANING

A. Protect weather barrier from contact with incompatible materials and sealants not approved per weather barrier manufacturer’s recommendation.
B. Protect installed weather barrier system from damage during construction prior to cladding installation.

1. If damaged or exposed to UV beyond nine (9) months, clean and prepare surfaces and install additional, full-thickness, fluid-applied weather barrier application in accordance with weather barrier manufacturer's instructions.

C. Remove masking materials and adjacent protection after weather barrier installation.

END OF SECTION
SECTION 07 25 00
WEATHER BARRIERS

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Weather barrier membrane
B. Seam Tape
C. Flashing
D. Fasteners

1.2 REFERENCES
A. ASTM International
   1. ASTM C 920; Standard Specification for Elastomeric Joint Sealants
   2. ASTM C 1193; Standard Guide for Use of Joint Sealants
   3. ASTM D 882; Test Method for Tensile Properties of Thin Plastic Sheeting
   4. ASTM D 1117; Standard Guide for Evaluating Non-woven Fabrics
   5. ASTM E 84; Test Method for Surface Burning Characteristics of Building Materials
   6. ASTM E 96; Test Method for Water Vapor Transmission of Materials
   7. ASTM E 1677; Specification for Air Retarder Material or System for Framed Building Walls
   8. ASTM E2178; Test Method for Air Permeance of Building Materials
   9. ASTM E2357; Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
B. AATCC – American Association of Textile Chemists & Colorists
   1. Test Method 127 Water Resistance: Hydrostatic Pressure Test
C. TAPPI
   1. Test Method T-410; Grams of Paper and Paperboard (Weight per Unit Area)
   2. Test Method T-460; Air Resistance of Paper (Gurley Hill Method)

1.3 SUBMITTALS
A. Refer to Section 013000
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.
3. Manufacturer’s Field Service Reports: Provide site reports from authorized field service representative, indicating observation of weather barrier assembly installation.

E. Closeout Submittals
1. Refer to Section 017800.
2. Weather Barrier Warranty: Manufacturer’s executed warranty form with authorized signatures and endorsements indicating date of Substantial Completion.

1.4 QUALITY ASSURANCE

A. Qualifications
1. Installer shall have experience with installation of weather barrier assemblies under similar conditions.
2. Installation shall be in accordance with weather barrier manufacturer’s installation guidelines and recommendations.

B. Mock-up
1. Install mock-up using approved weather barrier assembly including fasteners, flashing, tape and related accessories per manufacturer’s current printed instructions and recommendations.
   a. Mock-up size: 10 feet by 10 feet [insert size].
   b. Mock-up Substrate: Match wall assembly construction, including window opening.
   c. Mock-up may not remain as part of the work.
2. Contact manufacturer’s designated representative prior to weather barrier assembly installation, to perform required mock-up visual inspection and analysis as required for warranty.

C. Pre-installation Meeting
1. Hold a pre-installation conference, two weeks prior to start of weather barrier installation. Attendees shall include Contractor, Architect, installer, Owner’s Representative, and weather barrier manufacturer’s designated representative.
2. Review all related project requirements and submittals, status of substrate work and preparation, areas of potential conflict and interface, availability of weather barrier assembly materials and components, installer’s training requirements, equipment, facilities and scaffolding, and coordinate methods, procedures and sequencing requirements for full and proper installation, integration and protection.

1.5 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 016000.

B. Deliwer weather barrier materials and components in manufacturer’s original, unopened, undamaged containers with identification labels intact.

C. Store weather barrier materials as recommended by weather barrier manufacturer.
1.6 SCHEDULING

A. Review requirements for sequencing of installation of weather barrier assembly with installation of windows, doors, louvers and flashings to provide a weather-tight barrier assembly.

B. Schedule installation of weather barrier materials and exterior cladding within nine months of weather barrier assembly installation.

1.7 WARRANTY

A. Special Warranty

1. Weather barrier manufacturer's warranty for weather barrier for a period of ten (10) years from date of purchase.
2. Pre-installation meetings and jobsite observations by weather barrier manufacturer for warranty is required prior to assembly installation.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. DuPont; 4417 Lancaster Pike, Chestnut Run Plaza 728, Wilmington, DE 19805; 1-800-44-TYVEK (8-9835); http://www.construction.tyvek.com

B. Other manufacturers meeting or exceeding these specifications.

2.2 MATERIALS

A. Basis of Design: spunbonded polyolefin, non-woven, non-perforated, weather barrier is based upon DuPont Tyvek CommercialWrap D and related assembly components.

B. Performance Characteristics:

1. Air Penetration: 0.001 cfm/ft² at 75 Pa when tested in accordance with ASTM E2178. Type 1 when tested in accordance with ASTM E 1677. ≤0.04 cfm/ft @ 75 Pa when tested in accordance with ASTM E2357.
2. Water Vapor Transmission: 30 perms, when tested in accordance with ASTM E 96, Method B.
3. Water Penetration Resistance: 235 cm when tested in accordance with AATCC Test Method 127.
4. Basis Weight: 2.4 oz/yd², when tested in accordance with TAPPI Test Method T-410.
5. Air Infiltration Resistance: Air infiltration at >750 seconds, when tested in accordance with TAPPI Test Method T-460.
6. Tensile Strength: 33/41 lbs/in., when tested in accordance with ASTM D 822, Method A.
7. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E 84. Flame Spread: 15, Smoke Developed: 25.

2.3 ACCESSORIES

A. Seam Tape: 3” DuPont Tyvek Tape as distributed by DuPont.
B. Fasteners:

C. Sealants
   1. Provide sealants that comply with ASTM C 920, elastomeric polymer sealant to maintain watertight conditions.
   2. Products:
      a. DuPont Commercial Sealant.
      b. Sealants recommended by the weather barrier manufacturer.

D. Adhesives:
   1. Provide adhesive recommended by weather barrier manufacturer.

E. Primers:
   1. Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.

F. Flashing
   3. DuPont™ StraightFlash™: Straight flashing membrane materials for flashing windows and doors and sealing penetrations such as masonry ties, etc.
   5. DuPont™ Thru-Wall Surface Adhered Membrane with Integrated Drip Edge: Thru-Wall flashing membrane materials for flashing at changes in direction or elevation (shelf angles, foundations, etc.) and at transitions between different assembly materials.
   6. Preformed Inside and Outside Corners and End Dams as distributed by DuPont: Preformed three-dimensional shapes to complete the flashing system used in conjunction with DuPont™ Thru-Wall Flashing.

PART 3 - 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 INSTALLATION - WEATHER BARRIER
   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 recommend fasteners, space 6 -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.

3.4 OPENING PREPARATION

A. Flush cut weather barrier at edge of sheathing around full perimeter of opening.

B. Cut a head flap at 45-degree angle in the weather barrier at window head to expose 8 inches of sheathing. Temporarily secure weather barrier flap away from sheathing with tape.

3.5 FLASHING

A. Cut 9-inch wide DuPont™ FlexWrap a minimum of 12 inches longer than width of sill rough opening.

B. Cover horizontal sill by aligning DuPont FlexWrap edge with inside edge of sill. Adhere to rough opening across sill and up jambs a minimum of 6 inches. Secure flashing tightly into corners by working in along the sill before adhering up the jambs.

C. Fan DuPont FlexWrap at bottom corners onto face of wall. Firmly press in place. Mechanically fasten fanned edges.

D. Apply 9-inch wide strips of DuPont StraightFlash at jambs. Align flashing with interior edge of jamb framing. Start StraightFlash at head of opening and lap sill flashing down to the sill.

E. Spray-apply primer to top 6 inches of jambs and exposed sheathing.
F. Install DuPont FlexWrap at opening head using same installation procedures used at sill. Overlap jamb flashing a minimum of 2 inches.

G. Coordinate flashing with window installation.

H. On exterior, install backer-rod in joint between window frame and flashed rough framing. Apply sealant at jambs and head, leaving sill unsealed. Apply sealants in accordance with sealant manufacturer’s instructions and ASTM C 1193.

I. Position weather barrier head flap across head flashing. Adhere using 4-inch wide DuPont StraightFlash over the 45-degree seams.

J. Tape top of window in accordance with manufacturer recommendations.

K. On interior, install backer rod in joint between frame of window and flashed rough framing. Apply sealant around entire window to create air seal. Apply sealant in accordance with sealant manufacturer’s instructions and ASTM C 1193.

3.6 THRU-WALL FLASHING INSTALLATION

A. Apply primer per manufacturer’s written instructions.

B. Install preformed corners and end dams bedded in sealant in appropriate locations along wall.

C. Starting at a corner, remove release sheet and apply membrane to primed surfaces in lengths of 8 to 10 feet.

D. Extend membrane through wall and leave ¼ inch minimum exposed to form drip edge.

E. Roll flashing into place. Ensure continuous and direct contact with substrate.

F. Lap ends and overlap preformed corners 4 inches minimum. Seal all laps with sealant.

G. Apply sealant bead at each termination.

3.7 THRU-WALL FLASHING / WEATHER BARRIER INTERFACE AT BASE OF WALL

A. Overlap thru-wall flashing with weather barrier by 6-inches.

B. Mechanically fasten bottom of weather barrier through top of thru-wall flashing.

C. Seal vertical and horizontal seams with tape or sealing membrane.

3.8 THRU-WALL FLASHING / WEATHER BARRIER INTERFACE AT SHELF ANGLE

A. Seal weather barrier to bottom of shelf angle with sealing membrane.

B. Apply thru-wall flashing to top of shelf angle. Overlap thru-wall flashing with weather barrier by 6-inches.

C. Seal bottom of weather barrier to thru-wall flashing with tape or sealing membrane.
3.9  THRU-WALL FLASHING / WEATHER BARRIER INTERFACE AT WINDOW HEAD

A.  Cut flap in weather barrier at window head.
B.  Prime exposed sheathing.
C.  Install lintel as required. Verify end dams extend 4 inches minimum beyond opening.
D.  Install end dams bedded in sealant.
E.  Adhere 2 inches minimum thru-wall flashing to wall sheathing. Overlap lintel with thru-wall flashing and extend ¼ inch minimum beyond outside edge of lintel to form drip edge.
F.  Apply sealant along thru-wall flashing edges.
G.  Fold weather barrier flap back into place and tape bottom edge to thru-wall flashing.
H.  Tape diagonal cuts of weather barrier.
I.  Secure weather barrier flap with fasteners.

3.10  FIELD QUALITY CONTROL

A.  Notify manufacturer’s designated representative to obtain required periodic observations of weather barrier assembly installation.

3.11  PROTECTION

A.  Protect installed weather barrier from damage.

END OF SECTION
SECTION 074100
METAL PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Prefinished prefabricated nonstructural wall panels providing cladding protection of a weather barrier substrate.

B. Associated flashings, fasteners, clips, sealants and accessories.

1.2 RELATED SECTIONS

A. Section 054000 – Cold Formed Metal Framing.

B. Section 061000 - Rough Carpentry.

C. Section 076200 - Sheet Metal Flashing and Trim.

D. Section 079000 - Joint Protection.

1.3 REFERENCES


B. AWS Structural Welding Code D1.3 - Structural Welding Code, Sheet Steel.

C. American Iron and Steel Institute (AISI) - Specification for the Design of Cold-Formed Steel Structural Members.

D. American Society for Testing and Materials (ASTM) A446 - Steel sheet, zinc coated (galvanized) by the hot-dip process, structural (physical) quality.


P. American Architectural Manufacturer’s Association (AAMA) 605.2 - Voluntary Specification for High Performance Organic Coatings.


R. Underwriters Laboratories (UL) - Building Materials Directory.

1.4 SUBMITTALS

A. Submit under provisions of Section 013000.

B. Manufacturer’s data sheets on each product to be used, including:
   1. Data substantiating materials comply with requirements.
   2. Detailed specification of construction and fabrication.
   3. Manufacturer’s installation instructions.
   4. Certified test reports indicating compliance with performance requirements specified herein and as follows:
      a. Certification by the manufacturer that the roofing assembly is listed by UL for the wind uplift rating specified with relevant construction number indicated.
   5. Clip fastener pull-out tests.
   6. Concentrated load test data certifying compliance with specified performance requirements.
   7. Preparation instructions and recommendations.
   8. Storage and handling requirements and recommendations.
   9. Installation methods.

C. Shop Drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.
   1. Indicate material profile, jointing pattern, jointing details, fastening methods, and installation details.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 24 by 24 inches square representing actual product, color, profiles and patterns.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Manufacturer shall have a minimum of 10 years experience supplying metal roofing/siding to the region where the work is to be done.

B. Installer Qualifications:
   1. Acceptable to, licensed or certified by manufacturer.
   2. Not less than 5 years experience with systems.
3. Successfully completed not less than 5 comparable scale projects using this system.

C. Regulatory Requirements:
   1. Comply with local Building Code requirements if more restrictive than those specified.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect against damage and discoloration.

B. Handle panels with non-marring slings.

C. Do not bend panels.

D. Store panels above ground, with one end elevated for drainage.

E. Protect panels against standing water and condensation between adjacent surfaces.

F. If panels become wet, immediately separate sheets, wipe dry with clean cloth, and allow to air dry.

G. Remove any strippable film coating prior to installation and do not allow it to remain on the panels in extreme cold, heat or in direct sunlight.

H. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

A. Manufacturer/installer shall stand behind installed system for the periods described herein, starting from Date of Substantial Completion against all the conditions indicated below. When notified in writing from Owner, Manufacturer/installer shall, promptly and without inconvenience and cost to Owner, correct said deficiencies.

   1. Standard Material Warranty:
      a. 20 years from date of Substantial Completion on coil coated material.
      b. Finish coating shall not peel, blister, chip, crack or check in finish, and shall not chalk in excess of 7 numerical ratings when measured in accordance with ASTM D659.
      c. Finish coating shall not change color or fade in excess of 5 NBS units as determined by ASTM D2244 and ASTM D822.

   2. Standard 20-Year Warranties: Warrant wall panels, flashings, sealants, fasteners and accessories against defective materials and/or workmanship, to remain watertight and weatherproof with normal usage following Project Substantial Completion date for the period stated below:
      a. Concealed fastener warranty, 2 years.
      b. Weathertight Side Joint Only 20-Year Prorated Warranty: Side joint only warranties cover the weathertight integrity of the panel side joint only. This coverage is for water infiltration due to panel seam failure.
PART 2 PRODUCTS

2.1 MANUFACTURERS


B. Other manufacturers meeting these specifications.

2.2 PRODUCTS

A. Soffit & Wall Panels: Equal to Berridge “L – Panel”, 24 gauge with 12” panel coverage and 1” panel depth. Panels shall be full length. Panel end splices shall not be acceptable. Corner trim, base trim and transition flashings shall be provided as required to complete the assembly. Closures and fasteners shall be provided as required for a weathertight installation. Fastener spacing and type shall be determined by manufacturer's standard offering.

B. Base Metal: Prefinished Galvalume sheet, AZ50 coating made up of 55 percent aluminum, 1.6 percent silicon and the balance zinc as described in ASTM specification A792.

C. Closures, Flashing and Trim: Shall be of same material, gauge, finish and panels.

D. Concealed Clips: Clips as determined by manufacturer to suit specified performance requirements.

E. Fastener Screws: as determined by manufacturer to suit specified performance requirements.

2.3 FINISH

A. Exterior Finish:

1. Soffit & Wall Panels: Polyvinylidene Fluoride, full 70% Kynar 500 / Hylar 5000 consisting of a baked on .20 mil corrosion resistant primer and a baked on .8 mil finish coat with a specular gloss of 10-30% when tested in accordance with ASTM d-523-89 at 60 degrees F. Color shall match existing metal roof and wall panels. Provide custom color as required to match panels.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

1. Inspect installed work of other trades and verify that work required is complete.

2. Verify that installation will be made in accordance with approved shop drawings and manufacturer’s instructions.

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 in accordance with manufacturer's instructions.
   1. Follow wall panel manufacturer's directions.
   2. Lap panels away from prevailing wind direction.
   3. Do not stretch or compress panel side-laps.
   4. Secure panels without warp or deflection.
   5. Clean and dry surfaces prior to applying sealant.
   6. Exposed fasteners are not allowed, except to fasten flashings, at fixed points, or as indicated on Drawings.

B. Cutting and Fitting:
   1. Neat, square and true. Torch cutting is prohibited where cut is exposed to final view.
   2. Openings 6 inches (153 mm) and larger in any direction: Shop fabricate and reinforce to maintain original load capacity.
   3. Where necessary to saw-cut panels, debur cut edges.

C. Flashing:
   1. Follow manufacturer's directions and architect approved Shop Drawings.
   2. Install flashings to allow for thermal movement.
   3. Remove strippable protective film, if used, immediately preceding flashing installation.

D. Dissimilar Metals:
   1. Where sheet metal is in contact with dissimilar metals, execute juncture to facilitate drainage and minimize possibility of galvanic action.
   2. At point of contact with dissimilar metal, coat metal with protective paint or tape which can be placed between metals.

E. Field apply sealant to penetrations, transitions, and other locations necessary (not batten seam) for airtight, waterproof installation.

### 3.4 PROTECTION

A. Protect installed products until completion of project.
   1. Treat, or isolate with protective material, and contacting surfaces of dissimilar materials to prevent electrolytic corrosion.
   2. Protect work of other trades against damage and discoloration.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION
SECTION 075110
MULTI-PLY COLD PROCESS BUILT-UP ROOFING SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Cold process built-up roof system.
   2. Roofing insulation.
   3. Flashing Assemblies.

B. Related Sections include the following:
   1. Section 061000 – Rough Carpentry
   2. Section 076200 - Sheet Metal Flashing and Trim
   3. Section 079000 - Joint Sealers

1.02 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D1079 for definitions of terms related to roofing work not otherwise defined in this Section.

1.03 PERFORMANCE REQUIREMENTS

A. General: Install a watertight, cold process built-up and base flashing roofing system with compatible components that will not permit the passage of liquid water and will withstand wind loads, thermally induced movement, and exposure to weather without failure.

B. UL Listing: Provide built-up roofing, base flashing, and component materials that comply with requirements of Underwriter's Laboratory (U.L.) 790 Class A Fire Resistance and U.L. 1897 Class 90 Wind Resistance ratings. Roofing system shall be listed in the current U.L. "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with U.L. markings.
   1. Roofing system shall comply with the following:
      a. U.L. 790 Fire Classification: Class A.
      b. U.L. 1897 Wind Classification: Class 1A-90

1.04 SUBMITTALS

A. Product Data: For each type of roofing product specified. Include data substantiating that materials comply with requirements.

B. Shop Drawings: Include plans, sections, details, and attachments to other work, for the following:
   1. Base flashing, cants, and membrane terminations.
   2. Tapered insulation, including slopes.
   3. Crickets, saddles, and tapered edge strips, including slopes.

C. Samples for Verification: Of the following products:
   1. 12-by-12-inch square of roofing insulation.
   2. Roof membrane and base ply samples.
   3. 12-by-12-inch square of walkway pad.
   4. 6 insulation fasteners of each type, length, and finish.
Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install specified roofing system and is eligible to receive the roofing manufacturer's warranty. Roof contractor shall be experienced applying the specified roofing system and shall provide a list to the Project Architect seven (7) days prior to the bid date a list of five (5) projects where the specified roof system has been applied. Roof contractor shall provide a company name, phone number and contact person. Roof projects must be within a sixty (60) mile radius of the Tulsa Public School District.

D. Manufacturer Certificates: Signed by roofing system manufacturer certifying that the roofing system complies with requirements specified in the "Performance Requirements" Article. On request, submit evidence of complying with requirements.

E. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of components of roofing system with requirements based on comprehensive testing of current product compositions.
   1. Indicate compliance of bulk roofing asphalt materials delivered to Project with requirements. Include quantity and statistical and descriptive data for each product. Submit certificate with each load before it is used.
   2. Written verification from roofing material manufacturer that the specified roofing system meets or exceeds ASTM 2523 for Testing Load Strain Properties of the Roofing Membrane. Minimum standards are listed in product section of these specifications.

G. Maintenance Data: For roofing system to include in the maintenance manuals specified in Division 1.

H. Warranty: Sample copy of roofing manufacturer's proactive Ten (10) year roofing preventative maintenance service agreement stating obligations, remedies, limitations, and exclusions of service agreement.

I. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

J. Notarized documentation that roof system manufacturer has a history of producing/manufacturing this roofing system for at least as long as the manufacturer's longest warranty, and not less than the specified warranty.

K. The Tulsa Public Schools is desirous of working with a financially strong organization, which has the ability to protect and insulate the school from both product liability and warranty claims relating to roofing that could be brought before the building owner during the course of the roofing warranty period. As financial strength of suppliers are a requirement of the building owner proof of such must be shown. To this end, the following information is required by the building owner, to be submitted to the Project Architect: The manufacturer must present to the building owner a certificate of insurance for product liability with minimum limits of $5 million.

L. To help ensure ethical conduct and reduce the potential for conflict of interest, and to provide full disclosure, the roof material manufacturer shall provide an affidavit from a company officer which shall include the confirmation that all field employees in their organization have signed an ethics policy agreeing they will conduct business in an ethical manner.

M. Roof system manufacturer shall provide the Project Architect names of at least three (3) qualified applicators to install the specified roofing system.
N. Letter from roof system manufacturer that the technical service inspector overseeing the project for the specification compliance and installation quality is employed by the roof system manufacturer and have been an employee for a minimum of five (5) years. Technical service representative shall be prepared to respond to problems associated with roofing project within a two (2) hour period. In addition, field representative shall be available upon the Project Architects request during roofing activities and weekends.

O. Letter from the roofing contractor shall agree to participate in allowances and adjustments for five (5) years of the warranty period when it is determined that defects area a result of application and workmanship errors. All defects noted during this time period will be corrected by the roof contractor at their own expense.

1.05 PLANS AND SPECIFICATIONS

A. It is the intent that these roofing projects be completed by a manufactured certified roof contractor that has met the criteria to provide the long term warranty and service agreement. It is not the intent for these roof projects to bid and later be subcontracted out to an unqualified roofing company and labor personnel. All roofing work completed on the Tulsa Public School sites will be performed by the approved contracting company. The roof contractor alone will be held responsible by the Tulsa Public School for the completed project.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to perform Work of this Section who has specialized in installing roofing similar to that required for this Project; who is approved, authorized, or licensed by the roofing system manufacturer to install manufacturer's product; and who is eligible to receive the standard roofing manufacturer's warranty.

B. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method indicated below by UL, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Exterior Fire-Test Exposure: Class A; complying with Underwriters Laboratory (U.L.) Class 790.

C. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site. Meet with the same participants and review the same items listed for the pre-installation conference. In addition, review status of submittals and coordination of work related to roof construction. Notify participants at least 5 working days before conference.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store roofing materials in a dry, warm, well-ventilated, weathertight location according to roofing system manufacturer's written instructions. Store rolls of felt and other sheet materials on end on pallets or other raised surfaces. Do not double-stack rolls.
   1. Handle and store roofing materials and place equipment in a manner to avoid significant or permanent damage to deck or structural supporting members.

B. Do not leave unused felts and other sheet materials on the roof overnight or when roofing work is not in progress unless protected from weather and moisture and unless maintained at a temperature exceeding 40 deg F.

C. Deliver and store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.
D. Protect roofing insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

1.08 PROJECT CONDITIONS

A. Weather Limitations: Proceed with roofing work only when existing and forecasted weather conditions permit roofing to be installed according to manufacturer’s written instructions and warranty requirements.

1.09 PROJECT CONDITIONS

A. Weather Limitations: Proceed with roofing work only when existing and forecasted weather conditions permit roofing to be installed according to manufacturers’ written instructions and warranty requirements.

1.10 WARRANTY/SERVICE AGREEMENT

A. Upon project completion and the acceptance by the Project Architect and roof system manufacturer, the roofing manufacturer shall provide a Ten (10) year roof maintenance and program covering yearly roof inspections, proactive preventative maintenance and housekeeping of the roof as well as a 24 hour a day leak reporting response and tracking service. The specific areas covered shall be provided on the manufacturer’s sample agreement form.

PART 2 – PRODUCTS

2.01 ROOF SYSTEM MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
2. Multi-ply Cold Process Modified Bitumen Built-up Roofing System:
   a. Tremco, Inc.
   b. Substitutions will not be allowed for this specified product for Tulsa Public Schools’ master maintenance contract.

2.02 ROOFING PLY MATERIALS

A. Roofing base Ply Sheet: Trilaminate reinforced high strength ply sheet manufactured of polyester/fiberglass/polyester reinforcement carriers utilized by Tremco.

ASTM 2523 – Testing Load Strain Properties of the Roofing Membrane

<table>
<thead>
<tr>
<th></th>
<th>497 lbf. MD</th>
<th>411 lbf. XMD</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD</td>
<td></td>
<td>XMD</td>
</tr>
</tbody>
</table>

2.03 FLASHING MATERIALS

A. Flashing Sheet: 45 mil CSPE Hypalon Flashing Sheeting with polyester reinforced scrim by Tremco or approved equal.

2.04 ASPHALT MATERIALS

A. Asphalt Primer: ASTM D41.
B. Cold Process Modified Bitumen Adhesive: An environmentally friendly, low volatile, modified, cold process adhesive used in the construction of cold process built-up roofs manufactured by Tremco or approved equal.

2.05 AUXILIARY MEMBRANE MATERIALS

A. General: Furnish auxiliary materials recommended by roofing system manufacturer for intended use and compatible with built-up roofing.
   1. Furnish liquid-type auxiliary materials that meet VOC limits of authorities having jurisdiction.

B. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required by roofing system manufacturer for application.

C. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions of FM 4470; designed for fastening base sheets and base flashing and for back-nailing ply felts to substrate; tested by manufacturer for required pullout strength; and acceptable to roofing system manufacturer.

D. Wood Nailer Strips: Furnish wood nailer strips; fire retardant; pressure treated; size required, and complying with requirements of Division 6 Section "Miscellaneous Carpentry."

E. Cants: Perlite board, complying with ASTM C728.

F. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer for intended use.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions of FM 4470, designed for fastening thermal barrier to substrate.

2.06 INSULATION MATERIALS

A. General: Provide preformed, roofing insulation boards that comply with requirements, selected from manufacturer’s standard sizes and of thickness indicated.

B. Provide preformed, polyisocyanurate tapered insulation boards where indicated for sloping water to drainage outlets. Fabricate with the following taper:
   a. 1/4 inch per 12 inches, unless otherwise indicated on Drawings.
   b. Minimum thickness, ¾ inch.

1. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drainage outlets. Fabricate to slopes indicated.

C. Polyisocyanurate Board Insulation: Rigid, cellular polyisocyanurate thermal insulation with core formed by using HCFCs as blowing agents complying with ASTM C1289, classified by facer type as follows:
   1. Facer Type: Asphalt impregnated with organic/fiberglass facer.
   2. Minimum bottom layer thickness: 2”.

D. Asphalt impregnated fiberboard Cover Insulation Board: ASTM C-208 manufactured by Celotex or approved equal. Minimum top layer thickness: ½”.

2.07 INSULATION ACCESSORIES

A. General: Furnish roofing insulation accessories recommended by insulation manufacturer for intended use and compatible with sheet roofing material.
B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions of FM 4470, designed for fastening roofing insulation to substrate, tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.

C. Cover Board: Rigid, cellulosic-fiber insulation board, complying with ASTM C208, Type II, Grade 2, 1/2 inch thick.

D. Insulation Adhesive: An environmentally friendly, UL approved solvent free, elastomeric adhesive for securing insulation to deck substrate.

PART 3 – EXECUTION

3.01 ROOF INSTALLATION

A. Verify conditions are satisfactory to receive work.

B. Do not begin roofing until all unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions.

C. Verify that work of other trades penetrating roof deck or requiring men and equipment to traverse roof deck has been approved by the Project Architect, manufacturer and roofing contractor.

D. Check projections, curbs and deck for inadequate anchorage, foreign material, moisture or unevenness that would prevent the quality and execution of a new roofing system.

3.02 EXAMINATION

A. Examine substrates, areas, and conditions under which roofing will be applied, with Installer present, for compliance with requirements.

B. Verify that roof openings and penetrations are in place and set and braced and that roof drains are properly clamped into position.

C. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at roof penetrations and terminations and match the thicknesses of insulation required.

D. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.03 PREPARATION

A. Clean substrate of dust, debris, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections. Prime walls with water based asphalt primer as specified by roof system manufacturer and allow to dry tack free.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is in the forecast.

3.04 GENERAL INSTALLATION REQUIREMENTS

A. Install multi-ply cold process built-up roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations of ARMA/NRCA’s "Quality Control Guidelines for the Application of Cold Process Built-Up Roofing.

B. Where roof slope exceeds 1 inch per 12 inches, run sheets of built-up roofing membrane parallel with slope. Backnail top ends of sheets to nailer strips.
C. Cant Strips: Install and secure preformed 45-degree cant strips at junctures of built-up roofing membrane system with vertical surfaces or angle changes greater than 45 degrees.

D. Cooperate with inspecting and testing agencies engaged or required to perform services for installing built-up roofing membrane system.

E. Coordinate installing roofing system components so insulation and roofing plies are not exposed to precipitation or left exposed at the end of the workday or when rain is forecast.

F. Provide cutoffs at end of each day's work to cover exposed ply sheets and insulation with a course of coated felt with joints and edges sealed.

G. Complete terminations and base flashing and provide temporary seals to prevent water from entering completed sections of the roofing system.

H. Remove and discard temporary seals before beginning work on adjoining roofing.

3.05 INSULATION INSTALLATION

A. Comply with roofing system manufacturer's written instructions for installing roofing insulation.

B. Install tapered insulation under area of roofing to conform to slopes indicated Shop Drawings.

C. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

D. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install required thickness in 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush with ring of drain.

F. Nailer Strips: Where roof slopes are greater than 1 inch per 12 inches, mechanically fasten to deck 4-inch nominal- wide, wood nailer strips of same thickness as insulation, spaced not more than 20 to 21 feet apart. Run nailers perpendicular to slope of roof.

G. Install insulation with long joints of insulation in continuous straight lines with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

H. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

I. Attachment of Insulation: Mechanically attach bottom layer of insulation to steel deck at one (1) fastener every two (2) sq. ft. Install additional fasteners to ensure board is firm under foot.

J. Install tapered insulation system, crickets and saddles between drains, where applicable, wall transitions and along high sides of curbs to divert water to drainage outlets. Set tapered panels in insulation adhesive.

K. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Loosely butt cover boards together and adhere to bottom layer insulation board in insulation adhesive at the rate of 1.5 gallons per 100 sq. ft., fasten to roof deck according to roofing system manufacturer's written instructions.

3.06 ROOF MEMBRANE INSTALLATION
A. Install ply felts according to roofing system manufacturer’s written instructions, starting at low point of roofing system. Align ply felts without stretching. Shingle side laps of ply felts uniformly to achieve required number of membrane plies throughout. Shingle in direction to shed water. Extend ply felts over and terminate beyond cants.

B. Install Three (3) plies of the specified trilaminate base ply in alternate applications of cold process modified adhesive applied strictly to manufacturer’s recommendations and warranty requirements.

C. Application: Embed each ply felt in an application of cold process modified adhesive at the rate of 2 gallons per 100 sq. ft., to form a uniform membrane without ply felts touching each other. Where asphalt adhesive exudes out beyond the selvage edge, embed loose granules into adhesive.

D. Membrane Walkways: Install another ply felt, approximately 36 inches wide and in lengths not exceeding 10 feet, leaving a space of 6 inches between strips. Adhere walkways in same type of material used to build up roof membrane.

3.07 FLASHING AND STRIPPING INSTALLATION

A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer’s written instructions and as follows:
1. Prime substrates with asphalt primer if required by roofing system manufacturer.

B. Flashing Sheet Application: Shall be one of the methods below, as recommended by roofing manufacturer.
1. Adhere hypalon sheeting to substrate in a solid application of sheeting bond adhesive. Ensure complete bond and continuity without wrinkles or voids. Lap sheeting ends four (4) inches.
2. Seal vertical edges of membrane and base of flashing to roof membrane with two (2) course of reinforcing membrane embedded between alternate applications of asphalt mastic.
3. Extend base flashing up walls or parapets a minimum of 8 inches above roof membrane and 4 inches onto field of roof membrane.
4. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing. Seal top termination of base flashing.

C. Install stripping where metal flanges and edgings are set on built-up roofing according to roofing system manufacturer’s written instructions. Built-up Stripping: Install stripping of not less than 2 plies, one (1) trilaminate base ply and one (1) SBS membrane, setting each ply in a continuous application of cold process adhesive, extended onto roof membrane 6 inches and 8 inches, respectively.

D. Roof Drains: Set 30-by-30-inch lead metal flashing in bed of asphalt roofing cement on completed built-up roofing membrane. Cover metal flashing with stripping, extending a minimum of 4 inches beyond edge of metal flashing onto field of roof membrane. Clamp roof membrane, metal flashing, and stripping into roof-drain clamping ring.

E. Stripping Material: Install not less than 2 plies of roof membrane felt, each set in a continuous coating of cold process adhesive.

F. Install prefabricated roofing control (expansion) joints in accordance with manufacturer’s instructions. Expansion joint materials shall consist of 45 mil CSPE hypalon sheeting, 3” closed cell backer rod and nervastral vinyl barrier.

G. At gas lines and equipment runners: All gas lines greater than 3” shall be resting on wood blocking and resting on ¼” steel plate and protection pad consisting of trilaminate base ply/walktred set in the specified adhesive. Spacing shall be 4’ o.c. Remaining piping smaller
than 3” shall be resting on new 4 X 4 redwood runners and installed over trilaminate/walktred set in the specified adhesive.

H. Install wood blocking onto coping of parapet wall and secure in strict accordance to the manufacturer’s instructions. Wrap wood blocking with vinyl barrier and secure. Fabricate and Install pre-finished metal coping cover with batten plates. Follow manufacturer’s written detail drawings.

3.08 MEMBRANE PROTECTION LANDINGS

A. Install walkway landings around access doors, ladders and working sides of mechanical equipment. Set landings in heavy pads of asphalt mastic.

3.09 SURFACING TREATMENT

A. Flood Coat: Prior to the application of the surface treatment system, the roof contractor shall inspect roof with the system manufacturer. All deficiencies found during this inspection shall be repaired immediately prior to this roof area being accepted.

B. Over the entire roof membrane area apply a uniform and continuous flood coat of cold process adhesive at the rate of 7.5 gallons (60) lbs., per 100 sq. ft. Immediately broadcast a minimum of new, clean roofing aggregate per 100 sq. ft. Cover flood coat material completely.

C. Coat flashing surface, lead, drain screens, galvanized metal, walktreds etc., with two (2) coats of aluminized heat reflective coating applied at the rate of 130 sq. ft., per gallon. Coat flashings neatly.

3.10 FIELD QUALITY CONTROL

A. Roofing manufacturer’s representative, roofing applicator, and Architect shall inspect work as follows:
   1. Work in progress a minimum of two job visits per week with written field inspection reports on the roof contractors progress and quality of installation. Reports shall be submitted to the Project Architect.
   2. A pre-final inspection shall be conducted upon completion of all roofing ply sheets before flood coat and aggregate are applied.
   3. The final inspection will be performed by roofing manufacturer before issuance of Ten (10) year manufacturer’s preventative maintenance service agreement.

B. Correct deficiencies in or remove and replace roof membrane that inspections and test reports indicate does not comply with specified requirements.

C. Repair roof membrane that does not comply with specified requirements by re-adhering test specimens back in place and by applying additional plies, equal to the original number of plies specified, over test specimens according to roofing system manufacturer’s written instructions.

D. Test Cuts: Before flood coating and surfacing built-up roofing membrane, test specimens will be removed to evaluate problems observed during quality-assurance inspections of roof membrane as follows:
   1. Approximate quantities of components within roof membrane will be determined according to ASTM D3617.
   2. Test specimens will be examined for interply voids according to ASTM D3617 and to comply with the criteria established in Appendix 3 of ARMA/NRCA’S “Quality Control Guidelines for the Application of Built-up Roofing.”
3. Additional testing, at Contractor's expense, may be performed to determine that corrected Work complies with specified requirements.

E. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Project Architect.

F. Notify Architect 48 hours in advance of the date and time of inspection.

3.11 PROTECTING AND CLEANING

A. Protect built-up roofing membrane from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Project Architect.

B. Correct deficiencies in or remove built-up roofing that does not comply with requirements, repair substrates, reinstall roofing, and repair base flashing to a condition free of damage and deterioration at the time of Substantial Completion and according to warranty requirements.

END OF SECTION
SECTION 076200
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 DESCRIPTION
A. This section describes complete systems using proven details to exclude water from the building at copings, base flashings, parapet wall liners and other locations commonly closed by sheet metal.

1.2 REFERENCES
A. FM: FM Global
   1. FM Data Sheet 1-49: Perimeter Flashing
B. SMACNA: Sheet Metal and Air Conditioning Contractors’ National Association, Inc.
   1. SMACNA Architectural Sheet Metal Manual

1.3 SYSTEM DESCRIPTION
A. Allow for field adjustments for proper anchoring or joining to other items.
B. The requirements shown by the details are intended to establish basic dimensions, profiles and sightlines. Within these limitations, the Contractor shall be responsible for the design of the sheet metal flashing and trim assemblies and may make whatever modifications of and additions to the details as may be required to prevent water and air penetration. Maintain the visual design concept as shown, including member sizes, profiles and alignment of components.
C. Conform to criteria described in FM data sheets 1-49.

1.4 SUBMITTALS
A. Submit the following.
   1. Product Data: Submit metal manufacturer’s specifications, installation instructions and general recommendations for flashing and trim applications, with complete list of materials proposed for use.
   2. Shop Drawings:
      a. Show the manner of forming, jointing and securing the metal to form flashings and trim. Show waterproof connections to adjoining work and at obstructions and penetrations. Identify adjoining materials.
      b. Clearly identify design modifications recommended under System Description article above.

1.5 PROJECT CONDITIONS
A. Scheduling: Promptly cover exposed edges of completed roofing.
1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.7 WARRANTIES

Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

1. Exposed Coil-Coated Finishes:
   a. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color: Colors shall match existing metal roof panels. Provide custom color as required to match panels.

3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

B. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.

2. Surface: Smooth, flat and mill phosphatized for field painting at exposed locations and with manufacturer's standard clear acrylic coating on both sides at locations not exposed to view.

3. Exposed Coil-Coated Finish:
a. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers’ written instructions.

4. Color: Colors shall match existing metal roof panels. Provide custom color as required to match panels.

5. Concealed Finish: Pretreat with manufacturer’s standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.2 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

B. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
3. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
   c. Henry Company; Blueskin PE200 HT.
   d. Metal-Fab Manufacturing, LLC; MetShield.
   e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

C. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
   a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
   b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
   c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.

C. Solder:
1. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane, polysulfide, or silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.


2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA’s “Architectural Sheet Metal Manual” for application, but not less than thickness of metal being secured.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

H. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

I. Do not use graphite pencils to mark metal surfaces.

2.5 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Gutters at standing seam metal roofs to be installed by pre-engineered metal building manufacturer are not to be included here. Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.

1. Gutter Style: SMACNA designation D.
2. Expansion Joints: Butt type with cover plate.
3. Accessories: Continuous removable leaf screen with sheet metal frame and hardware cloth screen.
4. Gutters with Girth up to 15 Inches: Fabricate from the following materials:
   a. Galvanized Steel: 0.022 inch thick.

B. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Hanger Style: continuous cleat and hangar to SMACNA Standards. With metal straps at 36 inches on center max.
2. Fabricate from the following materials:
   a. Galvanized Steel: 0.022 inch thick.

C. Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch thick.

D. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape indicated complete with outlet tubes, exterior flange trim, and built-in overflows. Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch thick.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof-Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch long, but not exceeding 10-foot long, sections. Furnish with 6-inch wide, joint cover plates.

1. Joint Style: Butt, with 6-inch wide, exposed cover plates.
2. Fabricate from the following materials:
   a. Galvanized Steel: 0.028 inch thick.
B. Copings: Fabricate in minimum 96-inch long, but not exceeding 10-foot long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.

1. Coping Profile: SMACNA figure designation 3-4A.
2. Joint Style: Butt, with 12-inch wide, concealed backup plate and 6-inch wide, exposed cover plates.
3. Fabricate from the following materials:
   a. Galvanized Steel: 0.040 inch thick.

C. Roof and Roof to Wall Transition Expansion-Joint Cover: Fabricate from the following materials:
1. Galvanized Steel: 0.034 inch thick.

D. Base Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch thick.

E. Counterflushing: Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.

F. Flashing Receivers: Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.

G. Roof-Penetration Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch thick.

H. Roof-Drain Flashing: Fabricate from the following materials:
1. Copper: 12 oz./sq. ft.

2.7 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.

B. Valley Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch thick.

C. Drip Edges: Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.

D. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.

E. Counterflushing: Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.

F. Flashing Receivers: Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.

G. Roof-Penetration Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch thick.
2.8 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch long, but not exceeding 12-foot long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch high, end dams where flashing is discontinuous. Fabricate from the following materials:

1. Copper: 16 oz./sq. ft.

B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch high, end dams. Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch thick.

C. Wall Expansion-Joint Cover: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch thick.

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch thick.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that substrates are smooth and clean to extent needed for sheet metal work.

B. Verify that reglets, nailers, cants, and blocking, to receive sheet metal are installed and free of concrete and soil.

C. Start sheet metal work only after conditions are satisfactory.

3.2 UNDERLAYMENT INSTALLATION

A. General: Install underlayment as indicated on Drawings.

B. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
5. Install sealant tape where indicated.
6. Torch cutting of sheet metal flashing and trim is not permitted.
7. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

1. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws and metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints as shown and as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Section 07900 - Joint Sealers.

F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder metallic-coated steel sheet.
2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
3.4 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets and straps spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Fasten gutter spacers to front and back of gutter.
2. Loosely lock straps to front gutter bead and anchor to roof deck.
3. Anchor and loosely lock back edge of gutter to continuous cleat.
4. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.
5. Install continuous gutter screens on gutters with noncorrosive fasteners, removable for cleaning gutters.

C. Downspouts: Join sections with 1-1/2-inch telescoping joints.

1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c. in between.
2. Connect downspouts to underground drainage system indicated.

D. Splash Pans: Install where downspouts discharge on low-slope roofs Set in asphalt roofing cement compatible with roofing membrane.

E. Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

1. Anchor scupper closure trim flange to exterior wall and solder or seal with elastomeric sealant to scupper.
2. If conductor head is indicated in the Drawings, solder or seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.

F. Conductor Heads: Anchor securely to wall with elevation of conductor head rim 1 inch below scupper discharge.

G. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inches in direction of water flow.

3.5 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, and SMACNA’s “Architectural Sheet Metal Manual.” Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA’s “Architectural Sheet Metal Manual” and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
C. Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA’s “Architectural Sheet Metal Manual” and as indicated.

1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 16-inch centers.
2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Secure in a waterproof manner by means of interlocking folded seam or blind rivets and sealant.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.6 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing: Installation of through-wall flashing is specified in Division 4 Section "Unit Masonry Assemblies."

C. Reglets: Installation of reglets is specified in Division 4 Section "Unit Masonry Assemblies."

3.7 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

B. Curved Roof Flashing: Flashing at curved roof fascias shall be fabricated and installed in minimum lengths of 10'-0".

3.8 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
3.9 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION
SECTION 077200
ROOFTOP FALL PROTECTION AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY
   A. Work Included: Provide factory-fabricated fixed hatch railing system.

1.2 SUBMITTALS
   A. Product Data: Submit manufacturer’s product data.
   B. Shop Drawings: Submit shop drawings including profiles, accessories, location, adjacent construction interface, and dimensions.
   C. Warranty: Submit executed copy of manufacturer’s standard warranty.

1.3 QUALITY ASSURANCE
   A. Manufacturer: A minimum of 5 years experience manufacturing similar products.
   B. Installer: A minimum of 2 years experience installing similar products.
   C. Manufacturer’s Quality System: Registered to ISO 9001:2008 Quality Standards including in-house engineering for product design activities.

1.4 DELIVERY, STORAGE AND HANDLING
   A. Deliver products in manufacturer’s original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier’s freight bill of lading.

1.5 WARRANTY
   A. Manufacturer’s Warranty: Provide manufacturer’s standard warranty. Materials shall be free of defects in material and workmanship for a period of twenty-five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 - PRODUCTS

2.1 MANUFACTURER
   A. Basis-of-Design Manufacturer:
      Type Bil-Guard Roof Hatch Railing System
      The Bilco Company
      P.O. Box 120
      New Haven, CT 06505
      1-800-366-6530
      www.bilco.com
2.2 HATCH RAIL SYSTEM

A. Furnish and install where indicated on plans hatch rail system Model RL-E. The hatch rail system shall be field assembled and installed (by others) per the manufacturer’s instructions.

B. Performance characteristics:

1. High visibility safety yellow color shall be molded in.
2. Hatch rail system shall attach to the capflashing of the roof hatch and shall not penetrate any roofing material.
3. Hatch rail system shall satisfy the requirements of OSHA 29 CFR 1910.23 and shall meet OSHA strength requirements with a factor of safety of two.
4. UV and corrosion resistant construction with a twenty-five year warranty.
5. Self-closing gate shall be provided with hatch rail system.

C. Posts and Rails: Shall be round pultruded reinforced fire retardant yellow fiberglass treated with a UV inhibitor.

D. Hardware: Mounting brackets shall be ¼” (6mm) thick hot dip galvanized steel. Hinges and post guides shall be 6063T5 aluminum. Fasteners shall be Type 316 stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install products in strict accordance with manufacturer’s instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work.

1. Test units for proper function and adjust until proper operation is achieved.
2. Repair finishes damaged during installation.
3. Restore finishes so no evidence remains of corrective work.

3.3 ADJUSTING AND CLEANING

A. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provide factory-fabricated roof hatches for ladder access.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer’s product data.
B. Shop Drawings: Submit shop drawings including profiles, accessories, location, adjacent construction interface, and dimensions.
C. Warranty: Submit executed copy of manufacturer’s standard warranty.

1.3 QUALITY ASSURANCE

A. Manufacturer: A minimum of 5 years experience manufacturing similar products.
B. Installer: A minimum of 2 years experience installing similar products.
C. Manufacturer’s Quality System: Registered to ISO 9001:2008 Quality Standards including in-house engineering for product design activities.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer’s original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier’s freight bill of lading.

1.5 WARRANTY

A. Manufacturer’s Warranty: Provide manufacturer’s standard warranty. Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design Manufacturer:
Type E Roof Hatch
The Bilco Company
P.O. Box 1203
New Haven, CT 06505
1-800-366-6530
www.bilco.com
2.2 ROOF HATCH

A. Furnish and install where indicated on plans metal roof hatch Type E, size width: 36" (914mm) x length: 36" (914mm). Length denotes hinge side. The roof hatch shall be single leaf. The roof hatch shall be pre-assembled from the manufacturer.

B. Performance characteristics:

1. Cover shall be reinforced to support a minimum live load of 40 psf (195kg/m²) with a maximum deflection of 1/150th of the span or 20 psf (97 kg/m²) wind uplift.
2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
3. Operation of the cover shall not be affected by temperature.
4. Entire hatch shall be weather tight with fully welded corner joints on cover and curb.

C. Cover: Shall be 14 gauge (1.9mm) paint bond G-90 galvanized steel with a 3" (76mm) beaded flange with formed reinforcing members. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.

D. Cover insulation: Shall be fiberglass of 1” (25mm) thickness, fully covered and protected by a metal liner of 22 gauge (.8mm) paint bond G-90 galvanized steel.

E. Curb: Shall be 24” (610mm) in height and of 14 gauge (1.9mm) paint bond G-90 galvanized steel. The curb shall be formed with a 3-1/2" (89mm) flange with 7/16" (11.1mm) holes provided for securing to the roof deck. The curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, fully welded at the corners, that features the Bil-Clip® flashing system, including stamped tabs, 6” (153mm) on center, to be bent inward to hold roofing membrane securely in place.

F. Curb insulation: Shall be rigid, high-density fiberboard of 1” (25mm) thickness on outside of curb.

G. Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe through bolted to the curb assembly.

H. Hardware

1. Heavy pintle hinges shall be provided
2. Cover shall be equipped with a spring latch with interior and exterior turn handles
3. Roof hatch shall be equipped with interior and exterior padlock hasps.
4. The latch strike shall be a stamped component bolted to the curb assembly.
5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1” (25mm) diameter red vinyl grip handle to permit easy release for closing.
6. Compression spring tubes shall be an anti-corrosive composite material and all other hardware shall be zinc plated and chromate sealed.
7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.

I. Finishes: Factory finish shall be alkyd based red oxide primed steel.

J. Accessories: Bilco Ladder Safety Post, Model LU-1, installed per manufacturers instructions.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install products in strict accordance with manufacturer’s instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work.

1. Test units for proper function and adjust until proper operation is achieved.
2. Repair finishes damaged during installation.
3. Restore finishes so no evidence remains of corrective work.

3.3 ADJUSTING AND CLEANING

A. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Section, apply to work specified in this section.

1.02 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

Only tested and listed firestop systems shall be used in specific locations as follows:

A. Safing slot gaps between edge of floor slabs and perimeter curtain walls.
B. Openings between structurally separate sections of wall or floors.
C. Gaps between the top of walls and ceilings or roof assemblies.
D. Expansion joints in walls and floors.

1.04 RELATED WORK OF OTHER 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:

1. Section 033000 - Cast-In-Place Concrete
2. Section 048100 – Brick Unit Masonry
3. Section 092116 - Gypsum Board Assemblies

1.05 REFERENCES

A. Underwriters Laboratories, Inc. (UL) Fire Resistance Directory, Volume II, updated annually:

1. Joint Systems (XHBN)
2. Perimeter Fire Containment Systems (XHDG)
3. Fire Resistance Ratings (BXRH)
4. Fill, Voids, or Cavity Material (XHHW)
5. Forming Materials (XHKU)

B. Omega Point Laboratories, Inc. (OPL) Listed Products Directory, Volume II, updated annually:

1. Fire Resistant Joint Systems


F. ASTM E 2174, “Standard Practice for On-Site Inspection of Installed Fire Stops”


J. International Firestop Council Recommended (IFC) Guidelines for Evaluating Firestop Systems Engineering Judgments


1.06 QUALITY ASSURANCE

A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

B. Firestop System installation shall meet requirements of ASTM E 1966 and/or ANSI/UL 2079 tested and listed assemblies that provide fire-resistance ratings not less than that of the construction in which the joint occurs.

C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

E. For those firestop applications that exist for which no tested and listed system is available through a manufacturer, an engineering judgment derived from similar tested system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment documents shall follow requirements set forth by the International Firestop Council.

1.07 SUBMITTALS

A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of tested firestop systems to be used and manufacturer's installation instructions to comply with Section 01 30 00.

B. Manufacturer's engineering judgment identification number and details when no tested and listed system is available for an application. Engineering judgment shall include both project name and contractor's name who will install firestop system as described in document.

C. Submit safety data sheets provided with product delivered to job-site.

1.08 INSTALLER QUALIFICATIONS
A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer’s products per specified requirements. A manufacturer’s willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

B. The work is to be installed by a contractor with at least one of the following qualifications:

- FM 4991 Approved Contractor
- UL Approved Contractor
- Hilti Accredited Fire Stop Specialty Contractor

C. Installer shall have not less than 3 years experience with fire stop installation.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer’s clearly labeled, unopened containers, identified with brand, type, and UL or OPL label, where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.10 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

F. Comply with ASTM D 6905 (modified) for resistance to wind driven rain and water.

PART 2 - PRODUCTS

2.01 JOINT FIRESTOPPING - GENERAL

A. Provide firestopping composed of components that are compatible with each other and substrates forming joints under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
B. Provide components for each fire-resistive joint system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

C. Joints in or between Fire Rated Construction: Provide joint firestopping systems with ratings determined per UL 2079 or ASTM E 1966:
   1. F-Rating: not less than the fire resistance rating of the construction they will join.

D. Joints at Exterior Curtain Wall / Floor Intersections: Provide joint firestopping systems with ratings determined per ASTM E 2307:
   1. F-Rating: not less than the fire resistance rating of the construction they will join.

E. Joints in Smoke Barriers: Provide joint firestopping systems with ratings determined per UL 2079:
   1. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures.

F. Joints at Intersection between Rated Wall Assemblies and Nonrated Horizontal Assemblies: Provide joint firestopping systems with ratings determined by ASTM E 2837.

G. Mold Resistance: Provide joint firestopping system sealant with mold and mildew resistance rating of one (1) or less as determined by ASTM G21.

H. Rain and water resistance: provide perimeter joint sealant tested in accordance with ASTM D 6904 with less than 1 hour tack free time as tested in accordance with ASTM C 679.

2.02 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with joint systems (XHBN) listed in Volume II of the UL Fire Resistance Directory or OPL Listed Products Directory; provide products of the following manufacturer as identified below:

   1. Basis of Design:
      Hilti, Inc., Plano, Texas
      800-879-8000
      www.us.hilti.com

   2. Substitution requests shall be considered in accordance with contract provisions.

2.03 MATERIALS

A. Use only firestop products that have been tested in accordance with ASTM E 1966 and/or ANSI/UL 2079 for specific rated construction conditions conforming to construction assembly type, movement capability, spacing requirements, and fire-resistance-rating involved for each separate instance.

B. Sealants for use with fire-resistance-rated construction joints, the following products are acceptable:

   1. Hilti Firestop Joint Spray (CFS-SP WB)
   2. Hilti Firestop Silicone Joint Spray (CFS-SP SIL)
   3. Hilti Flexible Firestop Sealant (CP 606)
   4. Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
   5. Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)
   6. Hilti bottom of wall sealant CP 605
C.  Sealants for use as part of a Perimeter Fire Barrier System between fire-resistance-rated floors and exterior wall assemblies, the following products are acceptable:

1.  Hilti Firestop Joint Spray (CFS-SP WB)
2.  Hilti Firestop Silicone Joint Spray (CFS-SP SIL)
3.  Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
4.  Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)

D.  Pre-formed mineral wool designed to fit flutes of metal profile deck and gap between top of wall and metal deck profile; use as a backer for spray material.

1.  Hilti Speed Plugs (CP 777)
2.  Hilti Speed Strips (CP 767)

E.  Provide a firestop system with an Assembly Rating as determined by ASTM E 1966 and/or ANSI/UL 2079 which is equal to the fire-resistance ratings of the construction in which the joint occurs.

PART 3 - EXECUTION

3.01  PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1.  Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
2.  Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
3.  Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
4.  Do not proceed until unsatisfactory conditions have been corrected.

3.02  INSTALLATION

A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory or Omega Point Laboratories Listed Products Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of construction joint materials.

1.  Protect materials from damage on surfaces subjected to traffic.

3.04  FIELD QUALITY CONTROL

A.  Examine sealed joints to ensure proper installation before concealing or enclosing areas.

B.  Keep areas of work accessible until inspection by applicable code authorities and/or independent inspection agency.

C.  Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.05  ADJUSTING AND CLEANING
A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.
### SCHEDULES OF UL-2079 (DYNAMIC) JOINT FIRESTOP SYSTEMS

<table>
<thead>
<tr>
<th>JOINT TYPE</th>
<th>ASSEMBLY RATING</th>
<th>UL-CLASSIFIED SYSTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>JOINT WIDTH LESS THAN OR EQUAL TO 2&quot;</td>
<td>JOINT WIDTH GREATER THAN 2&quot;, LESS THAN OR EQUAL TO 6&quot;</td>
</tr>
<tr>
<td>CONCRETE FLOOR-TO-FLOOR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>FF-D-1012, FF-D-1013¹</td>
<td>FF-D-1012, FF-D-1013</td>
</tr>
<tr>
<td>2</td>
<td>FF-D-1012, FF-D-1013¹</td>
<td>FF-D-1012, FF-D-1013</td>
</tr>
<tr>
<td>3</td>
<td>FF-D-1011, FF-D-1026¹</td>
<td>FF-D-1011, FF-D-1026</td>
</tr>
<tr>
<td>4</td>
<td>FF-D-1047</td>
<td>FF-D-1125</td>
</tr>
<tr>
<td>EDGE OF CONCRETE FLOOR SLAB-TO-WALL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>FW-D-1011, FW-D-1012, FW-D-1013, FW-D-1021¹</td>
<td>FW-D-1011, FW-D-1012, FW-D-1013, FW-D-1021</td>
</tr>
<tr>
<td>2</td>
<td>FW-D-1011, FW-D-1012, FW-D-1013, FW-D-1021¹</td>
<td>FW-D-1011, FW-D-1012, FW-D-1013, FW-D-1021</td>
</tr>
<tr>
<td>3</td>
<td>FW-D-1011, FW-D-1021¹</td>
<td>FW-D-1011, FW-D-1021</td>
</tr>
<tr>
<td>4</td>
<td>FW-D-1047</td>
<td>FW-D-1092</td>
</tr>
<tr>
<td>CONCRETE OR BLOCK WALL TO FLAT CONCRETE SLAB FLOOR (TOP-OF-WALL)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>N/A**</td>
<td>N/A**</td>
</tr>
<tr>
<td>2</td>
<td>HW-D-0097¹</td>
<td>HW-D-1009</td>
</tr>
<tr>
<td>3</td>
<td>HW-D-1008¹, HW-D-0268</td>
<td>HW-D-1008</td>
</tr>
<tr>
<td>4</td>
<td>HW-D-1042</td>
<td>HW-D-1103</td>
</tr>
<tr>
<td>CONCRETE OR BLOCK WALL TO CONCRETE OVER FLUTED METAL DECK (TOP-OF-WALL)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>HW-D-0008</td>
<td>N/A**</td>
</tr>
<tr>
<td>2</td>
<td>HW-D-0080, HW-D-0081, HW-D-0098</td>
<td>HW-D-1037</td>
</tr>
<tr>
<td>3</td>
<td>N/A**</td>
<td>N/A**</td>
</tr>
<tr>
<td>4</td>
<td>HW-D-0294</td>
<td>N/A**</td>
</tr>
<tr>
<td>GYPSUM WALL TO FLAT CONCRETE SLAB FLOOR (TOP-OF-WALL)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>HW-D-0082, HW-D-0083, HW-D-0106, HW-D-0119</td>
<td>HW-D-1011, HW-D-1012, HW-1020</td>
</tr>
<tr>
<td>2</td>
<td>HW-D-0082, HW-D-0083, HW-D-0106, HW-D-0119</td>
<td>HW-D-1011, HW-D-1012, HW-1020</td>
</tr>
<tr>
<td>3</td>
<td>HW-D-0119</td>
<td>HW-D-1011, HW-D-1012, HW-1020</td>
</tr>
<tr>
<td>GYPSUM SHAFT WALL TO FLAT CONCRETE SLAB (TOP-OF-WALL)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>HW-D-0342</td>
<td>N/A**</td>
</tr>
<tr>
<td>GYPSUM WALL TO CONCRETE OVER FLUTED METAL DECK (TOP-OF-WALL)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>HW-D-0292, HW-D-0295</td>
<td>HWD-1011, HWD-1012, HWD-1020</td>
</tr>
<tr>
<td>4</td>
<td>HW-D-0292, HW-D-0295</td>
<td>N/A**</td>
</tr>
<tr>
<td>CONCRETE WALL TO WALL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>WW-D-0017, WW-D-0092</td>
<td>WW-D-1090, WW-D-1094</td>
</tr>
<tr>
<td>3</td>
<td>WW-D-1011¹, WW-D-0032</td>
<td>WW-D-1011</td>
</tr>
<tr>
<td>4</td>
<td>WW-D-1047</td>
<td>WW-D-1128</td>
</tr>
<tr>
<td>GYPSUM WALL TO CONCRETE WALL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>WW-D-0040</td>
<td>N/A**</td>
</tr>
</tbody>
</table>

* SEE NOTE 3
** CONTACT HILTI FOR CURRENT UL-CLASSIFIED SYSTEM OR ENGINEER JUDGMENT DRAWING: 800-879-8798
1. CLASSIFIED SYSTEMS FOR 2" - 6" WIDE JOINTS MAY BE USED FOR JOINTS 2" WIDE AND LESS.
2. CONFIRM THAT MOVEMENT CAPABILITIES OF THE SELECTED UL SYSTEM MEETS OR EXCEEDS THE SPECIFIED MOVEMENT RANGE OF THE PARTICULAR JOINT.
3. SYSTEMS MARKED WITH ASTERIK (*) ARE SUITABLE FOR TOP-OF-WALL JOINTS WHERE THE FLUTED DECK HAS SPRAY-ON MONOKOTE MK-6/HY FIREPROOFING.
4. VERIFY ALLOWABLE JOINT WIDTH ON SPECIFIC UL SYSTEM DRAWING.

**END OF SECTION**
SECTION 079000
JOINT SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES
   A. Caulks and sealants.
   B. Caulks and sealants application schedule.

1.2 REFERENCES
   A. American Architectural Manufacturers Association (AAMA):
      1. AAMA 808.3 - Specification for Exterior Perimeter Sealing Compound.
   B. ASTM International:
   C. Underwriters Laboratory (UL):

1.3 SUBMITTALS
   A. Submit under provisions of Section 013000 - Administrative Requirements.
   B. Product Data: Manufacturer's data sheets on each product to be used, including:
      1. Preparation instructions and recommendations.
      2. Storage and handling requirements and recommendations.
      3. Installation methods.
   C. Shop Drawings:
      1. Show details of each system including material layers and thicknesses, flashing, terminations, and penetrations with each rooftop support system to be installed.
      2. All supports shall be pre-assembled and shipped for turnkey installation. Indicate all steps and preparation required by others.
   D. Verification Samples: Provide two representative samples for each product to be installed.

1.4 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Minimum 5 years experience manufacturing similar products.
   B. Installer Qualifications: Minimum 2 years experience installing similar products.
   C. Product Requirements: Provide products to meet the following:
      1. VOC requirements of the state and local building authorities.
      2. GreenSeal GS-36 Specifications - Standard for Adhesives For Commercial Use.
D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship is approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.
   4. Accepted mock-ups may be included in the finished work and shall set the standard of workmanship and acceptance for remaining work.

1.5 PRE-INSTALLATION MEETINGS
A. Convene at the project site a minimum two weeks prior to starting work of this section.

1.6 DELIVERY, STORAGE, AND HANDLING
A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
B. Handle materials to avoid damage.
C. Store materials in a clean, dry, interior location in accordance with the manufacturer's instructions. Maintain temperature range required by the manufacturer. Keep containers sealed until ready for use. Do not use sealants past the expiration date.

1.7 PROJECT CONDITIONS
A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products to wet surfaces or under environmental conditions outside manufacturer's recommended limits.

1.8 SEQUENCING
A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.9 WARRANTY
A. Warranty: Provide manufacturer's standard limited warranty for the following:
   1. Elastomeric Acrylic Sealant: 60 years.
   2. Siliconized Acrylic Caulk: 50 years.
   3. Acrylic Latest Caulk: 40 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS
A. Acceptable Manufacturer:
   Top Gun Brand
   400 Bertha Lamme Dr.
   Cranberry Township, PA 16066
   Tel: 800-834-0015

B. Requests for substitutions will be considered in accordance with provisions of
2.2 JOINT SEALANTS

A. Acrylic Sealants:

1. Siliconized Acrylic Sealant: Provide TOP GUN 200 to meet the following:
   a. Product Type: Siliconized acrylic.
   b. Class: ASTM C834, Type OP, Grade 0'C.
   c. VOC (actual): 1 percent.
   d. Solids by Weight: 80 percent minimum.
   f. Flash Point: > 200 degrees F (93 degrees C).
   g. Color: As selected by Architect to match adjacent surfaces

2. Acrylic Polymer Sealant: Provide TOP GUN 200xi to meet the following:
   a. Product Type: Acrylic Polymer.
   b. Class: ASTM C834, Grade -18'C.
   c. VOC (actual): 1 percent.
   d. Solids by Weight: 72.5 percent minimum.
   e. Flash Point: > 200 degrees F (93 degrees C).
   f. Color: 1411 Bright White.

3. Elastomeric Siliconized Acrylic Sealant: Provide TOP GUN 210x to meet the following:
   a. Product Type: High-Acrylate, Vinyl acrylic copolymer Siliconized latex.
   b. Class: ASTM C834, Type OP, Grade -18'C.
   c. VOC (actual): 1.2 percent.
   d. Solids by Weight: 82 percent minimum.
   e. Flash Point: > 200 degrees F (93 degrees C).

4. Modified Acrylic Sealant: Provide TOP GUN 250 to meet the following:
   a. Product Type: Proprietary modified acrylic.
   b. Class: ASTM C834, Type OP, Grade -18'C.
   c. VOC (actual): 1 percent.
   d. Solids by Weight: 83 percent minimum.
   e. Flash Point: > 200 degrees F (93 degrees C).

5. Elastomeric Siliconized Acrylic Sealant: Provide TOP GUN 300 to meet the following:
   a. Product Type: Siliconized acrylic.
   1) Class: Class: ASTM C834 and ASTM C920, Type S, Grade NS,
      Class 12-1/2, Use NT, M, G, A, and O.
   b. VOC (actual): 1 percent.
   c. Solids by Weight: 82 percent minimum.
   d. Hardness: Not reported.
   e. Flash Point: > 200 degrees F (93 degrees C).
   f. Product Type: Proprietary Urethane/ Modified acrylic blend
      (Siliconized).
   g. Class: ASTM C 920, Type S, Grade NS, Class 25, Use NT, M, G, A
      and O.
   h. VOC (actual): <1.5 % (30 g/L less water.
   i. Solids by Weight: 67 percent minimum.
   j. Flash Point: > 200 degrees F (93 degrees C).
   k. Color: As selected by Architect to match adjacent surfaces
   l. Silicone Sealants:

6. Silicone All Purpose Sealant: Provide TOP GUN 350 to meet the following:
   a. Product Type: Silicone rubber.
b. Class: ASTM C920, Type S, Grade NS, Class 25, Use NT, G, and A.
c. Food Safety: When cured and washed, meets FDA No. 21 CFR 177.2600.2.
d. VOC (actual): 2.9 percent.
e. Solids by Weight: 97 percent minimum.
f. Flash Point: > 200 degrees F (93 degrees C).
g. Color: 1419 Clear.

B. Thermoplastic Sealants:
   1. Thermoplastic Sealant: Provide Top Gun 750 to meet the following:
      a. Product Type: Thermoplastic elastomer.
      b. Meets requirements of ASTM C 1311.
      c. Hardness: 40 (Shore A).
      d. Flash Point: 82°F (28°C).
      e. Solids by Weight: 60%.
      f. VOC (actual): 40%.
      g. Elongation: 1400%.

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 in accordance with manufacturer's instructions and in proper relationship with adjacent construction. Produce uniform appearance on exposed surfaces. Remove excess sealants immediately.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.5 SEALANT APPLICATIONS SCHEDULE

A. Application: Masonry Veneer:
   1) Sealant: TOP GUN 200, TOP GUN 200xi, TOP GUN 300, TOP GUN 400, TOP GUN 350, TOP GUN 750

B. Application: Rough Carpentry:
   1) Sealant: TOP GUN 200, TOP GUN 200xi, TOP GUN 300, TOP GUN 250
C. Application: Miscellaneous Rough Carpentry:
   1) Sealant: TOP GUN 200, TOP GUN 200xi, TOP GUN 300, TOP GUN 250

D. Application: Sheathing Roof and Wall:
   1) Sealant: TOP GUN 200, TOP GUN 200xi, TOP GUN 300, TOP GUN 250, TOP GUN 140

E. Application: Gypsum Sheathing:
   1) Sealant: TOP GUN 200, TOP GUN 200xi, TOP GUN 140

F. Application: Sheathing, Moisture Resistant:
   1) Sealant: TOP GUN 200, TOP GUN 200xi, TOP GUN 140

G. Application: Cementitious Sheathing:
   1) Sealant: TOP GUN 200, TOP GUN 200xi, TOP GUN 140 (listed as "bonding" category)

H. Application: Wood Trim:
   1) Sealant: TOP GUN 200, TOP GUN 200xi, TOP GUN 300, TOP GUN 400, TOP GUN 250, TOP GUN 350

I. Application: Gypsum Board:
   1) Sealant: TOP GUN 200, TOP GUN 200xi, TOP GUN 140

J. Application: Solid Surface Countertops:
   1) Sealant: TOP GUN Kitchen and Bath, TOP GUN 300, TOP GUN 350, TOP GUN 400

K. Application: Joint Sealants:
   1) Sealant: TOP GUN 300, TOP GUN 400

L. Application: Acoustical Joint Sealants:
   1) Sealant: TOP GUN 200, TOP GUN 200xi, TOP GUN 300, TOP GUN 400

END OF SECTION
SECTION 081113
HOLLOW METAL DOORS AND FRAMES

PART 1  GENERAL

1.1 SECTION INCLUDES

A. The work under this section shall include the furnishing of all items shown on the drawings and as specified including, but not limited to, the following.

1. Steel Doors
2. Steel Door Frames
3. Tornado Resistant Doors
4. Tornado Resistant Frames

1.2 REFERENCES

A. Steel Doors and Frames in this section must meet all standards as established by the following listing.

1. Door and Hardware Preparation ANSI 115.
4. Steel Door Institute ANSI/SDI-100 (Latest edition)
5. UL10C and UBC 7 – 2 Positive Pressure fire testing.

1.3 SUBMITTAL

A. Coordinate approved shop drawings with all other trades and manufacturers whose products are used in conjunction with the Steel Doors and Frames under section 08100.

B. Finish 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.

C. Each floor of the building is to be detailed separately.

D. The steel door and frame supplier will furnish to the architect (6) complete copies of the proposed steel door and frames schedule and/or shop drawings. Using the same reference number for details and openings as those on the contract drawings. After receipt of the approved door schedule the steel door and frame supplier will make any corrections and submit to the architect (6) sets of corrected schedules.

E. Upon request of the architect or for any substitution to this specification, (4) copies of the steel door & frame manufacturers catalog cut sheets are to be submitted to the architect before any material is placed on the job site.

1.4 QUALITY ASSURANCE

A. Provide Steel Doors and Frames complying with the Steel Door Institute recommended specifications for Standard Steel Doors and Frames ANSI/SDI 100 (Latest edition).

1.5 DELIVERY, STORAGE & HANDLING

A. Doors and frames must be properly marked with door opening mark number to correspond with the schedule.

B. Deliver all steel doors in cartons and palletized to provide protection during transit and job storage.
C. Inspect doors and frames upon delivery for damage. Minor damage is to be repaired, provided the repair is equal to new work and acceptable to the architect.

D. Store doors and frames at the job site under cover. Place units on wood sills on the floor in a manner that will prevent rust and damage. Avoid the use of non-vented plastic or canvas shelters, which could create a humidity chamber. If the wrapper on the door becomes wet, remove the carton immediately. Provide a ¼ inch space between stacked doors to promote air circulation.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provided their products meet the requirements of the specifications.

1. Ceco Door Products
2. Curries Company
3. Other SDI or NAAMM members that conform to the specific requirements of this specification.

2.2 HARDWARE LOCATIONS & GENERAL REINFORCEMENTS

A. Locate hardware on doors and frames in accordance with the manufacturer’s standard location.

B. When steel frames are used with wood doors, the hardware preparation in the door is governed by the location on the frame. If the doors are factory mortised, the door supplier is responsible for coordinating hardware locations.

C. Hardware reinforcements are to be in accordance with the minimum standard gages as listed in SDI-100.

D. Doors shall be mortised, reinforced and function holes provided at the factory in accordance with the hardware schedule and templates provided by the hardware supplier. Through bolt holes, attachment holes, or drilling and tapping for surface hardware, shall be done by others in the field.

2.3 STEEL DOORS

A. Material - Exterior and as indicated on the schedule

1. Sheets are to be made of commercial quality hot dipped zinc coated steel that complies with ASTM A924 A60.
2. Vertical edges will join the face sheets by a continuous weld extending the full height of the door. Welds are to be ground, filled to make them invisible and provide a smooth flush surface.
3. Hinge reinforcement to be not less than 7 gauge (3/16”) plate 1-1/4” X 9”. Approved equal is a 12 gauge continuous channel with formed holes drilled and tapped. The manufacture is to provide test information with submittal that this type reinforcement is equal to a 3/16” or 7 gauge plate reinforcement.
4. Reinforce tops and bottoms of all 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 shall be flush with the top of the face sheets of the door. Plastic fillers are NOT acceptable.
5. Door Cores
   a. Insulated doors are to be completely filled with a rigid polyurethane core chemically bonded to all interior surfaces with a minimum insulation value of R10.
b. Insulated doors to have 20 gauge vertical steel stiffeners spanning the full thickness of the interior space between door faces. Stiffeners are spaced not more than 6" on centers, and attached by spot welds spaced not more than 5" on centers. Spaces between stiffeners are to be filled with fiberglass insulation (Min. density 0.8#/cubic ft.)

6. Door face sheets shall be 16 gage.

B. Materials - Other doors as indicated on the schedule.
1. Face sheets are to be made of commercial quality cold rolled steel that complies with ASTM A366 or A620.
2. Vertical edges to have a hairline edge seam.
3. Hinge reinforcement shall be not less than 7 gauge (3/16") plate 1-1/4" X 9". Approved as equal is a 12 gauge continuous channel with formed holes drilled and tapped. The manufacture is to provide test information with submittal that this type reinforcement is equal to a 3/16" or 7 gauge plate reinforcement.
4. Reinforce tops and bottoms of all 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 have a steel closure channel screwed in place so that the web of the channel is flush with the top of the face sheets of the door. Plastic filler is NOT acceptable.
5. Door Cores
a. Doors are to be fully filled with a one piece resin-impregnated honeycomb bonded to both faces.
b. Or doors are to be fully filled with a one piece polystyrene core, securely bonded to both faces.
6. Door face sheets shall be 16 gage.

C. Tornado Resistant Doors
   a. Acceptable Product: Steelcraft Paladin PW14 Series Tornado Door and Frame Systems or other manufacturers meeting or exceeding these specifications.
   b. Face sheets: 14 gage (1.7 mm) galvannealed steel having an A60 zinc-iron alloy coating conforming to ASTM designations A653 and A924.
   c. Hinge and lock edges:
      i. Continuous vertical mechanical joints with edge seams welded, filled and ground smooth.
      ii. Bevel edges 1/8 inch (3 mm) in 2 inches (50 mm). Square edges are not acceptable.
   d. Hinge reinforcements: Minimum 7 gage (4.2 mm) galvannealed steel, projection welded to the edge of the door.
   e. Top and bottom steel reinforcement channels, galvannealed 14 gage (1.7 mm), projection welded to both face sheets on 4 inches (102 mm) centers.
   f. Reinforce door faces with 18 gage (1.0 mm) vertical stiffeners manufactured from Galvannealed steel conforming to ASTM A 653 and ASTM A 924 and welded to each face sheet.
   g. Reinforced lock stiles with full-height 12 gage (2.3 mm) lock reinforcing channels.
   h. Fire Rating: Supply door units bearing Labels for fire ratings indicated in Door Schedule for the locations indicated.

2.4 STEEL FRAMES
A. Materials - Exterior
1. To be hot dipped zinc coated steel that complies with ASTM designations A924 A60.
2. Weld the face seam and the full web of the frame corner or intersection. Grind and dress the weld area smooth. Apply a zinc rich primer over the grinding area, and finish with a matching prime paint.
3. All exterior door frames shall be 14 gage.

B. Materials - Interior
1. Cold rolled steel that complies to ASTM A366 or A620.
2. Weld the face miter seam. Grind and dress the weld smooth. Finish with a matching prime paint.
3. All interior door frames shall be 14 gage.

C. Fabrication
1. Provide steel frames for doors, transoms, sidelights, borrowed lites, and other openings to the size and design as shown on the architectural drawings.
2. All finished work shall be strong and rigid, neat in appearance, square, true and free of defects.
3. Jamb depths, trim, profile and backbends to be as scheduled and shown on approved shop drawings.
4. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field.
5. Hardware reinforcements are to be in accordance with the minimum standard gages as listed in SDI-100.
6. Frames shall be mortised, reinforced, drilled and tapped at the factory for template mortised hardware only, in accordance with approved hardware schedule and template provided by the hardware contractor. Where surface mounted hardware is to be applied, frames shall have reinforcing plates only; all drilling and tapping to be done in the field by others.
7. Hinge reinforcements to be 7 gauge steel.
8. All frames shall be fully welded. **Knock-down type frames shall not be acceptable.**

D. Anchors
1. Floor anchors to be provided at each jamb.
2. Anchors for masonry walls to be of the wire type.
3. Anchors for stud partitions to be steel of a suitable design, not less than 18 gauge thickness.
4. Dust boxes/mortar guards to be no less than 26 gauge.
5. All frames that are to be welded are to have a steel spreader during shipping and handling. Spreader bars are for bracing only and are not be used to size the frame opening.
6. Loose glazing stops are to be of 16 gauge galvanized steel, butted at corner joints and secured to the frame with countersunk cadmium or zinc-plated screws.
7. Except on weather-stripped frames, punch the stop for 3 silencers on single door and 2 on double door frames.

E. Tornado Resistant Frames
   a. Acceptable Product: Steelcraft Paladin FP Series Tornado Door and Frame Systems or other manufacturers meeting or exceeding these specifications.
   b. Construction:
i. Face welded: Weld miter joints between head and jamb faces completely along their length either internally or externally. The remaining elements of the frame profile (soffit, stop and rabbets) are not welded. Grind and finish face joints smooth.

ii. Full profile welded:
   1) Weld miter joints between head and jamb faces completely along their length either internally or externally.
   2) Internally weld perimeter profile joints full length of soffit and rabbets with hairline seams on external meeting surfaces. Grind and finish face joints smooth.

c. Profile:
   i. 2 inch (51 mm) face dimension with 5/8 inch (16 mm) high stop, and types and throat dimensions indicated on the Door Schedule.

d. Provide following reinforcement and accessories:
   i. Hinge Preparation for 4-1/2 inches (114 mm) high, standard weight, or heavy weight, full mortise hinges; with plaster guard.
   ii. Hinge Preparation for 5 inch (127 mm) high, universal standard weight, or heavy weight, full mortise hinges; with plaster guard.
   iii. Strike preparation (single doors) for 4-7/8 inch (123 mm) universal strike; with plaster guard.
   iv. Silencers. Prepare frames to receive inserted type door silencers, 3 per strike jamb on single doors, and 2 per head for pair of doors. Stick-on silencers are not permitted.

e. Fire Rating: Supply frame units bearing Labels for fire ratings indicated in Door Schedule for the locations indicated.

f. Finish: Factory prime finish

2.5 LABELED DOORS & FRAMES

A. Construct and install doors and frames to comply with current issue of National Fire Protection Association (NFPA) Standard Number 80, as herein specified.

B. Doors and/or frames for labeled openings shall bear either a stamped or applied label from a nationally recognized testing agency.

C. All doors and frames shall have been tested in accordance with UL10C and UBC 7–2 Positive Pressure.

2.6 PRIME FINISH

A. Doors and frames are to be cleaned, and chemically treated to insure maximum finish paint adhesion. All surfaces of the door and frame exposed to view shall receive a factory applied coat of rust inhibiting primer. The finish to meet the requirements for acceptance stated in ANSI A224.1 “Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces.” The prime finish is not intended to be the final layer of protection from the elements. Field painting using a good grade of paint to be provided in accordance with the recommendations of the door and frame manufacturer. For specialty types of finished coatings, the paint supplier should also be consulted.

PART 3 EXECUTION

3.1 INSPECTION
A. It is the responsibility of the General Contractor to assure that scratches or disfigurements caused in shipping or handling are properly cleaned and touched up with a rust inhibitive primer.

3.2 INSTALLATION

A. Frames
1. Prior to installation, all frames must be checked for rack, twist and out of square conditions.
2. Place frames prior to enclosing walls and ceilings. Set frames accurately in position, plumbed and braced securely until permanent anchors are set. Remove shipping bar spreader and insert a wood spreader cut to the opening width, notched to clear the stops.
3. Fill frames in masonry walls with mortar.
4. When temperature conditions necessitate an additive to be used in the plaster or mortar to prevent freezing, the contractor installing the frames shall coat the inside of the frames, in the field, with a corrosion inhibiting bituminous material.
5. SDI-105, “Recommended Erection Instructions for Steel Frames” and SDI-110 “Standard Steel Doors and Frames for Modular Masonry Construction” shall indicate the proper installation procedures.

B. Doors
1. Install doors plumb and in true alignment in a prepared opening and fasten them to achieve the maximum operational effectiveness and appearance.
2. Proper door clearance must be maintained in accordance with SDI-110.
3. Where necessary, only metal hinge shims are acceptable to maintain clearances.

C. Hardware must be applied in accordance with hardware manufacturer’s templates and instructions.

3.3 ADJUST & CLEAN

A. Check and re-adjust operating finish hardware items in hollow metal work just prior to final inspection. Leave work in complete and proper condition.

B. Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply to touch-up or compatible air-drying primer.

END OF SECTION
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. Solid core veneer-faced doors.
2. High Pressure Decorative Laminate faced doors.
3. Fire-resistant composite core doors.
4. Factory finishing.
5. Sizing by manufacturer.

1.3 SUBMITTALS

A. Doors shall be numbered to correspond to numbering system used on Construction Drawings.

B. Product Data: For each type of door, include details of core and edge construction and trim for openings.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.
5. Requirements for veneer matching.
6. Doors to be factory finished and finish requirements.
7. Fire-protection ratings for fire-rated doors.

D. Samples for Initial Selection: For high pressure decorative laminate door faces.

E. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish.
2. Provide construction samples of doors, approximately 5 by 5 inches, with door faces and vertical edges representing actual construction to be used.
1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. A qualified manufacturer that is a member in good standing of the Window and Door Manufacturers Association.

B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body when FSC Certified wood is specified.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer’s written instructions.

B. Package factory-finished doors individually in manufacturer’s standard plastic bags, stretch wrap, or cardboard cartons.

C. Mark each door on top rail with opening number used on Shop Drawings. Include manufacturer’s order number and date of manufacture.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

   1. Failures include, but are not limited to, the following:
      a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
      b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (76.2-mm) span.

   2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.


PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Marshfield DoorSystems, Inc. flush wood doors or a comparable product by one of the following:
1. Algoma Hardwoods, Inc.
2. Eggers Industries.
3. Marshfield DoorSystems

B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL


B. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain added urea formaldehyde.

C. WDMA I.S.1-A Performance Grade:
   1. Extra Heavy Duty

D. Fire-Rated Wood Doors: Doors 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 NFPA 252 or UL 10C.
   1. Cores: Provide core specified or fire-resistant composite core as needed to provide fire-protection rating indicated.
   2. Blocking: Provide composite blocking approved for use in doors of fire-protection ratings indicated as needed to maintain WDMA performance level and eliminate through-bolting hardware.
   3. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals.

E. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

F. Wood-Based Particleboard-Core Doors:
   1. Provide wood-based particleboard core doors with a minimum density per ANSI A208.1, Grade LD-2 as required to meet WDMA Performance Duty level specified without added blocking.

2.3 HIGH PRESSURE DECORATIVE LAMINATE-FACED DOORS

A. Interior Solid-Core Doors:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Marshfield DoorSystems; “Signature Series” or a comparable product by one of the following:
      a. Algoma Hardwoods
      b. Eggers Industries
   2. Grade: Premium
   3. HPDL Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS. Vertical and post formable grade laminates are not acceptable.
   4. Colors, Patterns, and Finishes: As indicated on Construction Drawings.
5. Exposed Vertical Edges: High-pressure decorative laminate that matches faces, applied to structural composite lumber stile after faces, 1/8 inch (3.2 mm) impact-resistant edging, applied after faces, color selected from manufacturer's standard offering.


7. Construction: Three plies. Stiles and rails are bonded to core, and then entire unit is abrasive planed before faces are applied.

2.4 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 NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs. Any deficiencies must be corrected prior to door installation.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: Refer to Finish Hardware Schedule

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

1. Install fire-rated doors according to NFPA 80.
2. Install smoke- and draft-control doors according to NFPA 105.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Do not trim factory finished doors for width.
3.3 ADJUSTING

A. Operation: Correct any deficiency that prohibits the door from swinging or operating freely. Do not remove hinge screws after initial insertion. Shims used for alignment purposes must be inserted between hinge and frame. Do not insert shims between hinge and door.

B. To prevent stile failure, insure that door closers are properly adjusted and do not limit the door opening swing. Limit door opening swing only with a properly located stop.

C. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION
PART 1   GENERAL

1.1 SECTION INCLUDES
A. Fiberglass reinforced polyester (FRP) flush doors with aluminum frames.

1.2 RELATED SECTIONS
A. Section 081113 – Hollow Metal Doors & Frames
B. Section 087100 - Door Hardware
C. Section 087150 – Finish Hardware Schedule

1.3 REFERENCES
B. ANSI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings.
D. ASTM B 209 - Aluminum and Aluminum-Alloy Sheet and Plate.
E. ASTM B 221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
F. ASTM D 256 - Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.
H. ASTM D 570 - Water Absorption of Plastics.
I. ASTM D 638 - Tensile Properties of Plastics.
L. ASTM D 1621 - Compressive Properties of Rigid Cellular Plastics.
M. ASTM D 1623 - Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
N. ASTM D 2126 - Response of Rigid Cellular Plastics to Thermal and Humid Aging.
O. ASTM D 2583 - Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
Q. ASTM D 6670-01 - Standard Practice for Full-Scale Chamber Determination of Volatile Organic Emissions from Indoor Materials/Products.
1.4 PERFORMANCE REQUIREMENTS

A. General: Provide door assemblies that have been designed and fabricated to comply with specified performance requirements, as demonstrated by testing manufacturer's corresponding standard systems.

B. Air Infiltration: For a single door 3'-0" x 7'-0", test specimen shall be tested in accordance with ASTM E 283 at pressure differential of 6.24 psf. Door shall not exceed 0.90 cfm per linear foot of perimeter crack.

C. Water Resistance: For a single door 3'-0" x 7'-0", test specimen shall be tested in accordance with ASTM E 331 at pressure differential of 7.50 psf. Door shall not have water leakage.

D. Indoor air quality testing per ASTM D 6670-01: GREENGUARD Environmental Institute Certified including GREENGUARD for Children and Schools Certification.

E. Hurricane Test Standards, Single Door with Single-Point Latching:
   1. Uniform Static Load, ASTM E 330: Plus or minus 75 pounds per square foot.
   2. Forced Entry Test, 300 Pound Load Applied, SFBC 3603.2 (b)(5): Passed.
   3. Cyclic Load Test, SFBC PA 203: Plus or minus 53 pounds per square foot.
   4. Large Missile Impact Test, SFBC PA 201: Passed.

F. Blast Test, Doors and Frames, ASTM F 1642-04, 6 psi / 41 psi-msec: Minimal Hazard.

G. Swinging Door Cycle Test, Doors and Frames, ANSI A250.4: Minimum of 25,000,000 cycles.

H. Cycle Slam Test Method, NWWDA T.M. 7-90: Minimum 5,000,000 Cycles.

I. Swinging Security Door Assembly, Doors and Frames, ASTM F 476: Grade 40.


L. Thermal Transmission, Exterior Doors, U-Value, AAMA 1503-98: Maximum of 0.29 BTU/hr x sf x degrees F. Minimum of 55 CRF value.

M. Surface Burning Characteristics, FRP Doors and Panels, ASTM E 84:
   1. Flame Spread: Maximum of 200, Class C.
   2. Smoke Developed: Maximum of 450, Class C.

N. Surface Burning Characteristics, Class A Option On Interior Faces of FRP Exterior Panels and Both Faces of FRP Interior Panels, ASTM E 84:
   1. Flame Spread: Maximum of 25.
   2. Smoke Developed: Maximum of 450.

O. Impact Strength, FRP Doors and Panels, Nominal Value, ASTM D 256: 15.0 foot-pounds per inch of notch.

P. Tensile Strength, FRP Doors and Panels, Nominal Value, ASTM D 638: 14,000 psi.

Q. Flexural Strength, FRP Doors and Panels, Nominal Value, ASTM D 790: 21,000 psi.

R. Water Absorption, FRP Doors and Panels, Nominal Value, ASTM D 570: 0.20 percent after 24 hours.


U. Abrasion Resistance, Face Sheet, Taber Abrasion Test, 25 Cycles at 1,000 Gram Weight with CS-17 Wheel: Maximum of 0.029 average weight loss percentage.

V. Stain Resistance, ASTM D 1308: Face sheet unaffected after exposure to red cabbage, tea, and tomato acid. Stain removed easily with mild abrasive or FRP cleaner when exposed to crayon and crankcase oil.

   1. Acetic acid, Concentrated.
   2. Ammonium Hydroxide, Concentrated.
   3. Citric Acid, 10%.
   4. Formaldehyde.
   5. Hydrochloric Acid, 10%.
   6. Sodium hypochlorite, 4 to 6 percent solution.

X. Compressive Strength, Foam Core, Nominal Value, ASTM D 1621: 79.9 psi.

Y. Compressive Modulus, Foam Core, Nominal Value, ASTM D 1621: 370 psi.

Z. Tensile Adhesion, Foam Core, Nominal Value, ASTM D 1623: 45.3 psi.

AA. Thermal and Humid Aging, Foam Core, Nominal Value, 158 Degrees F and 100 Percent Humidity for 14 Days, ASTM D 2126: Minus 5.14 percent volume change.

1.5 SUBMITTALS

A. Comply with Section 013000 for Submittal Procedures.

B. Product Data: Submit manufacturer’s product data, including description of materials, components, fabrication, finishes, and installation.
C. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections, and details, indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, hardware schedule, and finish.

D. Samples:
   1. Door: Submit manufacturer's sample of door showing face sheets, core, framing, and finish.
   2. Color: Submit manufacturer's samples of standard colors of doors and frames.

E. Test Reports: Submit certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements.

F. Manufacturer's Project References: Submit list of successfully completed projects including project name and location, name of architect, and type and quantity of doors manufactured.

G. Maintenance Manual: Submit manufacturer's maintenance and cleaning instructions for doors, including maintenance and operating instructions for hardware.

H. Warranty: Submit manufacturer's standard warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Continuously engaged in manufacturing of doors of similar type to that specified, with a minimum of 25 years successful experience.
   2. Door and frame components from same manufacturer.
   3. Evidence of a compliant documented quality management system.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening door mark and manufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials and finish from damage during handling and installation.

1.8 WARRANTY

A. Warrant doors, frames, and factory hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.

B. Warranty Period: Ten years starting on date of shipment. In addition, a limited lifetime (while the door is in its specified application in its original installation) warranty covering: failure of corner joinery, core deterioration, delamination or bubbling of door skin.

PART 2 PRODUCTS

2.1 MANUFACTURERS


B. Manko Window Systems
2.2 FRP FLUSH DOORS

A. Model: SL-17 Flush Doors with SpecLite3 fiberglass reinforced polyester (FRP) face sheets.

B. Door Opening Size: As indicated on the Drawings.

C. Construction:
   2. Stiles and Rails: Aluminum extrusions made from prime-equivalent billet that is produced from 100% reprocessed 6063-T6 alloy recovered from industrial processes, minimum of 2-5/16-inch depth.
   4. Provide joinery of 3/8-inch diameter full-width tie rods through extruded splines top and bottom integral to standard tubular shaped stiles and rails reinforced to accept hardware as specified.
   5. Securing Internal Door Extrusions: 3/16-inch angle blocks and locking hex nuts for joinery. Welds, glue, or other methods are not acceptable.
   6. Furnish extruded stiles and rails with integral reglets to accept face sheets. Lock face sheets into place to permit flush appearance.
   7. Rail caps or other face sheet capture methods are not acceptable.
   8. Extrude top and bottom rail legs for interlocking continuous weather bar.
   9. Meeting Stiles: Pile brush weatherseals. Extrude meeting stile to include integral pocket to accept pile brush weatherseals.
  10. Bottom of Door: Install bottom weather bar with nylon brush weatherstripping into extruded interlocking edge of bottom rail.
  11. Glue: Use of glue to bond sheet to core or extrusions is not acceptable.

D. Face Sheet:
   1. Material: SpecLite3 FRP, 0.120-inch thickness, finish color throughout.
   2. Protective coating: Abuse-resistant engineered surface. Provide FRP with SpecLite3 protective coating, or equal.
   4. Color: To be selected by Architect from manufacturer’s standard colors.
   5. Adhesion: The use of glue to bond face sheet to foam core is prohibited.

E. Core:
   2. Density: Minimum of 5 pounds per cubic foot.

F. Cutouts:
   1. Manufacture doors with cutouts for required vision lites, louvers, and panels.
   2. Factory install vision lites, louvers, and panels.

G. Hardware:
   1. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.
   2. Factory install hardware.

2.3 MATERIALS

A. Aluminum Members:
   1. Aluminum extrusions made from prime-equivalent billet that is produced from 100% reprocessed 6063-T6 alloy recovered from industrial processes: ASTM B 221.
   2. Sheet and Plate: ASTM B 209.
   3. Alloy and Temper: As required by manufacturer for strength, corrosion resistance, application of required finish, and control of color.

B. Components: Door and frame components from same manufacturer.
C. Fasteners:
   1. Material: Aluminum, 18-8 stainless steel, or other noncorrosive metal.
   2. Compatibility: Compatible with items to be fastened.
   3. Exposed Fasteners: Screws with finish matching items to be fastened.

2.4 FABRICATION

A. Sizes and Profiles: Required sizes for door and frame units, and profile requirements shall be as indicated on the Drawings.

B. Coordination of Fabrication: Field measure before fabrication and show recorded measurements on shop drawings.

C. Assembly:
   1. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.
   2. Remove burrs from cut edges.

D. Welding: Welding of doors or frames is not acceptable.

E. Fit:
   1. Maintain continuity of line and accurate relation of planes and angles.
   2. Secure attachments and support at mechanical joints with hairline fit at contacting members.

2.5 HARDWARE

A. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.

B. Hardware Schedule: As specified in Section 08715.

C. Doors shall be provided with continuous hinges, adjustable bottom brush sweeps and flush pulls by manufacturer.

2.6 VISION LITES

A. Factory Glazing: As indicated on Construction Drawings.

2.7 ALUMINUM FINISHES

A. Anodized Finish: Class I finish, 0.7 mils thick.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Ensure openings are plumb, level, square, and in tolerance.
3.3 INSTALLATION

A. Install doors in accordance with manufacturer's instructions.
B. Install doors plumb, level, square, true to line, and without warp or rack.
C. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by Architect.
D. Install exterior doors to be weathertight in closed position.
E. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
F. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 ADJUSTING

A. Adjust doors, hinges, and locksets for smooth operation without binding.

3.5 CLEANING

A. Clean doors promptly after installation in accordance with manufacturer's instructions.
B. Do not use harsh cleaning materials or methods that would damage finish.

3.6 PROTECTION

A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END OF SECTION
PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Provide all materials, labor, equipment and services necessary to furnish, deliver and install all work under this section as shown on the contract documents, specified herein, and as specified by the job conditions.

1.02 DESCRIPTION

A. Related work specified elsewhere:
   1. Metal Fabrication. Section 055000
   2. Rough Carpentry. Section 061000
   4. Paints & Coatings: Section 099000
   5. Electrical

1.03 SUBMITTALS

A. Procedures: Furnish submittals in accordance with the general requirements specified.

B. Shop Drawing: Furnish shop drawings for architect's approval. Include elevations, sections, and details indicating dimensions, materials, finishes, conditions for anchorage and support of each coiling acoustically rated service door.

C. Certifications:
   1. Provide certification from an accredited testing laboratory of product compliance with FEMA 361 Safe Rooms for Tornadoes and Hurricanes.
   3. Provide certification form accredited testing laboratory of product compliance to sustain a 240 psf wind pressure (1.2 times the design wind pressure of 200 psf) in accordance with ASTM E330.
   4. Provide certification form accredited testing laboratory of product compliance in accordance with the requirements of ASTM E1886 Large Missile Impact for FEMA 361 assemblies.

D. Product Literature: Submit manufacturer's technical literature describing the product to be used under this section.

E. Maintenance and Operating Manuals: Furnish complete manuals describing the materials, devices and procedures to be followed in operating and maintaining all tornado and hurricane resistant coiling doors under this section. Include manufacturer's brochures and parts lists describing the actual materials used in the product.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with applicable FEMA requirements as well as laws, codes, ordinances and regulations of federal, state and municipal authorities having jurisdiction.

B. Manufacturer Requirements: Manufacturer shall have been in the business of and have experience in manufacturing wide span opening protective door assemblies as well as providing dependable credible service for a minimum of ten (10) years.
1.05 DELIVERY, STORAGE AND HANDLING

A. General: Deliver and store materials in manufacturer's original packaging, labeled to show name, brand and type. Store materials in a protected dry location off the ground in accordance with manufacturer's instructions.

1.06 WARRANTY

A. Tornado and Hurricane Resistant Coiling Door Warranty: Furnish one (1) year written warranty signed by the manufacturer and installer agreeing to repair or replace work which has failed as a result of defects in materials or workmanship. Upon notification within the warranty period, such defects shall be repaired at no cost to the owner.

PART 2 PRODUCTS

2.01 TORNADO RESISTANT COILING DOORS

A. Manufacturer: Tornado resistant coiling doors shall be the model SafeSpace 500-G as manufactured by McKeon Door Company. Door assembly shall be tested and certified by an accredited testing laboratory, approved for use in FEMA 361 and ICC 500 safe rooms and storm shelters.

B. Substitutions shall be submitted to Architect a minimum of 10 days prior to bidding. All substitution requests shall include assembly test certificate and testing agency certifications.

2.02 MATERIALS

A. Curtain: Shall be assembled of interlocking galvanized steel slats. Curtain shall be formed of ID slat profile sections with a polymeric insulation core of gauge as required to sustain the minimum required design wind pressure. Slat cross section shall not be less than 3” wide by 1-1/2” deep. Paint standard McKeon Sterling Gray finish.

B. Bottom Bar: Shall consist of a double structural steel angle assembly formed to fit and engage the curtain assembly, paint Black.

C. Guides: Each guide assembly shall be fabricated of structural steel support angles and guide retaining angles of a sufficient depth to retain curtain in in the guides under the design wind pressure and impact forces specified, paint Black.

D. Mounting Brackets: Fabricated of 3/16” minimum steel plates, brackets shall be provided to house ends of the counterbalance barrel assembly. Paint standard McKeon Sterling Gray finish.

E. Hood: Shall be provided to entirely enclose coiled curtain and counterbalance barrel assembly. Hood shall be fabricated 22 gauge galvanized steel, designed and formed to match brackets. Top and bottom shall be bent and reinforced to provide for proper stiffness. Paint standard McKeon Sterling Gray finish.

F. Counterbalance Assembly: Coiling door shall be counterbalanced by means of adjustable steel helical torsion springs attached to shaft enclosed in pipe with required mounting blocks or rings for attachment of curtain. Grease sealed bearings or self-lubricating graphite bearings shall be attached to the spring barrel which shall be fabricated of hot formed structural quality carbon steel seamless pipe.

G. Electric Motor Operator: Coiling door shall be provided with a compact power unit designed and built by the coiling door manufacturer. Operator shall be equipped with an adjustable screw-type limit switch to break the circuit at termination of travel. High efficiency gearing running in an oil bath, shall be furnished together with a magnetic operated brake, completely housed to protect against damage, dust and moisture. An efficient overload protection device, which will break the power circuit and protect against damage to the motor windings shall be integral with the unit. Operator is to be housed in a NEMA type 1 enclosure.
1. Motor: Shall be intermediate duty, thermally protected, ball bearing type with a class A or better insulation. Horsepower of motor is to be 1/3hp minimum or of manufacturer’s recommended size, whichever is greater.

2. Starter: Shall be size "0" magnetic reversing starter, across the line type with mechanical and electrical interlocks, with 10 amp continuous rating and 24 volt control circuit.

3. Reducer: Spiral gear type, 70% efficiency minimum.

4. Brake: Magnetically activated, integral within the operator's housing.

5. Control Station: Provide recessed mount push button control station marked open, close and stop.

6. Fail Safe Design to include FXN-EP Motor Operator with AR-C Magnetic Release Device to automatically close doors when power has failed or is shut off.

H. Obstruction Sensing Device: The coiling door shall be designed with an obstruction sensing safety edge. In the event that the safety edge meets an obstruction during the normal closing operation, the coiling door shall stop, reverse and return to the open position.

I. Finish: After completion of fabrication, clean all metal surfaces to remove dirt and chemically treat to provide for paint adhesion. All steel components shall receive a prime coat finish of .2 mils epoxy primer and .8 mils of polyester paint color as indicated for each component in this section parts 2.02, A, B, C, D, & E.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces and field conditions to which this work is to be performed and notify architect if conditions of surfaces exist which are detrimental to proper installation and timely completion of work.

B. Verify all dimensions taken at job site affecting the work. Notify the architect in any instance where dimensions vary.

C. Coordinate and schedule work under this section with work of other sections so as not to delay job progress.

3.02 INSTALLATION

A. Perform installation using only factory approved and certified representatives of the coiling door manufacturer.

B. Install coiling door assemblies at locations shown in perfect alignment and elevation, plumb, level, straight and true.

C. Adjust coiling acoustically rated service door installation to provide uniform clearances and smooth non-binding operation.

D. Install wiring in accordance with applicable local codes and the National Electrical Code Standard. Materials shall be UL listed.

3.03 PROTECTION AND CLEANING

A. Protect installed work using adequate and suitable means during and after installation until accepted by owner.

B. Remove, repair or replace materials which have been damaged in any way.

C. Clean surfaces of grime and dirt using acceptable and recommended means and methods.

END OF SECTION
SECTION 084113
ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Aluminum Storefront Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront units.

1.02 SYSTEM DESCRIPTION

A. Storefront System Performance Requirements:

1. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft² at a static air pressure differential of 6.24 psf.

2. Water Resistance: The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a minimum static air pressure differential of 8 psf as defined in AAMA 501.

3. Uniform Load: A static air design load of 20 psf shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

1.03 SUBMITTALS

A. General: Prepare, review, approve, and submit specified submittals in accordance with Section 013000.

B. Submittals shall include component dimensions, anchorage/fastener requirements, glass preparation and manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications: Installer experienced to perform work of this section who has specialized in the installation of work similar to that required for this project and who is acceptable to product manufacturer.

B. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

1.05 DELIVERY, STORAGE AND HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

B. Packing, Shipping, Handling, and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
C. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront against damage from elements, construction activities, and other hazards before, during and after entrance installation.

**PART 2  PRODUCTS**

**2.01 MANUFACTURERS**

A. Kawneer Company, Inc.
B. EFCO
C. YKK AP America

**2.02 MATERIALS**

A. Aluminum (Storefront and Components):

1. Material Standard: Extruded Aluminum, ASTM B 221; 6063-T5 alloy and temper.
2. Member Wall Thickness: Each framing member shall provide structural strength to meet specified performance requirements.
3. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

B. Framing: Kawneer, Trifab VG 451T, center glazed.

**2.03 ACCESSORIES**

A. Fasteners: Where exposed, shall be Stainless Steel.
B. Gaskets: Glazing gaskets shall be extruded EPDM rubber.
C. Perimeter Anchors: Aluminum. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
D. Brake metal: Aluminum.
E. Provide Pivot Mullions and similar corners where indicated on plans.

**2.04 FABRICATION**

A. General:

1. Fabricate components per manufacturer’s installation instructions and with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
2. Accurately fit and secure joints and corners. Make joints flush, hairline and weatherproof.
4. Arrange fasteners and attachments to conceal from view.

2.05 FINISHES
A. Factory Finishing:
   1. Kawneer Permacoat, AAMA 2604, Powder Coating
   2. Color: Green to match existing (Contractor shall submit actual powder coated material samples of all Permacoat colors for final approval by Architect)

PART 3 EXECUTION

3.01 EXAMINATION
A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer’s instructions. Verify openings are sized to receive storefront system and sill plate is level in accordance with manufacturer’s acceptable tolerances.

   1. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

3.02 INSTALLATION
A. General: Install storefront systems plumb, level, and true to line, without warp or rack of frames with manufacturer’s prescribed tolerances and installation instructions. Provide support and anchor in place.

   1. Dissimilar Materials: Provide separation of aluminum materials from sources of corrosion or electrolytic action contact points.

   2. Weathertight Construction: Install sill members and other members in a bed of sealant or with joint filler or gaskets, to provide weathertight construction. Coordinate installation with wall flashings and other components of construction.

3.03 PROTECTION AND CLEANING
A. Protection: Protect installed product’s finish surfaces from damage during construction. Protect aluminum storefront system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.

B. Cleaning: Repair or replace damaged installed products. Clean installed products in accordance with manufacturer’s instructions prior to owner’s acceptance. Remove construction debris from project site and legally dispose of debris.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. The General Conditions of the Contract, including Supplementary Conditions and Division 1, General Requirements, apply to work of this Section.

B. Hardware for hollow metal doors.

C. Hardware for fire-rated doors.

D. Lock cylinders for doors for which hardware is specified in other sections.

E. Thresholds.

F. Weatherstripping, seals and door gaskets.

1.02 REFERENCES


1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate locations and mounting heights of each type of hardware, schedules, catalog cuts, electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention and adjustment.

D. Project Record Documents: Record actual locations of installed cylinders and their master key code.

E. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

F. Keys: Coordinate with existing system and deliver with identifying tags to Owner's designated representative ONLY by security shipment direct from hardware supplier.

G. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
1.04 QUALITY ASSURANCE
   A. Single-Source: All door hardware is to be furnished by the same vendor.
   B. Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this section.

1.05 PRE-INSTALLATION MEETING
   A. Convene one week prior to commencing work of this section. The Architect and the Owner's Representative is to be notified of date, time, and location of said meeting at least one (1) week ahead of the meeting and be given the opportunity to attend same.

1.06 DELIVERY, STORAGE, AND PROTECTION
   A. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

1.07 COORDINATION
   A. Coordinate the work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware.
   B. Furnish templates for door and frame preparation.
   C. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.08 WARRANTY
   A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

1.09 MAINTENANCE PRODUCTS
   A. Provide special wrenches and tools applicable to each different or special hardware component.
   B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. **Keying Instructions** – (No Substitution)
      Key All Locks To The Existing Corbin Russwin Restricted Keyway System. Provide Temporary Construction Master Keyed Cores (CT6R) For All Exterior Doors, And Lock-Up Rooms As Required. Provide Disposable Plastic Temporary Cores (CT6D) For All Other Locks. Provide Twenty Construction Keys. Provide Permanent 8000 Series Cores, Keyed As Required, For Final Installation After Project Completion. Provide complete bitting schedule.
   
   **Hinges** – (Or Equal Acceptable)
   - Pemko Continuous CFM 83 HD1 – Exterior Hollow Metal and all doors on Early Childhood
   - Pemko Continuous KDFM 83 HD1 – All Aluminum Storefront
   - Continuous Hinges By Door Supplier – All FRP Doors
   - PBB 4B81 HD Hinges – Interior Multi Use Restrooms, Cross Corridor, Stairs, Interior Doors Equipped With Exit Devices, Doors Over 3'0" Wide
**Exit Devices** – (No Substitution)
Von Duprin 99 series US28 finish (313AN @ Storefront) with Corbin Russwin 6 pin restricted keyway interchangeable core cylinders at keyed functions & mullions.
99NL-OP - Keyed Entry (only one keyed per bank of doors)
99EO - Inactive Entry Pairs, Exit Only Doors
99L-F W/ 03 Lever – Fire Rated
99L-F-2 W/03 – Fire Rated Classrooms, Libraries, and Gyms etc.
9947EO-F – Cross Corridor Fire Rated Double Egress
9947L-F W/03 Lever – Cross Corridor Fire Rated Standard Pair
330 Dummy Bar at Full Glass Non Latching Doors

**Removable Mullions** – (No Substitution)
Von Duprin Keyed Removable KR4954 or KR9954. KR4854 with 6111 electric strike at card access doors. (Card access system by others)

**Locks** – (No Substitution)
Corbin Russwin mortise with 6 pin restricted keyway interchangeable core cylinders, LWA design interior, LWM design exterior, 630 finish.
ML2052 Classrooms, Corridor Office Doors
ML2057 Mech, Elect, Janitor, Non Classroom Storage (M30 Half Trim At Exterior W/ Flush or Vandal Resistant Pull)
ML2055 Offices, Classroom Storage
ML2022 Adjoining Classrooms
ML2030 M19V Single Toilets
ML2065 Early Childhood Classrooms
DL4000 series deadlocks function as required
Double Mechanical Closets have double doors, shall be rated 20 minute. All single closets non rated doors.

**Flush Bolts** – (Or Equal Acceptable)
Ives FB458B US26D finish manual flush bolt (use top bolt only where security is not an issue) provide long top rod as required
Ives FB51T US32D finish top self latching flush (use at non fire rated wood or hollow metal doors to ensure locking at most applications) provide long top rod as required
Ives FB52T US32D finish top self latching flush (use at fire rated hollow metal doors) provide long top rod as required
Ives FB62T US32D finish top self latching flush (use at fire rated wood doors) provide long top rod as required

**Closers** – (No Substitution)
LCN 4041 series AL finish (DKB finish at Aluminum Storefront)
All closers to be parallel arm application, except regular arm application may be used at inswinging doors to non student areas such as Mech, Elect, Janitor, etc. Where wall stop cannot be used, use “Spring Cush” application. Use “EDA” or “Spring Cush” At exterior doors. At Aluminum Storefront provide drop plates, shoe supports, and spacers as required. Install all closers with “TBSRT” thru bolt application. None required on furnace closets.

**Automatic Operators** – (No Substitution)
LCN 4642 AL finish (DKB finish at Aluminum Storefront) with 8310 series hardwired actuators & bollards as required.

**Door Pulls** – (Or Equal Acceptable)
Rockwood BF158 W/ Type 1XHD (3/8” thru bolt) mounting US32D finish (US10B finish at Aluminum Storefront) use at entry doors w/ exit devices.
Integral Flush Pulls at FRP Doors (except Elementary & Early Childhood, use BF158)
Rockwood 111 x 70C US32D finish at other push/pull applications – restrooms etc. with 70E (Doors W/ no lite) or 70C (W/ lite) push plates.
Rockwood 94L US32D finish flush pull
Ives VR910NL & VR910DT US32D finish vandal resistant exit device trim (do not use on elementary or early childhood)

Kickplates – (Or Equal Acceptable)
Rockwood K1050 series US32D finish at wood or hollow metal doors, 2” less than door width X 10” high standard or 30” high at kitchen (provide 3” less than door width at doors with finger guards)

Overhead Stops – (Or Equal Acceptable)
Glynn Johnson 90 series W/ Friction Hold Open at doors where standard wall or floor stop cannot be used.

Door Stops – (Or Equal Acceptable)
Rockwood 406 US32D finish wall mount where possible
Rockwood 442 US26D finish floor mount if required
Rockwood 491S US26D finish floor stop & holder at classroom doors

Magnetic Holders - (Or Equal Acceptable)
Rixson 993 with optional release button (300 lb holding force) controlled by fire alarm system (by others) coordinate

Thresholds - (Or Equal Acceptable)
National Guard 425 saddle typical public access doors
National Guard 883S W/bumper Mech, Elec, etc.

Weather Seal - (Or Equal Acceptable)
Pemko S88D gasketing @ exterior & fire doors, and @ sound doors in addition to heavy surface seals
National Guard 200SA sweep @ doors with saddle threshold (use DKB finish at aluminum storefront), not required @ FRP doors
National Guard 5100S mullion seal @ removable mullions at exterior, fire, and sound doors (use 5100N at doors with bronze finish mullions)
National Guard – 16A overhead drip @ doors with no overhead protection (use DKB finish at aluminum storefront) provide 4” longer than door width

Finger Guards – No Substitution
National Guard 2248A (DKB at Aluminum Storefront) custom length full height at all doors on Early Childhood only

Gasketing -
Utilize screw-on mounting. Adhesive type installation shall not be acceptable. Pemko Manufacturing or Zero International.

2.02 GENERAL REQUIREMENTS FOR DOOR HARDWARE PRODUCTS

A. Provide products that comply with the following:
1. Applicable provisions of Federal, State, and local codes.
5. All Hardware on Fire-Rated Doors: Listed and classified by UL as suitable for the purpose specified and indicated.
6. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

Tulsa Public Schools 087100-4
2.03 KEYING

A. Door Locks: Grand master keyed.
   1. For remodel or limited expansion projects, key to existing keying system as directed by
      Program Manager or Owner.

B. Finishes: Identified in schedule.

B. Keying shall be done by manufacturer prior to shipping to job site.

C. ALL KEYS SHALL HAVE THE ROOM NUMBER and MASTER DESIGNATION STAMPED
   INTO THE KEY.

D. Provide temporary construction master keyed cores (CT6R) for all exterior doors and lock-up
   rooms as required.

E. Provide temporary cores (CT6D) for all other locks.

F. Provide twenty (20) construction keys.

G. Provide permanent 8000 Series cores.

H. Provide complete bitting schedule.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive work and dimensions are as indicated on
   shop drawings.

B. Verify that electric power is available to power operated devices and of the correct
   characteristics.

3.02 INSTALLATION

A. All door hardware is to be installed by the Vendor.

B. Install wood blocking backup for all wall stops and electro-magnetic hold-opens.

C. All closers to be "through bolted" to the doors, whatever the closer element may be. If the arm
   attaches to the door, it is to be "through bolted." If the body of the closer attaches to the door,
   it is to be "through-bolted."

D. Install hardware in accordance with manufacturer's instructions and applicable codes.

E. Use templates provided by hardware item manufacturer.

F. Install hardware on fire-rated doors and frames in accordance with code and NFPA 80.

G. Mounting heights for hardware from finished floor to center line of hardware item: As listed in
   Schedule, unless otherwise noted:

3.03 FIELD QUALITY CONTROL

A. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that
hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified. Installer/AHC is to contact Tulsa Public Schools to be present during installation.

3.04 ADJUSTING  
   A. Adjust work under provisions of Section 017000.  
   B. Adjust hardware for smooth operation.

3.05 PROTECTION OF FINISHED WORK  
   A. Protect finished Work.  
   B. Do not permit adjacent work to damage hardware or finish.

END OF SECTION
SECTION 087150
FINISH HARDWARE SCHEDULE

**Keying Instructions**

Key All Locks To The Existing Corbin Russwin Restricted Keyway System.
Provide Temporary Construction Master Keyed Cores For All Exterior Doors, And Lock-Up Rooms As Required.
Provide Disposable Plastic Temporary Cores For All Other Locks.
Provide Twenty (20) Construction Keys.

Keying shall be performed by manufacturer.

**SET #01**

Doors: 101B, 101C, 103

<table>
<thead>
<tr>
<th>Item</th>
<th>Model/Description</th>
<th>Finish/Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Key Removable Mullion</td>
<td>KR4954</td>
<td>SP313 VO</td>
</tr>
<tr>
<td>2 Exit Device</td>
<td>99EO</td>
<td>313AN VO</td>
</tr>
<tr>
<td>1 IC Rim Cylinder</td>
<td>3080-178-6 CT6R</td>
<td>613 CR</td>
</tr>
<tr>
<td>1 IC Mortise Cylinder</td>
<td>1080-114-6 CT6R</td>
<td>613 CR</td>
</tr>
<tr>
<td>2 IC Core</td>
<td>8000 39 RESTRICTED KEYWAY VKC1</td>
<td>613 CR</td>
</tr>
<tr>
<td>2 Offset Door Pull</td>
<td>BF158 TYPE 1XHD FASTENING</td>
<td>US10B RO</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>653 DW</td>
<td>AL NA</td>
</tr>
<tr>
<td>1 Gasketing</td>
<td>S88 D H&amp;J</td>
<td>PE NA</td>
</tr>
<tr>
<td>1 Mullion Seal</td>
<td>5100N DH</td>
<td>NA</td>
</tr>
</tbody>
</table>

Note: Continuous Hinges & Sweeps By Door Supplier

**SET #02**

Doors: 105, 110, 111, 116, 117, 129, 134, 142A 20 min

<table>
<thead>
<tr>
<th>Item</th>
<th>Model/Description</th>
<th>Finish/Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Continuous Hinge</td>
<td>CFM HD1 DH</td>
<td>PE</td>
</tr>
<tr>
<td>1 Lockset</td>
<td>ML2068 LWA CT6D M19N (SECURE INDICATOR</td>
<td>630 CR</td>
</tr>
<tr>
<td>TURN ON CLASSROOM SIDE)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 IC Core</td>
<td>8000 39 RESTRICTED KEYWAY VKC1</td>
<td>626 CR</td>
</tr>
<tr>
<td>1 Parallel Arm Closer W/ Stop</td>
<td>4040 XP SCUSH TBSRT</td>
<td>AL LC</td>
</tr>
<tr>
<td>1 Protection Plate</td>
<td>K1050 10&quot; x DW-2&quot;</td>
<td>US32D RO</td>
</tr>
<tr>
<td>1 Finger Guard</td>
<td>2248 DKB 82&quot; (CUSTOM LENGTH)</td>
<td>NA01</td>
</tr>
<tr>
<td>1 Gasketing</td>
<td>S88 D H&amp;J</td>
<td>PE</td>
</tr>
</tbody>
</table>

**SET #03**


<table>
<thead>
<tr>
<th>Item</th>
<th>Model/Description</th>
<th>Finish/Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Hinges</td>
<td>BB81 4 1/2 X 4 1/2</td>
<td>US26D PB</td>
</tr>
<tr>
<td>1 Lockset</td>
<td>ML2055 LWA CT6D</td>
<td>630 CR</td>
</tr>
<tr>
<td>1 IC Core</td>
<td>8000 39 RESTRICTED KEYWAY VKC1</td>
<td>626 CR</td>
</tr>
<tr>
<td>1 Wall Bumper</td>
<td>406</td>
<td>US32D RO</td>
</tr>
<tr>
<td>1 Finger Guard</td>
<td>2248 DKB 82&quot; (CUSTOM LENGTH)</td>
<td>NA01</td>
</tr>
<tr>
<td>3 Door Silencers (HM Frame)</td>
<td>SR64</td>
<td>IV</td>
</tr>
</tbody>
</table>
### SET #04


<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Model Number</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Hinges</td>
<td>BB81 4 1/2 X 4 1/2</td>
<td>US26D PB</td>
<td></td>
</tr>
<tr>
<td>1 Lockset</td>
<td>ML2055 LWA CT6D</td>
<td>630 CR</td>
<td></td>
</tr>
<tr>
<td>1 IC Core</td>
<td>8000 39 RESTRICTED KEYWAY VKC1</td>
<td>626 CR</td>
<td></td>
</tr>
<tr>
<td>1 Overhead Door Holder</td>
<td>90F Series</td>
<td>SP28 GL</td>
<td></td>
</tr>
<tr>
<td>3 Door Silencers (HM Frame)</td>
<td>SR64 IV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Finger Guard</td>
<td>2248 DKB 82&quot; (CUSTOM LENGTH)</td>
<td>NA01</td>
<td></td>
</tr>
</tbody>
</table>

### SET #05

Doors: 104A, 104B

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Model Number</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Continuous Hinge</td>
<td>CFM HD1</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>2 FEMA Fire Exit Device</td>
<td>WS 9927L-F x 996L-R &amp; V 03 48&quot;</td>
<td>US26D, US28 VO</td>
<td></td>
</tr>
<tr>
<td>Note: FEMA Exit Devices must be installed on Steelcraft Paladin Doors &amp; Frames</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 IC Core</td>
<td>8000 39 RESTRICTED KEYWAY VKC1</td>
<td>626 CR01</td>
<td></td>
</tr>
<tr>
<td>2 IC Rim Cylinder</td>
<td>3080-178-6 CT6R</td>
<td>626 CR</td>
<td></td>
</tr>
<tr>
<td>2 HD Parallel Arm Closers</td>
<td>4040 XP REG/PA TBSRT</td>
<td>AL LC</td>
<td></td>
</tr>
<tr>
<td>2 Protection Plate</td>
<td>K1050 10&quot; x DW-2&quot;</td>
<td>US32D RO</td>
<td></td>
</tr>
<tr>
<td>2 Mag Holder With Release Button</td>
<td>993 689 RX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Power Supply</td>
<td>PS902 900-FA LO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Gasketing</td>
<td>S88 D H&amp;J PE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Brush Astragal</td>
<td>600 A DH NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NOTE: Magnetic Holders are controlled by Fire Alarm System (by others)......Coordinate</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SET #06

Doors: 141B

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Model Number</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Hinges</td>
<td>BB81 4 1/2 X 4 1/2</td>
<td>US26D PB</td>
<td></td>
</tr>
<tr>
<td>1 Lockset</td>
<td>ML2072 LWA CT6D M19N</td>
<td>630 CR</td>
<td></td>
</tr>
<tr>
<td>2 Parallel Arm Closers</td>
<td>4040 XP REG/PA TBSRT</td>
<td>AL LC</td>
<td></td>
</tr>
<tr>
<td>1 Protection Plate</td>
<td>K1050 10&quot; x DW-2&quot;</td>
<td>US32D RO</td>
<td></td>
</tr>
<tr>
<td>1 Wall Bumper</td>
<td>406</td>
<td>US32D RO</td>
<td></td>
</tr>
<tr>
<td>1 Gasketing</td>
<td>S88 D H&amp;J</td>
<td>PE</td>
<td></td>
</tr>
</tbody>
</table>

### SET #07

Doors: 123, 124, 160, 163

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Model Number</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Hinges</td>
<td>BB81 4 1/2 X 4 1/2</td>
<td>US26D PB01</td>
<td></td>
</tr>
<tr>
<td>1 Lockset</td>
<td>ML2072 LWA CT6D M19N</td>
<td>630 CR</td>
<td></td>
</tr>
<tr>
<td>1 IC Core</td>
<td>8000 39 RESTRICTED KEYWAY VKC1</td>
<td>626 CR01</td>
<td></td>
</tr>
<tr>
<td>1 Parallel Arm Closers With Stop</td>
<td>4040 XP SCUSH TBSRT</td>
<td>AL LC</td>
<td></td>
</tr>
<tr>
<td>1 Gasketing</td>
<td>S88 D H&amp;J</td>
<td>PE</td>
<td></td>
</tr>
</tbody>
</table>

### SET #08

Doors: 126, 127, 128A, 142D

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Model Number</th>
<th>Notes</th>
</tr>
</thead>
</table>
3 Hinges BB81 4 1/2 X 4 1/2 US26D PB
1 Lockset ML2052 LWA CT6D 630 CR
1 IC Core 8000 39 RESTRICTED KEYWAY VKC1 626 CR
1 Regular Arm Closer 4040 XP REG TBSRT AL LC
1 Protection Plate K1050 10” x DW-2” US32D RO
1 Wall Bumper 406 US32D RO
1 Gasketing S88 D H&J PE

SET #09

Door: 121, 122, 146 20 min
3 Hinges BB81 4 1/2 X 4 1/2 US26D PB
1 Privacy Set ML2030 LWA M19V 630 CR
1 Overhead Door Holder 450F Series SP28 GL
1 Gasketing S88 D H&J PE

SET #10

Door: 144, 142C
3 Hinges BB81 4 1/2 X 4 1/2 US26D PB
1 Privacy Set ML2030 LWA M19V 630 CR
1 Overhead Door Holder 450F Series SP28 GL
3 Door Silencers (HM Frame) SR64 IV

SET #11

Door: 142B, 143
3 Hinges BB81 4 1/2 X 4 1/2 US26D PB
1 Lockset ML2052 LWA CT6D 630 CR
1 IC Core 8000 39 RESTRICTED KEYWAY VKC1 626 CR
1 Wall Bumper 406 US32D RO
3 Door Silencers (HM Frame) SR64 IV

SET #12

Door: 141A 20 min
1 Continuous Hinge CFM HD1 PE
1 Lockset ML2042 LWA CT6D 630 CR
1 IC Core 8000 39 RESTRICTED KEYWAY VKC1 626 CR
1 Parallel Arm Closer w/ Stop 4040 XP SCUSH TBSRT AL LC
1 Protection Plate K1050 10” x DW-2” US32D RO
1 Gasketing S88 D H&J PE

SET #13

Door: 140A
2 Continuous Hinge CFM HD1 DH PE
2 Power Transfer EPT 2 SP28 VO
1 Power Supply PS914 900-2RS VO

NOTE: Field Notch Continuous Hinges For Power Transfer

087150 - 3
1 Maintained Pushbutton Switch 623GR AA DP 630 LO
1 Key Removable Mullion KR4954 SP28 VO
1 Electric Exit Device HD-EL 99NL-OP x 110MD-NL US26D, US28 VO
1 Electric Exit Device HD-EL 99EO US28 VO
1 IC Rim Cylinder 3080-178-6 CT6R 626 CR
1 IC Mortise Cylinder 1080-114-6 CT6R 626 CR
2 IC Core 8000 39 RESTRICTED KEYWAY VKC1 626 CR
2 Offset Door Pull BF158 TYPE 1XHD FASTENING US32D RO
2 Parallel Arm Closer W/ Stop 4040 XP SCUSH TBSRT AL LC
2 Protection Plate K1050 10" x DW-2" US32D RO
2 Door Silencers (HM Frame) SR64 IV

OPERATION:
Pushing alternate action pushbutton switch (located at Office 110) holds exit device latches retracted during arrival & departure times. Pushing switch again releases exit device latches to lock doors during school hours. Free egress is provided at all times by manual operation of exit devices. Coordinate with electrical contractor.

SET #14

Door: 140B, 140C

1 Exit Device HD-QEL RX-2 99EO 299 313AN VO
1 Power Transfer EPT 10 SP313 VO

Field Notch Cont. Hinge for Power Transfer

1 Power Supply PS904 900-4RL-FA VO
1 Corner Pad 54 CP NA
1 IC Rim Cylinder 3080-178-6 CT6R 613 CR
1 Mortise Cylinder 1080-114-A02-6-CT6R 613 CR
1 IC Core 8000 39 RESTRICTED KEYWAY VKC1 613 CR
1 Offset Door Pull BF158 TYPE 1XHD FASTENING US10B RO
1 Parallel Arm Closer w/Stop 4040 XP SCUSH 30 Shoe Support DKBRZ LC 4040-18PA 61 Stop Spacer TBSRT
1 1/4" Offset Threshold 653 36" AL NA
1 Gasketing S88 D 17" PE

NOTE: Continuous Hinge & Sweep By Door Supplier

OPERATION:
Card reader (by others) releases electric strike for authorized entry. Free egress is provided at all times by manual operation of exit devices.

SET #15

Door: 149B 90min

3 Hinges 4B81 4 1/2 X 4 1/2 US26D PB
1 3-Point Lock FE6855 LSH CT6D 630 CR
1 IC Core 8000 39 RESTRICTED KEYWAY VKC1 626 CR

087150 - 4
<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>Accurate Lock</td>
</tr>
<tr>
<td>CR</td>
<td>Corbin Russwin (No Substitution)</td>
</tr>
<tr>
<td>GL</td>
<td>Glynn Johnson</td>
</tr>
<tr>
<td>IV</td>
<td>Ives</td>
</tr>
<tr>
<td>LC</td>
<td>LCN Closers (No Substitution)</td>
</tr>
<tr>
<td>LO</td>
<td>Schlage Electronics (No Substitution)</td>
</tr>
<tr>
<td>NA</td>
<td>National Guard</td>
</tr>
<tr>
<td>PB</td>
<td>PBB, INC</td>
</tr>
<tr>
<td>PE</td>
<td>Pemko</td>
</tr>
<tr>
<td>RO</td>
<td>Rockwood</td>
</tr>
<tr>
<td>RX</td>
<td>Rixson</td>
</tr>
<tr>
<td>ST</td>
<td>Stanley</td>
</tr>
<tr>
<td>VO</td>
<td>Von Duprin (No Substitution)</td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 088000
GLASS & GLAZING

PART 1 GENERAL

1.1 SECTION INCLUDES
A. High performance glass

1.2 RELATED SECTIONS
A. Section 081113 – Hollow Metal Doors and Frames
B. Section 081416 – Flush Wood Doors
C. Section 081613 – FRP Flush Doors
D. Section 084000 – Aluminum Entrances and Storefronts

1.3 REFERENCES
B. ASCE 7 - "Minimum Design Loads for Buildings and Other Structures".
C. ASTM International (ASTM):

1.4 DEFINITIONS
A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
B. Glass Thicknesses: Indicated by thickness designations in inches.
C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or other specified gas.
D. Sealed Insulating Glass Unit Surface Designations:
1. Surface 1 - Exterior surface of the outer glass lite.
2. Surface 2 - Interspace surface of the outer glass lite.
3. Surface 3 - Interspace surface of the inner glass lite.
4. Surface 4 - Interior surface of the inner glass lite.

1.5 PERFORMANCE REQUIREMENTS
A. General: Provide glass capable of withstanding thermal movement and wind and
impact loads (where applicable) as specified in paragraph B following.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
   1) Design loads shall be in accordance with IBC, 2015 edition.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from ambient and surface temperatures changes acting on glass framing members and glazing components.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer’s published test data, as determined according to procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 1/4 inch (6.0 mm) thick.
2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
3. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
   a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. per h per degree F.

1.6 SUBMITTALS

A. Submit under provisions of Section 013000.

B. Product Data: For each glass product and glazing material indicated.

C. Verification Samples: For the following products, in the form of 12 inch (305 mm) square samples for insulating glass units.

D. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

E. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

F. Qualification Data: For installers.

G. Product Test Reports: For each type of glazing.

H. Warranties: Special warranties specified in this Section.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has
resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: clear float glass, coated float glass and insulating glass.

C. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Glazing Publications: Comply with published recommendations of glass product manufacturers and industry organizations, including but not limited to those below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

E. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:
   1. Insulating Glass Certification Council.
   2. Associated Laboratories, Inc.

F. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, for wired glass, ANSI Z97.1.
   1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
   2. Lites more than 9 square feet (sf) (0.84 sq. m) in area are required to be Category II materials.
   3. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sf in area, provide glazing products that comply with Category II materials, and for lites 9 sf or less in area, provide glazing products that comply with Category I or II materials.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.9 WARRANTY

A. Manufacturer's Warranty for Coated-Glass Products: Manufacturer's standard form, made out to the glass fabricator in which the coated glass manufacturer agrees to replace coated glass units that deteriorates during normal use within the specified warranty period. Deterioration of the coated glass is defined as peeling and/or cracking, or discoloration that is not attributed to glass breakage, seal failure,
improper installation, or cleaning and maintenance that is contrary to the manufacturer’s written instructions.

1. Warranty Period: Ten years from date of Substantial Completion.

B. Manufacturer’s Warranty on Insulating Glass: Manufacturer’s standard form in which the insulating glass unit manufacturer agrees to replace insulating-glass units that deteriorate during normal use within the specified warranty period. Deterioration of insulating glass units is defined as an obstruction of vision by dust, moisture, or a film on the interior surfaces of the glass caused by a failure of the hermetic seal that is not attributed to glass breakage, improper installation, or cleaning and maintenance that is contrary to the manufacturer’s written instructions.

1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer:

PPG Industries, Inc., Glass Group
Glass Business and Discovery Center 400 Guys Run Rd.
Pittsburgh, PA 15024
Tel: 800-377-5267
www.ppgideascapes.com

B. Other manufacturers meeting or exceeding these specifications.

2.2 GLASS PRODUCTS

A. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.

2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.

3. For uncoated glass, comply with requirements for Condition A.

4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).

5. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated or required.

C. Pyrolitic-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide coating applied by pyrolitic deposition process during initial manufacture, and complying with other requirements specified.

D. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 “Performance Requirements” Article.
2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated or required.
3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
4. Sealing System: Dual seal, with primary and secondary sealants of polyisobutylene and silicone.
5. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
   a. Spacer Material: Aluminum with finish to match window system framing color.
   b. Desiccant: Molecular sieve or silica gel, or blend of both.
   c. Corner Construction: Manufacturer's standard corner construction.

2.3 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

2.4 GLASS MATERIALS

A. Glass materials shall be as scheduled on drawings.
B. Basis-of-Design cut-sheets are included at the end of this Section

PART 3 EXECUTION

3.1 INSTALLATION

A. Install units in accordance with approved Shop Drawings, plumb, level, square and free from warp or twist while maintaining dimensional tolerances and alignment with surrounding surfaces.
B. Provide glazing compounds and accessories as required.
C. Contractor's beginning of work shall signify acceptance of substrate. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.2 PROTECTION AND CLEANING

A. Mark panes with removable tape after installation.
B. Prior to final acceptance, clean as recommended by manufacturer. Do not use materials or methods which may damage finish or surrounding construction.
PRODUCT ADVANTAGES

- Most economical fire and safety rated glazing available.
- Provides superior optical clarity over ceramics.
- Meets the highest human impact safety requirements.
- Can be used for interior and exterior applications.
- Available in specialty architectural make-ups.
- Lifetime manufacturer’s warranty.
- USA manufactured for fast delivery and competitive pricing.

SuperLite I is listed and labeled by Intertek and Underwriters Laboratories, nationally recognized testing laboratories approved by OSHA.

Now available with Starphire® Ultra-Clear Glass by PPG

20 MINUTE APPLICATIONS

<table>
<thead>
<tr>
<th>Application</th>
<th>Max. CV Area</th>
<th>Max. CV Width</th>
<th>Max. CV Height</th>
<th>Stops</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel Door</td>
<td>3,341 in.²</td>
<td>35-1/8 in.</td>
<td>95-1/8 in.</td>
<td>5/8 in.</td>
</tr>
<tr>
<td>Wood Door</td>
<td>3,299 in.²</td>
<td>36-1/8 in.</td>
<td>91-1/16 in.</td>
<td>5/8 in.</td>
</tr>
<tr>
<td>Aluminum Door</td>
<td>3,436 in.²</td>
<td>36-3/4 in.</td>
<td>95-1/2 in.</td>
<td>5/8 in.</td>
</tr>
<tr>
<td>Steel, Wood and Aluminum Sidelites*</td>
<td>5,760 in.²</td>
<td>96 in.</td>
<td>95-1/2 in.</td>
<td>5/8 in.</td>
</tr>
<tr>
<td>Steel Windows*</td>
<td>5,760 in.²</td>
<td>96 in.</td>
<td>95-1/2 in.</td>
<td>5/8 in.</td>
</tr>
</tbody>
</table>

* Requires AHJ approval for these applications because it is tested without hose stream

UL AND INTERTEK TESTED AND CERTIFIED

SuperLite I is listed and labeled by Intertek and Underwriters Laboratories, nationally recognized testing laboratories approved by OSHA.

FIRE PROTECTIVE

Contains smoke and flames. Does not block radiant heat.

For fire resistive glazing that blocks radiant heat see SuperLite II-XL.

SPECIFICATIONS

- Thickness: 1/4 in. (6 mm)
- Weight: 3.0 lbs./sq.ft. (15 kg/m²)
- Fire Rating: 20 minutes without hose stream
- Sound Transmission Rating: STC 28
- Solar Heat Gain Coefficient: 0.82 SHGC
- Impact Safety Rating: CPSC 16 CFR 1201 Cat. I and II

3-Part Specifications: Available at www.safti.com/specifications

APPROVALS

UL 9, UL 10B, UL 10C, NFPA 80, NFPA 252, NFPA 257, ASTM E152, ASTM E163, ASTM E2074, ASTM E2010-01, CPSC 16 CFR 1201 Cat. II., ANSI Z97.1

Made in the USA

Rain Narrow Reed P-516 Satin Etched

www.safti.com

888.653.3333
The architect used SuperLite I for the 20 minute door vision panels and SuperLite II-XL 45 for the sidelites to create a cost-effective, wire-free solution that meets all the fire and safety requirements for this fire protective application.

Project: Sunset Elementary School in San Ysidro, CA
Architect: Coup Smith Diaz Architects
Contract Glazier: Plaza Glass Company
Products Used: SuperLite I in GPX Builders Series Fire Protective Door and SuperLite II-XL 45 in GPX Builders Series Fire Protective Framing

TYPICAL DETAILS

SuperLite I in vision kit and GPX Builders Series Fire Protective Door and SuperLite II-XL 45 in GPX Builders Series Fire Protective Transom

Scale 3" = 1"
PRODUCT ADVANTAGES

- Most economical fire and safety rated glazing meeting all the standards for 45/60/90 minute doors.
- Non-wired and tint-free clear glazing providing the highest visual clarity.
- Impact safety rated to meet federal and code standards.
- Can be used for interior and exterior applications.
- USA manufactured for fast delivery and competitive pricing.

TESTED AND CERTIFIED TO UL 10B AND 10C

SuperLite X-45/60/90 is listed and labeled by Intertek, a nationally recognized testing laboratory approved by OSHA.

SPECIFICATIONS

- **Thickness**: 3/4 in. (19 mm)
- **Weight**: 9.0 lbs./sq.ft. (44 kg/m²)
- **Fire Rating**: 45/60/90 minutes with hose stream
- **Sound Transmission Rating**: Approx. STC 38
- **Solar Heat Gain Coefficient**: 0.67 SHGC
- **Impact Safety Rating**: CPSC 16 CFR 1201 Cat. I and II

APPROVALS

- UL 10B, UL 10C, NFPA 80, NFPA 252, ULC CAN4-S104, CPSC 16 CFR 1201 Cat. I & II, ANSI Z97.1

3-Part Specifications:
Available at
www.safti.com/specifications

Made in the USA

SuperLite X-45/60/90 vision kit in a 90 minute temperature rise door
SuperLite X-45/60/90 in GPX Builders Series Temperature Rise Door and SuperLite II-XL 120 in GPX Architectural Series Transoms

90 MINUTE RATED
SUPERLITE X-45/60/90
FIRE PROTECTIVE

120 MINUTE RATED
SUPERLITE II-XL
FIRE RESISTIVE

END OF SECTION
SECTION 088100

HEAVY VANDAL RESISTANT SECURITY SCREENS

PART 1   GENERAL

1.01    WORK INCLUDED

A. Product engineering and fabrication techniques, shop drawings, structural calculations
   and Professional Engineering approval stamps for large missile impact tested window
   and door screen barriers designed for exterior wall applications in accordance with local
   codes.

B. Fabrication and installation of heavy vandal protection screen system.

C. Finish of heavy vandal resistant screen barrier assembly and accompanied metals.

1.02    RELATED WORK

A. Section 081113 – Hollow Metal Doors and Frames

B. Section 084113 – Entrances and Storefronts

C. Section 088000 – Glass & Glazing

1.03    REFERENCES

A. SMA-6001-185  (A HUD requirement)

1.04    QUALITY ASSURANCE

A. Obtain heavy vandal resistant screens for the entire project form one source and from a
   single manufacturer.

1.05    SUBMITTALS

A. Shop Drawings

   1. Submit scaled shop drawings including all conditions of construction, location
      diagrams including identification of and spacing of anchorage, framing members
      inclusive of any installer notations.

B. Product Data

   1. Submit manufacturer’s product literature and specifications describing screen barrier
      units including hardware, finishes and accessories.

C. Samples

   1. Submit (1) sample of each finish and color to be used.

D. Warranties
1. Provide manufacturers warranty in accordance with the contract documents.
2. Provide installation warranty in accordance with the contract documents.

1.06 WARRANTY

A. Stating that window screen barriers for above project will be free from defects and workmanship for a period of one (1) year from date of substantial completion.

B. The contractor shall assume responsibility for the handling, installation and integrity of the application for a period of one (1) year from date of substantial completion.

C. Standard warranty is one (1) year in workmanship and Materials from the date of purchase.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Olney Sales Inc.
   Melvin (Danny) Greenhaw, President
   1019 West Main  P.O. Box #176
   Olney, Texas 76374
   1-800-658-2689; 1-800-687-3147; 1-940-564-3592
   1-940-564-3594 fax

2.02 EXTRUSIONS

A. All extrusions shall be made from 6063 T5 aluminum.

2.03 SCREEN FRAME:

A. The screen frame shall be an ‘L’ shape which is miter cut.

B. A groove at the back of the small leg to accept either vinyl or felt weather stripping

C. It shall have raised ridges on the surface where the wire lies to help in securing the wire tightly to the frame.

D. The dimensions shall be 1.118” x .996” x .050 typical walls.

2.04 COVER PLATE

A. The cover plate is used to secure the wire to the screen frame.

B. It shall have raised ridges to accomplish that task.

C. A channel on each side to accept a vinyl stripping which serves to hide the screws from view.

D. The cover plate dimensions are to be .830” x .167” x .062 typical wall.
2.05 CENTER BAR
   A. The center bar is a rectangular shape with raise ridges on the surface for securing the wire.
   B. The dimensions are 1.00” x .50” x .050 typical wall.

2.06 LATCH
   A. Slide bolts are used to latch the screen to the existing window.
   B. Shall be made completely of stainless steel parts including the body, slide pin, spring, and 'C' clip.

2.07 LATCH GUARD
   A. The barrel bolt latches are protected from outside access by a modified cover plate that is elongated on one side to completely cover the latch.
   B. The dimensions are 6” long x 2 3/4” tall x .062 typical wall.

2.08 HINGE
   A. The standard hinge is a continuous piano hinge which is made of 40 gauge aluminum.

2.09 WIRE
   A. Stainless steel wire is standard in all screens.
   B. It shall be .023 gauge and is 12 X 12 mesh.

PART 3 EXECUTION

3.01 INSTALLATION
   A. After verification of field conditions and properly prepared openings, install screen system in strict accordance with approved submittal drawing and in agreement with product approval.
   B. Install true and plumb without warping or racking.

3.02 CLEANING AND PROTECTION
   A. Clean metal surfaces of barrier assemblies promptly after installation, exercising care to avoid damage to finishes of new and existing surfaces.
   B. Care should be taken to so as to maintain separation between dissimilar metals at point of application.
   C. Remove all protective coverings and dispose of all rubbish and surplus materials resulting from work of this section.

END OF SECTION
SECTION 092116

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Gypsum board and accessories.
B. Non-structural metal studs for wall assemblies.

1.2 RELATED SECTIONS

A. Section 054000 - Cold-Formed Metal Framing.
B. Section 061000 - Rough Carpentry.

1.3 REFERENCES

A. ASTM International (ASTM):
1. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
14. ASTM C 1002 - Standard Specification for Steel Self Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
21. ASTM C 1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.
24. ASTM E 413 - Classification for Rating Sound Insulation.

B. AISI North American Specification for the Design of Cold-Formed Steel Structural Members.

C. AISI - Standard for Cold-Formed Steel Framing General Provisions.

D. Gypsum Association (GA):
   1. GA-214 - Recommended Levels of Gypsum Board Finish.


1.4 SUBMITTALS

A. Submit under provisions of Section 013000 - Administrative Requirements.

B. Submit manufacturer's certification of product compliance with codes and standards along with product literature and data sheets for specified products. Electronic submittals generated via ClarkDietrich website and submitted electronically are acceptable.

C. Evaluation Reports: Submit evaluation reports certified under an independent third party inspection program administered by an agency accredited by IAS to ICC-ES AC98, IAS Accreditation Criteria for Inspection Agencies.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.

B. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, and manufacturer's installation instructions.

C. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-structural steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by, and displaying a classification label, from an independent testing agency acceptable to authority having jurisdiction. Products used in the assembly shall carry a classification label from a testing laboratory acceptable to authority having jurisdiction.
   1. Construct fire-resistance-rated partitions in compliance with tested assembly requirements indicated on the Drawings.
   2. Rated assemblies to be substantiated from applicable testing using the proposed products, by Contractor.
D. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect and store products in manufacturer’s unopened packaging until ready for installation per requirements of AISI’s “Code of Standard Practice”.

B. Deliver and store gypsum board in accordance with GA-238.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended ASTM C 840 and by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer’s absolute limits.

PART 2 PRODUCTS

2.1 METAL FRAMING MANUFACTURERS

A. Acceptable Manufacturer, Metal Framing:
   1. ClarkDietrich Building Systems
      4200 Cedar Blvd.
      Baytown, TX 77520
      Tel: (281) 383-1617.

B. Acceptable Manufacturers, Gypsum Board
   1. G-P Gypsum Corp.
   2. National Gypsum Co.
   3. United States Gypsum Co.

C. Substitutions: Other manufacturers that meet or exceed these specifications

D. Requests for substitutions will be considered in accordance with provisions of Section 016000 - Product Requirements.

2.2 METAL FRAMING COMPONENTS

A. Recycled Content of Steel Products: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

B. Framing Members, General: Comply with ASTM C 645 for conditions indicated.
   1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
   2. Protective Coating: Comply with ASTM C 645; roll-formed from hot-dipped galvanized steel, complying with ASTM A 653/A653M G40 (Z120) or having a coating that provides equivalent corrosion resistance. A40 galvannealed products are not acceptable.
      a. Coatings shall demonstrate equivalent corrosion resistance with an evaluation report acceptable to the authority having jurisdiction.

C. Steel Studs and Runners: ASTM C 645.
   1. Non-Structural Studs: Cold-formed galvanized steel C-studs as per ASTM C
645 for conditions indicated below:
   a. Flange Size: 1-1/4 inch (32 mm).
   b. Web Depth: As specified on Drawings.
2. Non-Structural Track: Cold-formed galvanized steel runner tracks, in conformance with ASTM C 645 for conditions indicated below:
   a. Flange Size: 1-1/4 inch (32 mm).
   b. Web Depth: Track web to match stud web size.
   c. Minimum Material Thickness: Track thickness to match wall stud thickness or as per design.

D. Slotted Deflection Track: Cold-formed galvanized steel in conformance with AISI's Specifications for Design of Cold-Formed Steel Members.
   1. Designation and size as indicated on the drawings.

E. Control Joint Backer: Metal profile which supports intumescent materials located inside and spanning gap between opposing drywall edge at control joint locations.

F. Furring Channel: Cold-formed galvanized steel in conformance with AISI's North American Specifications for Design of Cold-Formed Steel Structural Members; furring channel:
   1. Designation and size as indicated on the drawings.

G. U Channel: Cold-formed galvanized steel:
   1. Designation and size as indicated on the drawings.

H. H Studs and C-Runner: Cold-formed galvanized steel, approved for the use intended:
   1. Designation and size as indicated on the drawings.

I. CT Shaftwall Studs and J-Tabbed Track: Cold-formed galvanized steel, approved for the use intended based on a current Evaluation Report
   1. Designation and size as indicated on the drawings.

J. Metal Trims: Cold-formed galvanized steel.
   1. Type and Size as indicated on the drawings.

K. Drywall Corner Bead: Cold-formed galvanized steel sheet.
   1. Type: 103 Deluxe.
   2. Flange Length: 1-1/4 inches (32 mm).

L. Flat Straps: Sheet for blocking and bracing in length and width indicated.
   1. Galvanized Sheet Steel:
      a. Minimum Base-Steel Thickness: As indicated on Drawings.

M. Channel Bridging and Bracing:
   a. Depth: As indicated on Drawings.

N. Radius Framing: Steel sheet runner for non-load-bearing curves, bends, variable radii and arches using expandable ribbon technology.
   1. Size: As indicated on Drawings.

O. Framing Component Accessories: Provide the following accessories as required for a complete system.
   2. Angles.

P. Fasteners: Self-drilling, self-tapping screws; steel, complying with ASTM C 1513;
galvanized coating, plated or oil-phosphate coated complying with ASTM B 633 as needed for required corrosion resistance.


R. Non-Hardening, Flexible Sealant: Latex acrylic.

S. Framing: Framing components may be preassembled into panels prior to erecting.
   1. Fabricate panels square, with components attached in a manner so as to prevent racking or distortion.
   2. Cut all framing components squarely for attachment to perpendicular members, or as required for an angular fit against abutting members. Hold members positively in place until properly fastened.

2.3 GYPSUM BOARD AND ACCESSORIES

A. Gypsum Wallboard: ASTM C 1396, of types, edge configuration and thickness indicated below; in maximum lengths available to minimize end-to-end butt joints.
   1. Type: Regular, unless otherwise indicated. Type X for fire-resistant rated assemblies and where indicated. Sag-resistant type for ceiling surfaces.
   2. Edges: Tapered.
   3. Thickness: 5/8 inch (16 mm), unless otherwise indicated.

B. Gypsum Backing Board for Multi-Layer Applications: ASTM C 1396 or, where backing board is not available from manufacturer, gypsum wallboard, ASTM C 1396, of type, edge configuration and thickness indicated below, in maximum lengths available to minimize end-to-end joints.
   1. Type: Regular, unless otherwise indicated. Type X for fire-resistant rated assemblies and where indicated. Sag-resistant type for ceiling surfaces.
   2. Edges: Square, non-tapered, or V-tongue and groove.
   3. Thickness: 5/8 inch (16 mm), unless otherwise indicated.

C. Abuse-Resistant Gypsum Wallboard: ASTM C 1278 and ASTM C 1396, of types, edge configuration and thickness indicated below without paper facing and with fiber mesh reinforced backing; in maximum lengths available to minimize end-to-end butt joints.
   1. Type: Regular, unless otherwise indicated.
   2. Thickness: 5/8 inch (16 mm), unless otherwise indicated.
   3. Manufacturer: USG "Fiberock VHI Abuse-Resistant Gypsum Fiber Interior Panels".

D. Mold and Mildew Resistant Gypsum Board: ASTM C 1396, of type and thickness indicated below to resist mold and mildew; in maximum lengths available to minimize end-to-end butt joints. Board shall score minimum 10 when tested per ASTM D 3273.
   1. Type and Thickness: Regular, 1/2 inch (12 mm) thick, unless otherwise indicated. Type X, 5/8 inch thick, for fire-resistant rated assemblies and where indicated.
   2. Manufacturer: G-P Gypsum Corporation "DensArmor Plus" / "DensArmor Plus Fireguard" or LaFarge "Drywall with Mold Defense".

E. Mold and Mildew Resistant Backing Board: ASTM C 1177/ASTM C 1396, of type and thickness indicated below with glass mat facing embedded on both sides to resist mold and mildew; in maximum lengths available to minimize end-to-end butt
joints.
1. Type and Thickness: Regular, 1/2 inch (12 mm) thick, unless otherwise indicated. Type X, 5/8 inch thick, for fire-resistant rated assemblies and where indicated.
2. Manufacturer: G-P Gypsum Corporation "DensArmor Plus".

F. Water-Resistant Backing Board: ASTM C 1396, with tapered edges and of type and thickness indicated below; in maximum lengths available to minimize end-to-end butt joints.
1. Types: Regular, unless otherwise indicated. Type X for fire-resistant rated assemblies and where indicated.
2. Thickness: 5/8 inch (12 mm), unless otherwise indicated.

G. Water-Resistant Backing Board: ASTM C 1178, of type and thickness indicated below with glass mat facing on both sides and acrylic coating on one side; in maximum lengths available to minimize end-to-end butt joints.
1. Type and Thickness: Regular, 5/8-inch thick, unless otherwise indicated. Type X, 5/8 inch (16 mm) thick, for fire-resistant rated assemblies and where indicated.
2. Manufacturer: G-P Gypsum Corporation "Dens-Shield Tile Guard".

H. Gypsum Shaftliner Board, Type X: ASTM C 1396 manufacturer's proprietary fire-resistant liner panels with paper faces.

I. Gypsum Shaftliner Board, Moisture- and Mold-Resistant Type X: ASTM C 1396, manufacturer's proprietary fire-resistant liner panels with moisture- and mold-resistant core and surfaces.

J. Exterior Soffit Board: ASTM C 1396, with manufacturer's standard edges, of type and thickness indicated.
1. Types: Regular unless otherwise indicated. Type X for fire-resistant rated assemblies and where indicated.
2. Thickness: 5/8 inch (16 mm), unless otherwise indicated.

K. Trim Accessories: Provide manufacturer's standard plastic or metal trim accessories for gypsum board work, per ASTM C 1047. Provide with either knurled or perforated expanded flanges for nailing or stapling, and beaded for concealment of flanges, in joint compound. Provide corner beads, L-type edge trim-beads, U-type edge trim-beads, special L-kerf-type edge trim-beads, and one-piece control joint beads.

L. Interior Trim Accessories: Provide corner beads, L-type edge trim-beads, U-type edge trim-beads, special L-kerf-type edge trim-beads, and one-piece control joint beads complying with the following requirements:
1. Materials: Formed metal complying with one of the following requirements:
   a. Sheet Steel zinc coated by the hot-dip process.

M. Exterior Surface Trim and Accessories: Cornerbead, edge trim, control joints formed from sheet steel zinc coated by the hot dip process per ASTM C 1047, or plastic conforming to ASTM C 1047 Section 4.3 plastic for accessories shall be manufactured from rigid PVC or ABS Plastic not less than 0.028 inch (0.7112 mm) and Section 4.3.1 PVC specification D 3678 Class II or III, in shapes indicated below by reference to ASTM C1047.
1. Cornerbead on outside corners, unless otherwise indicated.
2. Edge trim complying with shape LC-bead.
3. One piece control joint formed with V-shaped slot and removable strip covering slot opening.
N. Soffit Vents: Prefabricated extruded aluminum, with clear anodized finish or vinyl soffit vent.
   1. Manufacturer: Vinyl Corp "No. CSJ50-200V".

O. Laminating Adhesive: Special adhesive or joint compound specifically recommended for laminating gypsum boards.

P. Spot Grout: ASTM C 475, setting-type joint compound for type recommended for spot grouting hollow metal door frames.

Q. Gypsum Board Screws: ASTM C 1513. Fastening gypsum board to steel members less than 0.033 inch thick. Fastening gypsum board to gypsum board.

R. Steel Drill Screws: ASTM C 1513, for fastening gypsum board to steel members.

S. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing), unfaced mineral fiber blanket insulation in thicknesses shown. Fibers manufactured from glass, slag wool, or rock wool.

2.4 JOINT TREATMENT AND ACCESSORIES

A. Joint Treatment Materials: ASTM C 475; type recommended by manufacturer of sheet products and joint treatment materials for application indicated, unless indicated otherwise.

B. Joint Tape:
   1. Interior Gypsum Board: Paper reinforcing tape.
   3. Mold and Mildew Resistant Backer Board: Glass mesh tape.

C. Setting Type Joint Compound: Factory prepackaged, job mixed chemical-hardening powder products for bedding and filling, formulated for uses indicated.
   1. For taping and filling only.
   2. For prefilling gypsum board joints.
   3. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile.
   4. For filling joints and treating fasteners of mold and mildew resistant backing board behind base for ceramic tile.
   5. For filling joints and treating fasteners of gypsum base for veneer plaster.
   6. For topping compound, use sandable formulation.

D. Drying-Type Joint Compounds: Factory prepackaged vinyl-based products complying with the following requirements for formulation and intended use.
   2. All-purpose compound formulated for use as both taping and topping compound; use for finish (third) coat only.

E. Exterior Joint Compound: Special chemical-hardening-type for exterior application.

F. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer’s standard non-sag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following requirements.
PART 3 EXECUTION

3.1 EXAMINATION

A. Prior to installation, inspect previous work of all other trades. Verify that all work is complete and accurate to the point where this installation may properly proceed in strict accordance with framing shop drawings.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 METAL FRAMING INSTALLATION

A. Install cold-formed framing in accordance with requirements of ASTM C 754.

B. Framing Installation:
   1. Erect framing and panels plumb, level and square in strict accordance with approved drawings.
   2. Handle and lift prefabricated panels in a manner to not cause distortion in any member.
   3. Anchor runner track securely to the supporting structure. Install concrete anchors only after full compressive strength has been achieved.
   4. Butt all track joints. Securely anchor abutting pieces of track to a common structural element, or splice them together.
   5. Align and plumb studs, and securely attach to the flanges or webs of both upper and lower tracks.
   6. Attach wall stud bridging when required in a manner to prevent stud rotation. Space bridging rows according to manufacturer's recommendations.
   7. Provided temporary bracing until erection is completed.
   8. Where indicated in the drawings, provide for structural vertical movement using means in accordance with manufacturer's recommendations.
   9. Blocking: Install blocking for support of anything and everything mounted to the walls. All wood blocking shall be fire-retardent.

C. Shaftwall Framing Installation:
   1. Lay out as shown in construction drawings. Secure J-Tabbed Track at perimeter framing and plumb to ceiling, floor and sides. Attach with suitable fasteners, spaced not more than 24 inches (610 mm) o.c. Apply a bead of non-hardening, flexible sealant to the perimeter.
   2. Preplan the stud layout 24 inches (610 mm) o.c. and adjust the spacing at either end so the end studs will not fall closer than 12 inches (305 mm) from the end.
   3. Erect the first 1-inch (25.4 mm) shaft wall liner panel, cut 3/4 inch (19 mm) less than the total height of the framed section. Plumb the panel against the web of the J-Tabbed Track and bend out tabs in J-Tabbed Track to secure panels in place. If tabs are not used, screw the liner panel to the J-Tabbed Track.
   4. Insert CT Shaftwall Stud, cut 3/4 inch (19 mm) less than the overall height, into the top and bottom J-Tabbed Tracks and fit tightly over the previously installed 1 inch (25.4 mm) panel. Allow equal clearance between top and bottom J-Tabbed Track.
   5. Install the next 1-inch (25.4 mm) shaft wall liner panel inside the J-Tabbed Tracks and within the tabs of the CT Shaftwall stud.
   6. Progressively install succeeding studs and panels as described above until the wall section is enclosed. The final panel section may be secured with tabs from the J-Tabbed Track at 12 inches (305 mm) o.c.
   7. Where wall heights exceed the standard or available length of shaft wall liner
panels, the gypsum panels may be cut and stacked with joints occurring within the top or bottom third points of the wall. Joints of adjacent panels should be alternately staggered to prevent a continuous horizontal joint. Any butt joints must be factory edge to factory edge with pieces pushed tightly together. Gypsum panels must engage a minimum of 2 tabs of the CT Shaftwall Stud.

8. CT Shaftwall Studs cannot be spliced. They must be installed full height, one piece. J-Tabbed Track when not attached of the structure shall not be spliced.

9. Do not attach J-Tabbed Track to the CT Shaftwall Studs.

10. For doors, ducts or other large penetrations or openings, install J-Tabbed Track as perimeter framing. Use 20 gauge, 0.0329 inches (0.83 mm) track with a 3 inches (76 mm) back leg for elevator doors and block cavity with 12 inches (305 mm) wide gypsum filler strips for doors exceeding 7-foot (2 m) height.

3.3 GYPSUM BOARD INSTALLATION

A. Gypsum Board:
2. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 24 inches (610 mm) in alternate courses of board.
3. Install ceiling boards across framing in the manner which minimizes the number of end-butt joints, and which will avoid end joints in the central area of each ceiling. Stagger end joints a minimum of 24 inches (610 mm).
4. Install wall and partition boards vertically unless otherwise noted.
5. Install exposed gypsum board with face side out. Do not install imperfect, damaged, or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) open space between boards.
6. Locate either edge or end joints over supports, except in horizontal applications or where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges, and mill-cut or field-cut ends against mill-cut or field-cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.
7. Attach gypsum board to steel studs so that leading edge or end of each board is attached to open (unsupported) edge of stud flange first.
8. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cut-outs.
9. Form control joints and expansion joints at locations indicated on Drawings, and as recommended by Gypsum Association, with space between edges of boards prepared to receive trim accessories.
10. Cover both faces of steel stud partition framing with gypsum board in concealed spaces except in chase walls that are properly braced internally.
11. Fit gypsum board around ducts, pipes, and conduits.
12. Where partitions intersect open concrete coffers, cut gypsum board to fit profile of coffers and allow 1/4 to 1/2 inch (6 mm to 13 mm) wide joint for sealant.
13. Isolate perimeter of non-load bearing drywall partitions at structural abutments. Provide 1/4 to 1/2 inch (6 mm to 13 mm) space and trim edge with "U" bead edge trim. Seal joints with acoustical sealant. See also 07910.
14. Where sound-rated drywall construction is indicated on Drawings, seal construction at perimeters, control and expansion joints, openings, and penetrations with a continuous bead of acoustical sealant including a bead at both faces of partitions. Comply with ASTM C 919 and manufacturer's
recommendations for location of edge trim, and close off sound-flanking paths around or through construction, including sealing of partitions above acoustical ceilings.

15. Space fasteners in gypsum boards per referenced gypsum board application and finishing standard and manufacturer's recommendations.

B. Accessories:
   1. Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges to comply with manufacturer’s recommendations.
   2. Install metal corner beads at external corners.
   3. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed, except where plastic trim is indicated on Drawings. Provide type with face flange to receive joint compound except where "U" bead (semi-finishing type) is indicated.
   4. Install gypsum board reveals where indicated on Drawings.
   5. Install control joints at locations indicated on Drawings, or if not indicated, at no more than 30 feet apart on walls and ceilings over 50 feet long. At exterior soffits, not more than 30 feet apart in both directions.

C. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch (1.5 mm) in 10 feet (3048 mm) in any direction.

D. Joint Treatment: Comply with ASTM C 840, GA 214 and GA 216.
   1. Level 1: Plenums, service corridors; above ceilings
   2. Level 2: Areas of water resistant gypsum backing board under tile; exposed areas where appearance is not critical.
   3. Level 3: Areas to receive heavy or medium textured coatings; heavy-grade wall coverings.
   4. Level 4: Areas to receive flat sheen paint finish; light textured coatings; lightweight wall coverings.
   5. Level 5: Areas to receive gloss, semi-gloss sheen paints; critical lighting conditions.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION
SECTION 093013
PORCELAIN / CERAMIC / QUARRY TILE

PART 1  GENERAL

1.01  SUMMARY
A. Section Includes:
   1. Tile
B. Reference Standards:
   1. ANSI A108.5 – Porcelain Tile installed in Dry-Set Portland
      Portland_Cement Mortar or Latex P. C. Mortar.
   2. TCA 137.1 – Recommended Standard Specifications for Porcelain Tile.

1.02  SAMPLES
A. Submit sample panel of each type, color, and pattern of tile required. Provide full
   size samples for each type of trim and accessory.
B. Submit sample of grout.

1.03  ENVIRONMENTAL CONDITIONS
A. Provide sufficient heat and ventilation in areas where work of this Section is
   being preformed to allow tile to set properly. Take precautionary measures
   necessary to ensure that excessive temperature changes do not occur. Maintain
   installation area at 50 F or above.

PART 2  PRODUCTS

2.01  MANUFACTURERS
A. Tile: Dal-Tile, American Olean, or Equivalent
B. Grout: Hydroment - dry tile grout fortified with 425 multi-purpose acrylic latex
   Admixture.
C. Substitutions: In accordance with Section 016000

2.02  MATERIALS
A. Wall Tile: Sizes as indicated. Trim pieces as needed: inside corners coved,
   outside corners bull nosed.
B. See drawings for specific products.

2.03  COMPONENTS
A. Setting Bed and Bond Coat: Thinset consisting of Ultra or Multi-Flex Latex-
   Portland cement mortar.
B. Leveling Coat: Cementitious mortar with latex additive for water resistance.
C. **Grout:** Unsanded type with Acrylic Latex Grout Additive; color selected by Architect.

D. **Water:** Clean, fresh and free of deleterious substances.

### 2.04 MIXING

A. Mix and proportion cementitious materials for site made leveling coats, bond coats, and grout as recommended by the TCA Handbook for Porcelain Tile Installation.

B. Mix and proportion pre-mix setting bed, bond coat, and grout materials in accordance with manufacturers' recommendations.

### PART 3 EXECUTION

#### 3.01 INSPECTION

A. Examine surfaces to receive tile. Ensure surfaces are level, with maximum surface variation of ¼-inch in 10-feet, clean and well cured. Do not commence until surface conditions are within tolerances required for proper installation.

B. Prior to installing floor tile ensure surfaces slope to drains. Where ceramic tile meets thicker material apply leveling coat to make finished surfaces match, extend transition 4-feet.

#### 3.02 INSTALLATION

A. **Installation Standards:**
   1. Install wall tile in accordance with Tile Council of America Method #W243 and #W202.

B. Place tile in accordance with pattern indicated. Carefully plan tile layouts. Ensure pattern is uninterrupted from one wall and/or floor surface to the next.

C. Neatly cut tile around fixtures. Accurately form corners, base, intersections and returns.

D. Ensure tile joints are uniform in width, subject to normal variance in tolerance allowed in tile size. Ensure joints are watertight, without voids, cracks, excess mortar or grout.

E. Install coved internal wall angles and bull nosed external angles.

F. Sound tile after setting. Remove and replace hollow sounding units.

G. Keep expansion/contraction joints free of mortar or grout

H. Allow tile to set for a minimum of 48 hours prior to grouting.

I. Completed installation to be free of broken, damaged and faulty tile.

#### 3.03 EXTRA STOCK

A. Deliver to Owner 5 square feet of each tile and color used; include with closeout submittals.

**END OF SECTION**
SECTION 095113
SUSPENDED ACOUSTICAL CEILINGS

PART 1  GENERAL

1.01 SECTION INCLUDES
A. Suspended metal grid ceiling system.
B. Acoustical units.

1.02 REFERENCES

1.03 SUBMITTALS
A. See Section 013000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on suspension system components.
C. Samples: Submit two samples 6 x 6 inch in size illustrating material and finish of acoustical units.
D. Samples: Submit two samples each, 12 inches long, of suspension system main runner.

1.04 QUALITY ASSURANCE
A. Installer shall be a company specializing in the installation of suspended acoustical ceilings with a minimum of three years documented experience.

1.05 ENVIRONMENTAL REQUIREMENTS
A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.06 PROJECT CONDITIONS
A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
B. Install acoustical units after interior wet work is dry.

1.07 EXTRA MATERIALS
A. See Section 016000 - Product Requirements, for additional provisions.
B. Provide 5 percent of total acoustical unit area of each type of acoustical unit for Tulsa Public Schools' use in maintenance of project.

PART 2  PRODUCTS

2.01 ACOUSTICAL UNITS
A. Manufacturers:
   1. Armstrong World Industries, Inc or CertainTeed
      a. Classrooms, Halls, Offices & Cafeterias (ACS-1): 2' x 4' Armstrong #1729 Humiguard Plus-Fine fissured with BioBlock paint on face and back of panels; 2 x 4 CertainTeed HHF-197, High Humidity, Fine-fissured with BioShield paint on face and back of panel. Color: White
      b. Gymnasiums and designated high abuse areas (ACS-2): 2’ x 4’ Armstrong #860 Armatuff or #862 where plans indicate fire rated is required; 2 x 4 CertainTeed PSB-197 (Fire-rated). Color: White
      c. Libraries (ACS-3): 2’ x 2’ Armstrong #1910 Humiguard-Plus, Ultima/very fine texture with BioBlock paint on face and back of panels; 2 x 2 CertainTeed #1222-OVT-1-Symphony NRC-.65 - .70 x 5/8”. Color: White
      d. Kitchens, Restrooms & Classroom Toilet Rooms (ACS-4): 2’ x 4’ Armstrong #605 Ceramaguard with BioBlock/BioShield & Humiguard-Max; 2 x 4 CertainTeed Vinylrock 1140-CRF-1 (Fire-rated) or 1100-CRF-1 (Non-perforated) BioBlock/BioShield & Humiguard.

B. Acoustical Panels: ASTM E 1264 Type III, Painted mineral fiber, conforming to the following:
   1. Size: 24 x 24 inches, or 24 x 48 inches.
   2. Thickness: 5/8 inches.
   3. Composition: Wet felted.
   4. Density: 1.0 lb/cu ft.
   5. NRC Range: 0.55 to 0.65.
   7. Surface Color: White.

2.02 SUSPENSION SYSTEM(S)

A. Manufacturers:
   1. Armstrong World Industries, Inc.
   2. Chicago Metallic Corp.
   3. CertainTeed

B. Suspension Systems - General: ASTM C 635; die cut and interlocking components, with stabilizer bars,
   clips, splices, perimeter moldings, and hold down clips as required.
   1. Profile: Tee; 15/16 wide face.
   2. Construction: Double web, Hot dipped galvanized.
   3. Finish: white over galvanized substrate.

C. Match Acoustical Tile Manufacturer with same grid manufacturer to obtain 15-year warranty. 15/16" Grid System. Color: White.

2.03 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic
   requirements, and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C 636, ASTM E 580, and manufacturer's instructions
   and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection
   of 1:360.

C. Locate system on room axis according to reflected ceiling plan.

D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

E. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

F. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying
   members are spliced, avoid visible displacement of face plane of adjacent members.

G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected
   hangers and related carrying channels to span the extra distance.

H. Do not support components on main runners or cross runners if weight causes total dead load to exceed
   deflection capability.

I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support
   components independently.

J. Do not eccentrically load system or induce rotation of runners.

K. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other
   interruptions.
   1. Use longest practical lengths.
   2. Overlap and rivet corners.

L. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch movement. Maintain
   visual closure.
3.03 INSTALLATION - ACOUSTICAL UNITS
   A. Install acoustical units in accordance with manufacturer's instructions.
   B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and
      function.
   C. Fit border trim neatly against abutting surfaces.
   D. Install units after above-ceiling work is complete.
   E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
   F. Cutting Acoustical Units:
      1. Cut to fit irregular grid and perimeter edge trim.
      2. Make field cut edges of same profile as factory edges.
      3. Double cut and field paint exposed reveal edges.
   G. Install hold-down clips on panels within 20 ft of an exterior door.

3.04 ERECTION TOLERANCES
   A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
   B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.05 SCHEDULE
   A. See Room Finish Schedule.

END OF SECTION
SECTION 096513
RESILIENT BASE & FLOORING TRANSITION

PART 1   GENERAL

1.01    SECTION INCLUDES
A. Resilient base.
B. Flooring transition.

1.02    REFERENCES

1.03    SUBMITTALS
A. See Section 013000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
C. Verification Samples: Submit two samples, 12-inch long in size illustrating color and pattern for each wall base and transition product and color specified.
D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning and stripping.

1.04    ENVIRONMENTAL REQUIREMENTS
A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by Johnsonite, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

1.05    QUALITY ASSURANCE
A. Single-Source Responsibility for Flooring: Obtain each type, color and pattern of flooring from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the work.

1.06    PROJECT CONDITIONS
A. Sequence wall base work to ensure that wall base is not installed until installation of ALL millwork that abuts base material is complete and approved.
B. Install resilient products after other finishing operations, including painting, have been completed.
C. Maintain ambient temperatures within range recommended by Johnsonite, but not less than 65 deg F (18 deg C) or more than 85 deg F (29 deg C) in spaces to receive resilient products during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.
D. Maintain the ambient relative humidity between 40% and 60% during installation.
E. Until Substantial Completion, maintain ambient temperatures within range recommended by Johnsonite, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).
F. Do not install resilient wall base until they are at the same temperature as the space where they are to be installed.

1.01 EXTRA MATERIALS
A. See Section 016000 - Product Requirements, for additional provisions.
B. Provide: 50 lineal feet of each color of base or transition specified.

1.02 WARRANTY
A. Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period.

PART 2 PRODUCTS

2.01 MATERIALS
A. Resilient Base: ASTM F 1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove, and as follows:
   1. Height: 4 inch.
   2. Thickness: 0.125 inch thick.
   4. Length: 4 foot sections.
   5. Job formed corners using heat.
   6. Color: as indicated on drawings.
   7. Manufacturers:
      (a) Johnsonite.
      (b) Substitutions: none.
   8. Flexibility: ASTM F 137 - Will not crack, break, or show any signs of fatigue when bent around a 1/4" (6.4 mm) diameter cylinder.
B. Flooring Transition:
   1. As noted on Construction Drawings

2.02 ACCESSORIES
1. Primers & Adhesives: as recommended by wall base and transition strip manufacturer. Tape shall not be accepted.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that surfaces are smooth and flat within tolerances specified in Section 033000.
B. Verify that surfaces are dust-free, and free of substances which would impair bonding of adhesive materials surfaces.

3.02 PREPARATION
A. Wall Base and adhesives must be site conditioned at room temperature for a minimum of 48 hours prior to, during, and after installation. Room temperature must be maintained between 65deg and 85deg F (18deg and 30degC) with HVAC system operating. A minimum temperature of 55deg F (13degC) must be maintained afterwards.
   1. The ambient relative humidity should be between 40% and 60%.
   2. All walls must be clean, smooth, flat and dry. The surface must be free of all dust, loose particles, solvents, paint, grease, oil, wax, alkali, sealing/curing compounds, old adhesive, and any other foreign material,
which could affect installation. Remove existing adhesive mechanically – do not use chemical adhesive removers or solvents.

3. Fill all depressions, cracks, and other surface irregularities with a good quality patching compound.

3.03 INSTALLATION

A. Wall Base:
1. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
2. Miter internal corners. At external corners, use job formed units. At exposed ends, use job formed units.
3. Job-formed corners:
   a. Outside corners: Form by bending without producing discoloration (whitening) at bends.
   b. Inside corners: Butt one piece to corner then scribe next piece to fit.
4. Install base on solid backing. Bond tightly to wall and floor surfaces.
5. Scribe and fit to door frames and other interruptions.
6. Fill voids along the top edge of base at masonry walls with caulk.
7. Avoid excess adhesive in corners.
8. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
9. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates. Tape shall not be allowed.
10. Do not stretch resilient base during installation.

B. Transition Strips:
1. Provide transitions where flooring termination is higher than the adjacent finished flooring and at transitions between different flooring materials.
2. When required, locate transitions under door centerline.
3. Transitions are not required at doorways where thresholds are provided.
4. Secure transitions as recommended by the manufacturer.

3.04 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean base and transition strip products in accordance with manufacturer's instructions.

END OF SECTION
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. Resilient Tile (Vinyl Enhanced Tile) Flooring.
   B. Related Sections: Section 096513 – Resilient Base & Accessories

1.3 SUBMITTALS
   A. Product Data: For each type of product indicated.
   B. Samples for Verification: For each type of product indicated, in manufacturer’s standard-size samples of each resilient product color, texture, and pattern required.
   C. Product Schedule: For resilient products. Use same designations indicated on Drawings.

1.4 DELIVERY, STORAGE, AND HANDLING
   A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by Tarkett, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

1.5 PROJECT CONDITIONS
   A. Install resilient products after other finishing operations, including painting, have been completed.
   B. Maintain ambient temperatures within range recommended by Tarkett, but not less than 65 deg F (18 deg C) or more than 85 deg F (29 deg C) in spaces to receive resilient products during the following time periods:
      1. 48 hours before installation.
      2. During installation.
      3. 48 hours after installation.
   C. Maintain the ambient relative humidity between 40% and 60% during installation.
   D. Until Substantial Completion, maintain ambient temperatures within range recommended by Tarkett, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

1.6 EXTRA MATERIALS
   A. See Section 01600 - Product Requirements, for additional provisions.
   B. Provide: 5% of the net floor area but no less than 200 sq ft, whichever is greater, of each color of flooring.

PART 2 - PRODUCTS

2.1 RESILIENT TILE FLOORING
   A. Manufacturer:
      1. Tarkett, Inc; phone: 800-899-8916; www.azrock.com
B. Substitutions: Not Permitted

C. Resilient Vinyl Enhanced Tile Flooring
   1. COLOR ESSENCE Specify – Resilient Vinyl Enhanced Tile Flooring with the following physical characteristics:
      b. Wear layer/Overall thickness: 1/8" (3.2 mm)
      c. Tile size: 12” x 12” (30.5 x 30.5 cm)
      d. Slip Resistance: ADA Compliant
      e. Polyurethane Reinforced wear surface with Tritonite Finish
      f. ASTM F 970, Standard Test Method for Static Load Limit – 400 PSI (modified for higher load)
      g. ASTM E 648, Standard Test method for Critical Radiant Flux of 0.45 watts/cm² or greater, Class I
      h. Warranty: 10 year Manufacture's Warranty
      i. Color Essence is to be installed with Tarkett 800 Pressure Sensitive.
   
   2. AZTERRA Specify – Resilient Vinyl Enhanced Tile Flooring with the following physical characteristics:
      b. Wear layer/Overall thickness: 1/8" (3.2 mm)
      c. Tile size: 12” x 12” (30.5 x 30.5 cm)
      d. Slip Resistance: ADA Compliant
      e. Polyurethane Reinforced wear surface with Tritonite Finish
      f. ASTM F 970, Standard Test Method for Static Load Limit – 400 PSI (modified for higher load)
      g. ASTM E 648, Standard Test method for Critical Radiant Flux of 0.45 watts/cm² or greater, Class I
      h. Warranty: 10 year Manufacture's Warranty
      i. Azterra is to be installed with Tarkett 800 Pressure Sensitive.

2.2 INSTALLATION MATERIALS


B. Adhesives: As recommended by Tarkett to meet site conditions.
   1. Vinyl Enhanced Tile:
      a. Tarkett 800 Pressure Sensitive Adhesive

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to Azrock written instructions to ensure adhesion of Resilient Tile Flooring.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate paint, coatings and other substances that are incompatible with adhesives or contain soap, wax, oil, solvents, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

3. Mechanically remove contamination on the substrate that may cause damage to the resilient flooring material. Permanent and non-permanent markers, pens, crayons, paint, etc., must not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.

4. Prepare Substrates according to ASTM F 710 including the following:
   a. Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
      1) Perform anhydrous calcium chloride test, ASTM F 1869. Results must not exceed 5 lbs. Moisture Vapor Emission Rate per 1,000 sq. ft. in 24 hours.
      – or –
      2) Perform relative humidity test using in situ probes, ASTM F 2170. Results must not exceed 80%.
   b. A pH test for alkalinity must be conducted. Results should range between 7 and 9. If the test results are not within the acceptable range of 7 to 9, the installation must not proceed until the problem has been corrected.
   c. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.

5. Wood subfloors must have a minimum 18” (45.7 cm) of cross-ventilated space beneath the bottom of the joist.
   a. The floor must be rigid, free of movement.
   b. Single wood and tongue and groove subfloors should be covered with ¼” (6.4 mm) or ½” (12.7 mm) APA approved underlayment plywood.
      1) Use ¼” (6.4 mm) thick underlayment panels for boards with a face width of 3” (76 mm) or less.
      2) Use ½” (12.7 mm) thick underlayment panels for boards with a face width wider than 3” (76 mm).
   c. Do not install over OSB (Oriented Strand Board), particle board, chipboard, lauan or composite type underlayment’s.

B. Fill cracks, holes, depressions and irregularities in the substrate with good quality Portland cement based underlayment leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. Floor covering shall not be installed over expansion joints.

D. Do not install resilient products until they are the same temperature as the space where they are to be installed.
   1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT TILE FLOORING INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient tile flooring.

B. Vinyl Enhanced Tile Flooring:
   1. Install with Azrock/Tarkett adhesive specified for the site conditions and follow adhesive label for proper use.
   2. Follow Azrock's recommendation and lay tiles so graining follows the same direction.
   3. Roll the flooring in both directions using a 100 pound three-section roller.
3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. No heavy traffic, rolling loads, or furniture placement for 72 hours after installation.

E. It is the installer's responsibility to properly cover and protect the resilient product until ready to perform the initial cleaning.

F. Wait 72 hours after installation before performing initial cleaning.

G. A regular maintenance program must be started after the initial cleaning.

END OF SECTION
SECTION 096720
RESINOUS FLOORING
(CHIP EPOXY BROADCAST WITH URETHANE TOPCOAT)

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 the following:
   1. Resinous flooring system as shown on the drawings and in schedules.

B. Related sections include the following:
   1. Section 033000 – Structural Concrete

1.3 SYSTEM DESCRIPTION

A. The work shall consist of preparation of the substrate, the furnishing and application of an epoxy based multi roller applied flooring system with Micro or Macro colored decorative chips and urethane topcoat. The system shall have the color and texture as specified by the Owner with a nominal thickness of 40 mils. It shall be applied to the prepared area(s) as defined in the plans strictly in accordance with the Manufacturer’s recommendations.

B. Cove base (if required) to be applied where noted on plans and per manufacturers standard details unless otherwise noted.

1.4 SUBMITTALS

A. Product Data: Latest edition of Manufacturer’s literature including performance data and installation procedures.

B. Manufacturer’s Material Safety Data Sheet (MSDS) for each product being used.

C. Samples: Two 6-inch square samples of the proposed system. Color, texture, and thickness shall be representative of overall appearance of finished system.

1.5 QUALITY ASSURANCE

A. The Manufacturer shall have a minimum of 10 years experience in the production, sales, and technical support of epoxy and urethane industrial flooring and related materials.

B. The Applicator shall have been approved by the flooring system manufacturer in all phases of surface preparation and application of the product specified.

C. No requests for substitutions shall be considered that would change the generic type of the specified System.

D. System shall be in compliance with requirements of United States Department of Agriculture (USDA), Food, Drug Administration (FDA), and local Health Department.

E. A pre-installation conference shall be held between Applicator, General Contractor and the Owner to review and clarification of this specification, application procedure, quality control, inspection and acceptance criteria and production schedule.

F. System shall be in compliance with the Indoor Air Quality requirements of California Section 01350 as verified by a qualified independent testing laboratory.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping
1. All components of the system shall be delivered to the site in the Manufacturer's packaging, clearly identified with the product type and batch number.

B. Storage and Protection
1. The Applicator shall be provided with a storage area for all components. The area shall be between 60 F and 90 F, dry, out of direct sunlight and in accordance with the Manufacturer's recommendations and relevant health and safety regulations.
2. Copies of Material Safety Data Sheets (MSDS) for all components shall be kept on site for review by the Engineer or other personnel.

C. Waste Disposal
1. The Applicator shall be provided with adequate disposal facilities for non-hazardous waste generated during installation of the system.

1.7 PROJECT CONDITIONS

A. Site Requirements
1. Application may proceed while air, material and substrate temperatures are between 60 F and 90 F providing the substrate temperature is above the dew point. Outside of this range, the Manufacturer shall be consulted.
2. The relative humidity in the specific location of the application shall be less than 85 % and the surface temperature shall be at least 5 F above the dew point.
3. The Applicator shall ensure that adequate ventilation is available for the work area.
4. The Applicator shall be supplied with adequate lighting equal to the final lighting level during the preparation and installation of the system.

B. Conditions of new concrete to be coated with epoxy material.
1. Concrete shall be moisture cured for a minimum of 7 days and have fully cured a minimum of twenty eight days in accordance with ACI-308 prior to the application of the coating system pending moisture tests.
2. Concrete shall have a flat rubbed finish, float or light steel trowel finish (a hard steel trowel finish is neither necessary nor desirable).
3. Sealers and curing agents should not be used.
4. Concrete surfaces on grade shall have been constructed with a vapor barrier to protect against the effects of vapor transmission and possible delamination of the system.

C. Safety Requirements
1. All open flames and spark-producing equipment shall be removed from the work area prior to commencement of application.
2. "No Smoking" signs shall be posted at the entrances to the work area.
3. The Owner shall be responsible for the removal of foodstuffs from the work area.
4. Non-related personnel in the work area shall be kept to a minimum.

PART 2 – PRODUCTS

2.1 FLOORING

A. Epoxy-Based seamless flooring system
1. System Materials:
a. Primer.
b. First Broadcast Coat.
c. Second Broadcast and Grout Coat.
d. Chips; multi-colored. Color and size as indicated on drawings.
e. Topcoat, clear.
2. Patch Materials
a. Shallow Fill and Patching.
b. Deep Fill and Sloping Material (over ¼ inch).
### 2.2 MANUFACTURER

A. Dur-A-Flex, Inc., 95 Goodwin Street, East Hartford, CT 06108,  
   Phone: (860) 528-9838, Fax: (860) 528-2802  
B. For maintenance purposes, only Dur-A-Flex will be an acceptable manufacturer to match existing floor surfaces throughout the school district.

### 2.3 PRODUCT REQUIREMENTS

#### A. Primer
1. Percent Solids 56 %  
2. VOC 2 g/L  
3. Bond Strength to Concrete ASTM D 4541 550 psi, substrates fails  
4. Hardness, ASTM D 3363 3H  
5. Elongation, ASTM D 2370 9 %  
6. Flexibility (1/4: Cylindrical mandrel), ASTM D 1737 Pass  
7. Impact Resistance, MIL D-2794 >160  
8. Abrasion Resistance ASTM D 4060, CS 17 wheel, 1,000 gm load, 30 mg loss

#### B. Broadcast Coat
1. Percent Solids 100 %  
2. VOC 59 g/L  
3. Compressive Strength, ASTM D 695 16,000 psi  
4. Tensile Strength, ASTM D 638 3,800 psi  
5. Flexural Strength, ASTM D 790 4,000 psi  
6. Abrasion Resistance, ASTM D 4060 C-10 wheel, 1,000 gm load, 1,000 cycles 35 mg loss  
7. Flame Spread/NFPA-101, ASTM E 84 Class A  
8. Impact Resistance MIL D-3134 0.025 inch Max  
9. Water Absorption. MIL D-3134 Nil  
10. Potlife @ 70 F 20-25 minutes

#### C. Broadcast Coat and Grout Coat
1. Percent Solids 100 %  
2. VOC 3.8 g/L  
3. Compressive Strength, ASTM D 695 11,200 psi  
4. Tensile Strength, ASTM D 638 2,100 psi  
5. Flexural Strength, ASTM D 790 5,100 psi  
6. Abrasion Resistance, ASTM D 4060 C-10 wheel, 1,000 gm load, 1,000 cycles 29 mg loss  
7. Flame Spread/NFPA-101, ASTM E 84 Class A  
8. Impact Resistance MIL D-24613 0.0007 inches, no cracking or delamination  
9. Water Absorption. MIL D-24613 Nil  
10. Potlife @ 70 F 20 minutes

#### D. Topcoat
1. Percent Solids 95 %  
2. VOC 0 g/L  
3. Tensile Strength, ASTM D 2370 7,000 psi  
4. Adhesion, ASTM 4541 Substrate Failure  
5. Hardness, ASTM D 3363 4H  
6. 60º Gloss ASTM D 523 70  
7. Abrasion Resistance, ASTM D4060 CS 17 wheel, 1,000 g load, 1,000 cycles 4 - 8 mg loss with grit, 10 - 12mg loss without grit  
8. Pot Life, 70 F, 50% RH 2 Hours  
9. Full Chemical Resistance 7 days
PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas and conditions, with Applicator present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting flooring performance.
   1. Verify that substrates and conditions are satisfactory for flooring installation and comply with requirements specified.

3.2 PREPARATION

A. General
   1. New and existing concrete surfaces shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, and bituminous products.
   2. Moisture Testing: Perform tests recommended by manufacturer and as follows.
      a. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.
      b. If the relative humidity exceeds 75% then Dur-A-Flex, Inc Dur-A-Glaze MVP Primer moisture mitigation system must be installed prior to resinous flooring installation. Slab-on grade substrates without a vapor barrier may also require the moisture mitigation system.
   3. There shall be no visible moisture present on the surface at the time of application of the system. Compressed oil-free air and/or a light passing of a propane torch may be used to dry the substrate.
   4. Mechanical surface preparation
      a. Shot blast all surfaces to receive flooring system with a mobile steel shot, dust recycling machine (Blastrac or equal). All surface and embedded accumulations of paint, toppings hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a minimum profile of CSP 3-4 as described by the International Concrete Repair Institute.
      b. Floor areas inaccessible to the mobile blast machines shall be mechanically abraded to the same degree of cleanliness, soundness and profile using diamond grinders, needle guns, bush hammers, or other suitable equipment.
      c. Where the perimeter of the substrate to be coated is not adjacent to a wall or curb, a minimum 1/4 inch key cut shall be made to properly seat the system, providing a smooth transition between areas. The detail cut shall also apply to drain perimeters and expansion joint edges.
      d. Cracks and joints (non-moving) greater than 1/8 inch wide are to be chiseled or chipped-out and repaired per manufacturer’s recommendations.
   5. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufactures recommendations.

3.3 APPLICATION

A. General
   1. The system shall be applied in six distinct steps as listed below:
      a. Substrate preparation
      b. Priming
      c. First broadcast coat application with first chip broadcast
      d. Second broadcast coat with second chip broadcast
      e. Grout coat application,
      f. Topcoat application
   2. Immediately prior to the application of any component of the system, the surface shall be dry and any remaining dust or loose particles shall be removed using a vacuum or clean, dry, oil-free compressed air.
3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer’s recommendations.
4. The system shall follow the contour of the substrate unless pitching or other leveling work has been specified by the Architect.
5. A neat finish with well-defined boundaries and straight edges shall be provided by the Applicator.

B. Primer
1. The primer shall be mixed at the ratio of 1 part resin to 4 parts hardener per the manufacturer’s instructions.
2. The primer shall be applied by 1/8 inch notched squeegee and back rolled at the rate of 200 sf/gal to yield a dry film thickness of 4 mils.

C. Broadcast Coats
1. The broadcast coat shall be applied as a double broadcast system as specified by the Architect.
2. The broadcast coat shall be comprised of two components, a resin, and hardener as supplied by the Manufacturer and mixed in the ratio of 2 parts resin to 1 part hardener.
3. The resin shall be added to the hardener and thoroughly mixed by suitably approved mechanical means.
4. The first broadcast coat shall be applied over horizontal surfaces using the dip and roll, and back roll method at the rate of 300 sf/gal.
5. Chips shall be broadcast to excess into the wet material, Macro chips at the rate of 0.1 lbs/sf, and Micro chips at the rate of 0.15 lbs/sf.
6. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose aggregate.
7. Scrape the floor with a trowel or floor scraper. Sweep and vacuum the floor again.
8. Apply a second broadcast coat of resin shall be applied by flat squeegee then back rolled with a coverage rate of 200 sf/gal.
9. Chips shall be broadcast to excess, Macro chips at the rate of 0.1 lbs/sf, and Micro chips at the rate of 0.15 lbs/sf.
10. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose chips.
11. Scrape the floor with a trowel or floor scraper. Sweep and vacuum the floor again.

D. Grout Coat
1. The grout coat shall be comprised of a material that is mixed in the ratio of 1 part hardener to 2 parts resin and installed per the manufacturer’s recommendations.
2. The grout coat shall be squeegee applied and back rolled with a coverage rate of 150 sf/gal.

E. Topcoat
1. The topcoat of Armor Top shall be roller applied at the rate of 500 sf/gal to yield a dry film thickness of 3 mils.
2. The topcoat shall be comprised of a liquid resin and hardener that is mixed at the ratio of 4 parts hardener to 1 part resin and bag of grit per the manufacturer’s instructions.
3. The finish floor will have a nominal thickness of 40 mils.
4. Texture: even light sand yet scrubbable.

3.4 FIELD QUALITY CONTROL

A. Tests, Inspection
1. The following tests shall be conducted by the Applicator:
   a. Temperature
      i. Air, substrate temperatures and, if applicable, dew point.
   b. Coverage Rates
      i. Rates for all layers shall be monitored by checking quantity of material used against the area covered.
3.5 CLEANING AND PROTECTION

A. Cure flooring material in compliance with manufacturer’s directions, taking care to prevent their contamination during stages of application and prior to completion of the curing process.

B. Remove masking. Perform detail cleaning at floor termination, to leave cleanable surface for subsequent work of other sections.

END OF SECTION
SECTION 096800

CARPET

PART 1  GENERAL

1.01  SECTION INCLUDES

A.  Carpet, carpet tile, walk-off carpet; direct glue down.
B.  Accessories.

1.02  RELATED SECTIONS

A.  Section 096513:  Resilient Base & Transitions

1.03  REFERENCES

B.  CRI 104 - Standard for Installation of Commercial Textile Floor Covering Materials; Carpet and Rug Institute; 1996.

1.04  SUBMITTALS

A.  See Section 013000 - Administrative Requirements, for submittal procedures.
B.  Shop Drawings:  Indicate seaming plan, method of joining seams, direction of carpet pile and pattern, location of edge moldings and edge bindings, layout of flat wire system, and locations of base materials.
C.  Product Data:  Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
D.  Samples:  Submit two samples 12x12 inch in size illustrating color and pattern for each carpet specified.
E.  Manufacturer's Installation Instructions:  Indicate special procedures.
F.  Maintenance Data:  Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.05  QUALITY ASSURANCE

A.  The carpet selections shown hereafter are the only acceptable products pursuant to Master Agreement between Tulsa Public Schools and Tandus/Collins & Aikman (competitively bid), and vendor charges for the material are subject to price verification by TPS.
B.  Installer Qualifications:  Company specializing in installing carpet with minimum three years experience, and certified by Collins and Aikman as an approved installer.

1.06  ENVIRONMENTAL REQUIREMENTS

A.  Store materials in area of installation for minimum period of 24 hours prior to installation.
B.  Maintain minimum 70 degrees F ambient temperature 24 hours prior to, during and 24 hours after installation.
C. Ventilate installation area during installation and for 72 hours after installation.

1.07 PROJECT CONDITIONS
A. Sequence work to ensure carpet is not installed until installation of all millwork that abuts carpet is complete and approved.

1.08 EXTRA MATERIALS
A. Provide: 5% of the net floor area but no less than 200 sq ft, whichever is greater, of each color of flooring.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Tandus
1. Substitutions: None allowed for carpet or adhesive; Not permitted.

2.02 MATERIALS
A. Carpet: 6-foot rolled with Powerbond backing.
B. Carpet Tile: 24”x24” unless otherwise noted; Flexaire backing.
C. Walk-off Carpet: 6-foot rolled with Powerbond backing.

2.03 ACCESSORIES
A. Sub-Floor Filler: Type recommended by carpet manufacturer, however gypsum based fillers will not be accepted.
B. Tackless Strip: Carpet gripper, of type recommended by carpet manufacturer to suit application, with attachment devices.
C. Flooring Transition Strips: See Section 096513; color as indicated in the Room Finish Schedule.
D. Adhesive: as recommended by the carpet manufacturer.
E. Seam Adhesive: Recommended by manufacturer.
F. Contact Adhesive: Compatible with carpet material; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that floor surfaces are smooth and flat within tolerances specified in Section 033000, are dust-free, and are ready to receive carpet.
B. Verify that concrete sub-floor surfaces are ready for carpet installation by testing for moisture emission rate (per ASTM F 1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride, 1998) and alkalinity; obtain instructions if test results are not within the following limits:
1. Moisture emission rate: Not greater than 3 lb per 1000 sq ft per 24 hours when tested using calcium chloride moisture test kit for 72 hours.
3.02 PREPARATION

A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.

B. Apply, trowel, and float filler (gypsum based filler prohibited) to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

C. Clean substrate.

3.03 INSTALLATION – GENERAL

A. Install carpet in accordance with manufacturer's instructions and CRI 104.

B. Verify carpet match before cutting to ensure minimal variation between dye lots.

C. Lay out carpet in accordance with approved seaming plan.
   1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
   2. Do not locate seams perpendicular through door openings unless overall pattern dictates it.
   3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces unless otherwise noted.
   4. Locate change of color or pattern between rooms under door centerline.
   5. Provide monolithic color, pattern, and texture match within any one area.

D. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

3.04 DIRECT-GLUED CARPET

A. Double cut carpet seams, with accurate pattern match. Make cuts serpentine overlay and per manufacturer. Apply seam adhesive to cut edges of carpet immediately.

B. Apply contact adhesive to floor uniformly at rate recommended by manufacturer. After sufficient open time, press carpet into adhesive.

C. Apply seam adhesive to the base of all cut and uncut edges glued down; rolled or tile type. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.

D. Roll with appropriate roller for complete contact of adhesive to carpet backing.

E. Trim carpet neatly at walls and around interruptions.

F. Complete installation of edge strips, concealing exposed edges. Bind cut edges where not concealed by edge strips.

3.05 CLEANING

A. Remove excess adhesive from floor and wall surfaces without damage.

B. Clean and vacuum carpet surfaces.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Durable, decorative wall panels with smooth or textured finishes; Mounting hardware, adhesives, accessories and trims.

B. Performance Requirements: Provide durable, decorative wall panels which have been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

1.2 ENVIRONMENTAL AND SITE CONDITIONS

A. Environmental Requirements:
   1. Installation shall not begin until building is enclosed, permanent heating and cooling equipment is in operation and residual moisture from plaster, concrete or terrazzo work has dissipated.
   2. Install panels between 60 degrees F - 75 degrees F (15 - 24 degrees C) and relative humidity below 55%, ideally at the same conditions as the room’s normal operating temperatures after building is occupied.
   3. Provide ventilation to disperse fumes during application of adhesive as recommended by adhesive manufacturer.
   4. Do not install wall system until normal lighting conditions exist. Normal lighting conditions are described as those in place when the project is finished.

B. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.
   1. Wall, ceilings, floors and openings must be level, plumb, straight, in-line and square

1.3 DELIVERY & STORAGE OF MATERIALS

A. General: Comply with Division 01 Product Requirements Section.

B. Lead Time: Comply with manufacturer’s ordering instructions and lead time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

D. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
   1. Store panels indoors.
2. Lay panels flat. Do not stand panels on edge.
3. Protect panels from moisture.
4. Do not store panels in contact with the floor or against an outside wall.
5. Do not remove protective film from panel surface until after installation (if applicable).
6. Maintain optimum storage conditions of 60-75 degrees F (16-24 degrees C) at 35-55% relative humidity. Avoid extremes in temperature and humidity.

E. Handling: Remove foreign matter from face of panel by using a soft bristle brush, avoiding abrasive action.

1.4 SUBMITTALS

A. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors, patterns and textures. Indicate location and dimensions of joints and fastener attachment.

B. Samples: Submit selection and verification samples for finishes, colors and textures. Submit (2) samples of each type of panel, trim and fastener.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Marlite
   202 Harger Street
   Dover, OH 44622
   (330) 343-6621

B. Nudo
   1500 Taylor Avenue
   Springfield, IL 62703
   (800) 826-4132

2.2 PANELS

A. Texture: Smooth

B. Color: White (final color selection shall be made during submittal process of manufacturer’s standard colors)

C. Thickness: 0.90 inch

2.3 ACCESSORIES

A. All trim specified shall be extruded rigid PVC.

1. Extruded PVC Trim Profiles for .090” thick panels.
   a. M 350 Inside Corner
   b. M 360 Outside Corner
   c. M 365 Division
   d. M 370 Edge

2. Trim Finish
   a. Extruded PVC to be color-thru.
B. All PVC Base Molding shall be a Rigid extruded PVC with integral color.

1. Base Profiles for .090" thick panels
   a. M 612 FRP Base Molding
   b. M 651 Inside Corner
   c. M 660 Outside Corner
   d. M 620 LH End Cap
   e. M 625 RH End Cap

PART 3 EXECUTION

3.1 EXAMINATION

A. Open cartons and carefully inspect all panels.

3.2 PREPARATION

A. Panels must be applied over a smooth, solid, flat, clean sub-wall such as drywall or plywood.

B. Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer’s instructions. Verify that site conditions are acceptable for installation of durable, decorative wall panels. Examine back-up surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails are countersunk and joints and cracks are filled flush and smooth with the adjoining surface. Do not proceed with installation of durable, decorative wall panels until unacceptable conditions are corrected.

3.3 CONDITIONING

A. Panels should be opened and allowed to acclimate for 48 hours prior to installation. Room temperature should be approximately 70°F.

3.4 INSTALLATION

A. Install all panels in strict accordance with manufacturer’s installation instructions.

B. All moldings must provide for a minimum 1/8 inch expansion joint to insure proper installation.

C. Use Manufacturer’s recommended adhesive.

D. Do not install panels of unacceptable quality. Field cutting of all wall systems should be accomplished using a circular saw with fine tooth carbide blade.

E. Position panel so that the saw blade enters the finished HPL side first to avoid chipping or damage. Protect decorative laminate face of panel by covering work area, do not remove protective will until after installation.

3.5 SEALANT

A. As recommended by Manufacturer
3.6 CLEANING

A. Clean panel surfaces in compliance with manufacturer’s recommendations.
   1. Use a clean, damp, nonabrasive cotton cloth and a mild liquid detergent or household cleaner.
   2. Rinse with clean water using a clean, nonabrasive cotton cloth.
   3. Dry panels with a soft, clean nonabrasive cotton cloth.
   4. Do not use cleaners containing acid, alkali or sodium hypochlorite.

3.7 PROTECTION

A. Protect installed work from damage due to subsequent construction activity on the site.

END OF SECTION
SECTION 099000
PAINTS AND COATINGS

PART 1    GENERAL

1.01    SECTION INCLUDES
A. Surface preparation.
B. Field application of paints, stains, varnishes, and other coatings.

1.02    REFERENCES
A. Painting and Decorating Contractors of America – P.D.C.A. Type 1 Manual.

1.03    DEFINITIONS
A. P.D.C.A. standards and interpretations.

1.04    SUBMITTALS
A. See Section 013000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on all finishing products.
C. Verification samples: submit a minimum of three painted 6” x 10” (+/-) "pull down" samples, illustrating selected colors and textures for each color and system selected. Each sample to be identified on the backside with project ID and project color number. Two sets of samples will be returned to the GC, one of which must be maintained at the job site for reference.
D. Submit sealer and stain finishes on material on which that particular finish is to be used.
E. Manufacturer’s instructions: Indicated special surface preparation procedures.
F. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.
G. MSDS for each product to be utilized.

1.05    QUALITY ASSURANCE
A. Applicator Qualifications: Company specializing in performing the work of this section with minimum three (3) years experience.

1.06    REGULATORY REQUIREMENTS
A. Comply with safety recommendations of MSDS for each product utilized.
B. Conform to applicable code for flame and smoke rating requirements for products and finishes.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

1.09 EXTRA MATERIALS

A. See Section 016000 - Product Requirements, for additional provisions.

B. Supply 1 gallon of each color; store where directed.

C. Label each container with color in addition to the manufacturer's label.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Paints: Pittsburgh Paint Co.

B. Transparent Finishes: Pittsburgh Paint Co.

C. Stains: Pittsburgh Paint Co.

D. Primer Sealers: Pittsburgh Paint Co.

E. Substitutions: See Section 016000 - Product Requirements.
2.02 MATERIALS:

A. Provide best of their respective kinds, delivered to job in original unopened containers, plainly marked with manufacturer's name, name of product and color. A schedule of colors will be prepared by TPS upon receipt of all paint samples and other items required for color selections.

1. Materials: PPG, SHERWIN-WILLIAMS, GLIDDEN, BENJAMIN MOORE, and PORTER. Submit product information for equal material to TPS for approval prior to color selections.

2.03 PAINT SYSTEMS – EXTERIOR

A. Paint WE-OP-3A - WOOD, Opaque, 3 coats

1. One coat of PPG 17-941 Seal Grip Interior/Exterior Alkyd Universal Wood Primer
2. Two coats of PPG 78 Line Sun-Proof Exterior 100% Acrylics Semi-Gloss Enamel

B. Paint WE-OP-3L - WOOD, Opaque, 3 coats

1. One coat of PPG 6-609 Speedhide Exterior Latex Wood Primer.
2. Two coats of PPG 78 Line Sun-Proof Exterior 100% Acrylics Semi-Gloss Enamel

C. Paint CE-OP-3L - CONCRETE/MASONRY, Opaque, 3 coats

1. One coat of PPG 6-7 Speedhide Interior/Exterior Latex Block filler
2. Two coats of PPG 78 Line Sun-Proof Exterior 100% Acrylics Semi-Gloss Enamel

D. Paint GE-OP-3L - GYPSUM BOARD AND PLASTER, Opaque, 3 coats

1. One coat of PPG 17-921 Seal Grip Interior/Exterior Universal Acrylic Primer
2. Two coats of PPG 78 Line Sun-Proof Exterior 100% Acrylics Semi-Gloss Enamel

E. Paint ME-OP-3A - FERROUS METALS, Unprimed, 3 coats

1. One coat of PPG 6-208 Speedhide Interior/Exterior Rust Inhibitive Metal Primer
2. Two coats of PPG 90-474 Pitt-Tech DTM Acrylic Satin Enamel

F. Paint MgE-OP-3L - GALVANIZED METALS, 3 coats

1. One coat of PPG 90-712 Pitt-Tech DTM Acrylic Metal Primer
2. Two coats of PPG 90-474 Pitt-Tech DTM Acrylic Satin Enamel

G. Paint MaE-OP-3A - ALUMINUM and COPPER, Unprimed, 3 coats

1. One coat of PPG 97-687 Polyclutch Wash Primer
2. Two coats of PPG 90-474 Pitt-Tech DTM Acrylic Satin Enamel

H. Paint E-PAV - PAVEMENT MARKING PAINT

1. Two coats of Richards 3007 Lead Free Yellow Latex Traffic Coating
2.04 PAINT SYSTEMS - INTERIOR

A. Paint WI-OP-3A - WOOD, Opaque, 3 coats
   1. One coat of PPG 17-956 Seal Grip Interior Alkyd Wood Primer/Under coater
   2. Two coats of PPG 6-1110 Speedhide Interior Alkyd Semi-Gloss Enamel

B. Paint WI-OP-3L - WOOD, Opaque, 3 coats
   1. One coat of PPG 6-2 Speedhide Interior Latex Wood Primer
   2. Two coats of PPG 6-500 Speedhide Interior Latex Semi-Gloss

C. Paint WI-TR-V - WOOD, Transparent, Varnish, No Stain
   1. Three coats of PPG 43886 Clear Polyurethane Satin Varnish (Sand between each coat)

D. Paint WI-TR-VS - WOOD, Transparent, Varnish and Stain
   1. One coat of PPG 44500 Oil Wiping Stain
   2. Three coats of PPG 43886 Clear Polyurethane Satin Varnish (Sand between each coat)

E. Paint CI-OP-3L - CONCRETE / MASONRY, Opaque, 3 coats
   1. One coat of PPG 6-7 Speedhide Interior/Exterior Latex Block filler
   2. Two coats of PPG 6-500 Speedhide Interior Latex Semi-Gloss

F. Paint MI-OP-3A - FERROUS METALS, Unprimed, 3 coats
   1. One coat of PPG 6-208 Speedhide Interior/Exterior Rust Inhibitive Alkyd Metal Primer
   2. Two coats of PPG 6-1110 Speedhide Interior Alkyd Semi-Gloss Enamel

G. Paint MI-OP-2A - FERROUS METALS, Primed, 2 coats
   1. Touch up if needed with PPG 6-208 Speedhide Interior/Exterior Rust Inhibitive Alkyd Metal Primer
   2. Two coats of PPG 6-1110 Speedhide Interior Alkyd Semi-Gloss Enamel

H. Paint Mgl-OP-3A - GALVANIZED METALS, 3 coats
   1. One coat of PPG 6-209 Speedhide White Galvanized Metal Primer
   2. Two coats of PPG 6-1110 Speedhide Interior Alkyd Semi-Gloss Enamel

I. Paint Mai-OP-3A - ALUMINUM, Unprimed, 3 coats
   1. One coat of PPG 97-687 Polyclutch Wash Primer
   2. Two coats of PPG 6-1110 Speedhide Interior Alkyd Semi-Gloss Enamel

J. Paint GI-OP-3L - GYPSUM BOARD AND PLASTER, 3 coats
   1. One coat of PPG 6-2 Speedhide Interior Latex Primer
   2. Halls and other rooms: Three coats of PPG 6-500 Speedhide Interior Latex Semi-gloss
   3. Classrooms: Two coats of PPG 6-411 Speedhide Interior Latex Eggshell
K. Paint GI-OP-2E - GYPSUM BOARD AND PLASTER, Water Born Epoxy (Toilets, Kitchen, Drinking Fountains)
   1. One coat of PPG 17-921 Seal-Grip Interior/Exterior Acrylic Latex Primer/Sealer
   2. Two coats of PPG 16-510 Pitt-Glaze Precatalyzed WM Semi-Gloss Epoxy

L. Existing Lockers – Wash with Peso. Sand to achieve a smooth surface free of all nicks and scratches by sanding to a featheredge.
   1. Two coats of PPG 95-8000 Pitt-Thane Ultra Urethane Enamel

2.05 SURFACES NOT TO BE PAINTED
A. Surfaces permanently concealed from view, unless noted to receive finish
B. Materials or equipment with a complete factory applied finish, except as provided for elsewhere
C. Finish hardware unless specifically noted otherwise
D. Non-ferrous metals unless specifically noted otherwise
E. Plumbing fixtures
F. Toilet Room Accessories
G. Lighting Fixtures
H. Any areas noted as "Unfinished" on Finish Schedule or drawings

2.06 ACCESSORY MATERIALS
A. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified; commercial quality.
   B. Patching Material: Latex filler
   C. Fastener Head Cover Material: Latex filler

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.
B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
C. Test shop-applied primer for compatibility with subsequent cover materials.
D. Notify Architect of any incompatibilities of specified finish on substrates, including existing finishes.
E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Plaster and Gypsum Wallboard: 12 percent.
2. Masonry, Concrete and Concrete Unit Masonry: 12 percent.
3. Interior Wood: 15 percent, measured in accordance with ASTM D 4442.
4. Exterior Wood: 15 percent, measured in accordance with ASTM D 4442.

3.02 PREPARATION

A. Surface Appurtenances: Remove electrical plates, hardware, light fixture trim, escutcheons and fittings prior to preparing surfaces or finishing.

B. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.

C. Marks: Seal with shellac those which may bleed through surface finishes.

D. Impervious Surfaces: Remove mildew by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

E. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

F. Gypsum Board Surfaces to be Painted: Clean thoroughly all wallboard surfaces to be painted. Sand smooth all rough surfaces. Fill minor defects with filler compound. Spot prime defects after repair.

G. Aluminum Surfaces to be Painted: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

H. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

I. Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

J. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

K. Interior Wood Items to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
L. Interior Wood Items to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

M. Exterior Wood to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied. Back prime concealed surfaces before installation.

N. Exterior Wood to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior caulking compound after sealer has been applied. Prime concealed surfaces.

O. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

P. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Apply finishes at manufacturer's recommended spreading rate to provide total dry film of not less than 5 mils.

C. Apply material without reduction except as specifically required by label direction; reduction shall be the minimum permitted.

D. Provide uniform color and finish, the number of coats specified being a minimum. Provide any additional coats to produce work satisfactory to TPS.

E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

F. Apply each coat to uniform appearance.

G. Sand wood surfaces lightly between coats to achieve required finish.

H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

I. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

J. Fire hose cabinets, air registers and grilles, flanges around ceiling fixtures, exposed electrical panel boards, primed hardware, etc., shall be painted to match adjacent surfaces unless factory finished such as aluminum registers and grilles.

K. Where paint finish is specified on CMU, take special care to assure that every pore or irregularity of CMU texture is solidly and uniformly filled with block filler, adding extra coats to coarse textured units as necessary to provide a finish acceptable to TPS. Apply textured coating to uniform finish.
L. Where Epoxy finish is specified on CMU, take special care to assure that every pore or irregularity of CMU texture is solidly and uniformly filled with block filler, adding extra coats to coarse textured units as necessary to provide an easily washable finish acceptable to TPS and local Health Department.

M. Apply material without reduction except as specifically required by label direction; reduction shall be the minimum permitted.

3.04 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Paint shop-primed equipment, unless indicated otherwise.

B. Paint rooftop equipment furnished with or without factory finish only as indicated on the drawings.

C. Paint piping, equipment, conduits, vents, etc., on roof as indicated on the drawings. Identification labels will be provided by Mechanical Contractor.

D. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.05 CLEANING

A. Collect waste material that may constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. On completion of work, carefully clean all glass, hardware, factory finished surfaces, etc. and remove all misplaced paint and stain spots or spills and leave in a condition acceptable to TPS.

END OF SECTION
SECTION 101100
VISUAL DISPLAY BOARDS

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Porcelain enamel magnetic markerboards.
B. Tackboards and tack strips.
C. Visual display board accessories.

1.02  REFERENCES
A. The General Conditions of the Contract, including Supplementary Conditions and Division 1 General Requirements apply to the Work of this Section as fully as if written completely herein.
D. GREENGUARD Environmental Institute: GREENGUARD Children and Schools Indoor Air Quality Certified

1.03  SUBMITTALS
A. See Section 013000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide technical data for products specified. Include Material Safety Data Sheets, when applicable.
C. Shop Drawings: Provide shop drawings for each type of visual display board specified.
D. Selection Samples: For items without a specified color, submit set of color chips displaying manufacturer's full range of colors and finishes.
E. Verification Samples: Submit samples not less than 6 inches square and framed on two adjacent sides, to illustrate materials, finish, color, and texture of each type of visual display board required.
F. Maintenance Data: Provide data on cleaning requirements, stain removal, and recommended maintenance precautions.

1.04  DELIVERY, STORAGE, AND HANDLING
A. Comply with manufacturer's instructions for handling and storage of units.

1.05  FIELD CONDITIONS
A. Field measure prior to preparation of shop drawings and fabrication, to ensure proper fit.
B. Do not begin installation of visual display boards until environmental conditions approximate normal occupied conditions.

1.06  WARRANTY
A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
B. Submit manufacturer's "Life of the Building" warranty, stating that under normal usage and maintenance, and when installed in accordance with manufacturer's instructions and recommendations, porcelain enamel steel chalkboards and markerboards are guaranteed for the life of the building.
1. Warranty shall cover replacement of defective boards but not the cost of removal or reinstallation.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Acceptable Manufacturers include:
   1. Claridge Products and Equipment, Inc.; Harrison, Arkansas 72602-0910. ASD.
      Tel: (870) 743-2200. Fax: (870) 743 1908. Email: claridge@claridgeproducts.com. Website: www.claridgeproducts.com
   2. Nelson Adams Division of A. Lawer Corporation / Greensteel
   3. Alliance Manufacturing
B. Substitutions: See Section 01600 - Product Requirements.

2.02 MARKERBOARD MATERIALS
A. Steel Face Sheets: 0.0239 inch (24 gage) commercial quality steel, fired with porcelain enamel, using the DuPont process.
   1. Face sheets with high-fired brittle ground and finish coats are not acceptable.
   2. Fire porcelain enamel finish at approximately 1000 degrees F, or lowest possible temperature there under to reduce steel and porcelain stresses and achieve superior enamel bond and hardness.
B. Core Material: 7/16 inch Duracore; no added urea-formaldehyde resins
C. Backing Material: 0.002 inch aluminum foil.
D. Metal Trim and Accessories: ASTM B 221 (ASTM B 221M) aluminum alloy.
E. Laminations: Hot-type neoprene contact adhesive applied to both surfaces automatically.
   1. Each substrate shall have minimum 80 percent covering with 1.5-2.0 dry mils of adhesive.
   2. Panel components shall have uniform pressure applied mechanically over entire area.
   3. Laminations shall be made by manufacturer of face sheet.
F. Adhesive: As recommended by manufacturer for project conditions.

2.03 PORCELAIN ENAMEL MAGNETIC MARKERBOARDS
A. Markerboards: Claridge "LCS" markerboards Series 1. Grades PK-12
   1. Metal Trim and Accessories: Series 1 heavy gage aluminum extrusions.
      a. Finish: Etched and anodized satin finish.
      b. Trim Style: 5/8-inch, mitered corners
      c. All marker boards shall be mounted at a height shown on the drawings.
      d. Marker trough: Full length standard continuous solid type, with ribbed section and injection molded end closures.
      e. Map rail: Standard continuous rail with cork insert and end stops, length as shown on drawings, and as follows:
         i. Height: 1 in.
         ii. Map hooks: 10 hooks per classroom.
         iii. Roller brackets: 4 brackets per classroom.
         iv. Flag holders: 2 holders per classroom.
   2. Size: As indicated on drawings.

2.04 TACKBOARDS AND TACK STRIPS
A. Configuration and locations as indicated on drawings, including those integrated with marker boards, interactive boards, and in corridors.
1. Metal Trim and Accessories: Series 1 heavy gage aluminum extrusions; etched and anodized satin finish.
2. Size: As indicated on drawings.
3. Tackboard Surfacing: Claridge Cork composed of ¼" thick self-healing, burlap backed cork laminated on a ¼-inch hardboard backing.
   a. Color: As selected by Architect from manufacturer's standards.

2.05 FABRICATION
A. Laminate facing sheet and backing sheet to core material under pressure, using manufacturer's recommended adhesive.
B. Provide factory-assembled visual display boards, except where sizes demand partial field assembly.
C. Assemble units in one piece without joints, wherever possible. Where required dimensions exceed maximum panel size available, provide 2 or more pieces of equal length, as indicated on approved shop drawings. Assemble to verify fit at factory, then disassemble for delivery and final assembly at project site.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that substrates are properly prepared to receive visual display boards and that all necessary backing is in place. Do not begin installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION
A. Comply with manufacturer's installation instructions.
B. Where visual display boards must be partly assembled at project site, use factory-supplied H-bar to maintain proper alignment.
C. Install visual display boards level and plumb, keeping perimeter trim aligned in accordance with manufacturer's recommendations.
D. Tack strips shall have end caps, inside corners, and outside corners as needed per layout.

3.03 ADJUSTING AND CLEANING
A. Verify that all accessories are installed as required for each unit.
B. Upon completion of installation, clean surfaces and trim in accordance with manufacturer's recommendations, leaving all materials ready for use.

END OF SECTION
SECTION 101700
TOILET PARTITIONS
(SOLID COLOR REINFORCED COMPOSITE)

PART 1 GENERAL

1.01 RELATED DOCUMENTS
   A. Section includes
      1. Drawings and general provisions of the Contract, including General and Supplementary
         Conditions and Division 1 Specification Sections, apply to this Section.
      2. Division 6 Section “Rough Carpentry” for blocking.
      3. Division 10 “Toilet and Bath Accessories” for toilet tissue dispensers, grab bars, purse
         shelves, and similar accessories.

1.02 SUMMARY
   A. This section includes phenolic units as follows:
      1. Toilet Enclosures:
         a. Floor mounted, overhead (headrail) braced.

1.03 SUBMITTALS
   A. Product Data:
      1. For each type of product indicated. Include construction details, material descriptions, and
         dimensions of individual compartments profiles, and finishes.
   B. Shop Drawings:
      1. Include plans, elevations, sections, details, and attachments to other work.
      2. Show locations of cutouts for compartment mounted accessories.

1.04 PROJECT CONDITIONS
   A. Field Measurements:
      1. Verify actual locations of walls, columns, ceilings, and other construction contiguous with toilet
         compartments by field measurements before fabrication and indicate measurements on shop
         drawings.
   B. Established Dimensions:
      1. Where field measurements cannot be made without delaying the work, establish dimensions
         and proceed with fabricating toilet compartments without field measurements. Coordinate
         wall, floor, ceilings, and other contiguous construction to ensure that actual dimensions
         correspond to established dimensions.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Acceptable Manufacturers:
      1. Subject to compliance with requirements, manufacturers offering products that may be
         incorporated into the work include the following:
         Type 1: Bobrick- Sierra Series- Model # 1090 – No substitution.

2.02 MATERIALS
   A. General:
      1. Provide materials that have been selected for surface flatness and smoothness. Exposed
         surfaces that exhibit pitting, seam marks, roller marks, stain, discolorations, telegraphing of
         core material or other imperfections on finished units are unacceptable.
   B. Toilet Compartments:
1. **Type 1- Solid Color reinforced Composite partitions** with GRAFFITIOFF surface thermoset and integrally fused into one homogeneous piece. Provide units with eased edges and with minimum ½ inch (19mm) thick doors and pilasters, and minimum ½ inch (13mm) thick panels and screens. Continuous color throughout.

C. Color and Pattern:
   1. Surface edge and core to be the same color. Submit actual product color samples to Owner.
   2. Color: Desert Beige.

B. Pilaster Shoes:
   1. Manufacturer’s standard design: type 304, 18-8-S, 18 ga. stainless steel.

2.03 **ACCESSORIES**

A. Hardware and Accessories: To include hinges, door latches, door keepers, coat hooks, U-Channels, angle brackets and mounting brackets.
   1. Full Height (Continuous) Type: Manufacturer’s **Institutional Hardware Package**:
      a. One piece full height continuous Stainless U-Channels, type 304.
      b. Door latch slides on a shock resistant nylon.

B. Anchorage and Fasteners:
   1. Manufacturer’s institutional threaded inserts and fasteners of stainless steel, finished to match hardware, with theft-resistant-torx head with center rejection pin.

C. Cleaning product: Contractor shall provide Owner with one can of graffiti cleaning product per restroom as recommended by Bobrick. To be left with the custodian at the school.

2.04 **FABRICATION**

A. Overhead braced Units:
   1. Provide manufacturer’s standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Floor Anchored Units:
   1. Provide manufacturer’s standard corrosion-resistant assemblies complete with threaded rods, lock washers and leveling adjustment nuts at pilasters for structural connection to floor.
   2. Provide shoes at pilasters to conceal anchorage.
   3. All urinal screens shall be floor anchored.

C. Doors:
   1. Unless otherwise indicated, provide 24-inch (610-mm) wide **out-swinging** doors for standard toilet compartments and 36-inch (914-mm) wide **out-swinging** doors with a minimum 32-inch (813-mm) wide clear opening for compartments indicated to be accessible to people with disabilities.
   2. Standard heights unless otherwise noted.

D. Hinges:
   1. Continuous Stainless Steel spring loaded hinge.

E. Latch and Keeper:
   1. Manufacturer’s heavy duty slide surface mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be accessible to people with disabilities.

F. Coat Hook:
   1. Manufacturer’s standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment mounted accessories.
G. Door Bumper:
   1. Manufacturer’s standard rubber-tipped bumper at out-swinging doors.

H. Door Pull:
   1. Manufacturer’s standard unit at out-swinging doors that complies with accessibility requirements of authorities having jurisdiction. Provide units on both sides of doors at compartments indicated to be accessible to people with disabilities.

I. Panel Sizes:
   1. Doors and panels shall be 54 inches high, unless noted otherwise.
   2. Doors and panels in Pre-K and Kindergarten Classroom restrooms shall be 42 inches high.

PART 3 EXECUTION

3.01 INSTALLATION

A. General:
   1. Comply with manufacturer’s written installation instructions. Install unit’s rigid, straight, level and plumb.
   2. Secure units in position with manufacturer’s recommended anchoring devises.
   3. Wipe all marks from panels.
   4. Clean debris off floor.

B. Maximum Clearances:
   1. Pilaster and Panels: 1/2 inch (13mm)
   2. Panels and Walls: 1 inch (25mm)

END OF SECTION
SECTION 102600

WALL PROTECTION PANELS

PART 1 – GENERAL

1.01 SUMMARY
A. Section Includes:
   1. Wall Protection Systems:
      a. Rigid Protective Wallcoverings.
   2. Corner Guards
      a. High Impact Surface Mounted

1.02 REFERENCES
A. American Society for Testing and Materials (ASTM)
B. National Building Code of Canada (NBC)
C. National Fire Protection Association (NFPA)
D. Society of Automotive Engineers (SAE)
E. Underwriters Laboratory (UL)
F. Underwriters Laboratory of Canada (ULC)
G. Uniform Building Code (UBC)

1.03 SYSTEM DESCRIPTION
A. Performance Requirements:
   1. Fire Performance Characteristics: Comply with ASTM E 84 for the fire
      performance characteristics indicated below. Identify components with markings
      from testing and inspection organization.
      a. Flame Spread: 25 or less.
      b. Smoke Developed: 450 or less.
   2. Impact Strength: Provide Rigid Vinyl Sheet that has an Impact Strength of 30.4 ft-
      lbs/ inch of thickness as tested in accordance with the procedures specified in
   3. Chemical and Stain Resistance: Provide rigid vinyl sheet that show resistance to
      stain when tested in accordance with applicable provisions of ASTM D-543.
   4. GREENGUARD Certified: Provide GREENGUARD Certified material. Profiles
      shall meet the requirements of GREENGUARD Certification Standards for Low-
      Emitting Products and GREENGUARD Product Emission Standard for Children
      & Schools.
   5. Fungal and Bacterial Resistance: Provide rigid vinyl that does not support fungal
      or bacterial growth as tested in accordance with ASTM G-21 and ASTM G-22.
   6. Color Consistency: Provide components matched in accordance with SAE J-
      1545 - (Delta E) with a color difference no greater than 1.0 units using CIE Lab,
      CIE CMC, CIE LCh, Hunter Lab or similar color space scale systems.

1.04 SUBMITTALS
A. Product Data: Manufacturer's printed product data for each type of item specified.
B. Detail Drawings: Mounting details with the appropriate adhesives for specific project
   substrates for each type of item specified.
C. Samples:
   1. Rigid Vinyl Sheet: two 8-inch (203mm) square, of each type and color indicated.
      Shall also provide texture sample.
   2. High Impact Corner Guard: two 8-inch (203mm) long, in full size profiles of each
      type and color indicated. Shall also provide texture sample.
D. Manufacturer's Installation Instruction: Printed installation instructions for each type specified.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in unopened factory packaging to the jobsite
B. Inspect materials at delivery to assure that specified products have been received.
C. Store in original packaging in a climate controlled location away from direct sunlight.

1.06 PROJECT CONDITIONS

A. Environmental Requirements: Products must be installed in an interior climate controlled environment.

1.07 WARRANTY

A. Standard Limited Lifetime Warranty against material and manufacturing defects.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Acceptable manufacturers are identified on the drawings in the Finish Legend.

2.02 RIGID VINYL SHEET

A. Rigid Vinyl Sheet shall be manufactured from chemical and stain resistant polyvinyl chloride with the addition of impact modifiers. No plasticizers shall be added (plasticizers may aid in bacterial growth).

B. Thickness:
   1. 0.040-inch = 3/64-inch (1mm)

C. Accessories:
   1. Top Cap: J-mold of either brushed aluminum or extruded PVC; as indicated on the drawings.
   2. Vertical Divider Bar: extruded PVC
   3. Inside Corner: extruded PVC
   4. Outside Corner: extruded PVC
   5. Color Matched Caulk

D. Finishes
   1. Color as indicated on the drawings.
   2. Surface texture shall be selected by the architect from the manufacturer’s standard selection.
   3. Accessories: shall be of a color matching the Sheet.

2.03 CORNER GUARD SYSTEM

A. High Impact Surface Mounted corner guard.
   1. Profile: 3-inch (76mm) x 3-inch (76mm), 90 degree
   2. Height: shall be of manufacturer’s standard height options. See drawings for approximate height.

B. Materials
1. Vinyl: Snap on cover of .080-inch (2mm) thickness shall be extruded from chemical and stain resistant polyvinyl chloride with the addition of impact modifiers. No plasticizers shall be added (plasticizers may aid in bacterial growth).

2. Aluminum: Continuous aluminum retainer of .070-inch (1.8mm) thickness shall be fabricated from 6063-T5 aluminum, with a mill finish.

C. Components
   1. Top caps and bottom caps shall be made of injection molded thermoplastics.
   2. Fasteners: All mounting system accessories appropriate for substrates indicated on the drawings shall be provided.
   3. Optional flexible top caps shall be made of injection molded flexible PVC.

D. Finishes
   1. Vinyl Covers:
      a. Color: as indicated on the drawing.
      b. Surface texture shall be selected by the architect from the manufacturer’s standard selection.
   2. Molded Components: Top caps and bottom caps shall be of a color and texture matching the corner guards.

PART 3 - EXECUTION

3.01 EXAMINATION
   A. Examine areas and conditions in which the items will be installed.
      1. Complete all finishing operations, including painting, before beginning installation of the materials.
   B. Wall surface shall be dry and free from dirt, grease and loose paint.

3.02 PREPARATION
   A. General: Prior to installation, clean substrate to remove dust, debris and loose particles.

3.03 INSTALLATION
   A. General: Locate the rigid vinyl sheet as indicated on the approved detail drawing for the appropriate substrate and in compliance with the manufacturer’s installation instructions.
      1. Install wall surface protection units plumb, level, and true to line without distortions.
      2. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished work.
      3. Install aluminum retainers, mounting brackets, and other accessories in strict accordance with the manufacturer's instructions.
      4. Where splices occur in horizontal runs of over 20 feet (6 m), splice aluminum retainer and plastic cover at same locations along the run.
   B. Installation of Rigid Vinyl Sheet
      1. When rubber base will be applied to the wall receiving the rigid vinyl sheets, the sheets shall not be installed at a point lower than ¾-inch below the top of the rubber base.
      2. Adhere to substrate with a nonflammable, high strength, water-dispersed contact adhesive, with very little odor approved by the manufacturer.
      3. Apply adhesive to cover 100% of the surface receiving the Rigid Vinyl Sheet to ensure appropriate drying.
C. Installation of High Impact Surface Mount Corner Guard:
1. Position the aluminum retainer against the wall, allowing 5/16-inch (8mm) from the bottom of the aluminum to the top of the cove base or baseboard for the bottom cap.
3. Top and Bottom Cap Installation: follow manufacturer installation instructions for the substrate.
4. Position the vinyl cover on the aluminum retainer to check the fit. Adjust the top cap on the aluminum retainer to obtain a tight fit with the vinyl cover.

3.04 CLEANING

A. At completion of the installation, clean surfaces in accordance with the clean-up and maintenance instructions.

END OF SECTION
SECTION 102800
TOILET ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Accessories for toilet rooms, showers and utility rooms
B. Grab bars

1.02 RELATED SECTIONS

A. Section 093013 – Porcelain / Ceramic / Quarry Tile
B. Section 101700 – Toilet Partitions

1.03 REFERENCES

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Toilet Accessories
   1. Bradley Corporation
   2. Kimberly-Clark Corporation
   4. Sloan Company
   5. San Jamar
   6. Substitutions: Section 016000 - Product Requirements

B. All items of each type to be made by the same manufacturer.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.

B. Keys: Provide two (2) keys for each accessory to Tulsa Public Schools; master key all lockable accessories.

C. Fasteners, Screws and Bolts: Hot dip galvanized, tamper-proof, security type.

D. Expansion shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES
A. Stainless Steel: No. 4 satin brushed finish, unless otherwise noted.

2.04 TOILET ROOM ACCESSORIES

A. Toilet Tissue Dispenser: San Jamar #R4000, 9” JBT Junior Roll Twin Tissue Dispenser; Color: TBK Black H12” x W19” x D5¼”.

B. Paper Towel Dispenser: San Jamar #T1100, 8” W x 8” Dia. Roll Towel Dispenser; Color: TBK Black H16 ⅜” x W12-15/16” x D9¼”.

C. Hand Dryer: Bobrick B-7128, surface mounted, sensor operated; Color: Stainless Steel H13-19/32” x W13-25/32” x D4”

D. Grab Bars: Stainless steel, 1-1/2 inches outside diameter, minimum 0.05 inch wall thickness, nonslip grasping surface finish, concealed flange mounting; 1-1/2 inches clearance between wall and inside of grab bar.

1. Length: 36 inches.
2. Length: 42 inches.
3. Length and configuration: As indicated on drawings

E. Combination Sanitary Napkin/Tampon Dispenser: Stainless steel, semi-recessed.

F. Sanitary Napkin disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.

2.05 SHOWER AND TUB ACCESSORIES

A. Shower Curtain Rod: Stainless steel tube, 1 inch outside diameter, 0.04 inch wall thickness, satin-finished, with 3 inch outside diameter, minimum 0.04 inch thick satin-finished stainless steel flanges, for installation with exposed fasteners.

B. Shower curtain: Opaque Vinyl, 0.008 inch thick, matte finish, with antibacterial treatment, flameproof and stain-resistant.

1. Size: 42 x 72 inches, hemmed edges
2. Grommets: Stainless steel; pierced through top hem on 6 inch centers

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.
3.03 INSTALLATION

A. Install accessories in accordance with manufacturers’ instructions.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights and Locations: As required by accessibility regulations and as indicated on drawings.

END OF SECTION
SECTION 104300
INTERIOR SIGNAGE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE

A. Furnish all material, labor and engineering services necessary to fabricate and install signage.

1.3 REFERENCES

A. Signs and their installation shall comply with applicable provisions of the latest edition of the following standards and with requirements of authorities having jurisdiction:
   1. ADAAG – Americans with Disabilities Act Accessibility Guidelines; US Architectural and Transportation Barriers Compliance Board.

1.4 SUBMITTALS

A. Submit under provisions of Section 013000.

B. Product Data: Manufacturer's data sheets on each product to be installed, including operation and maintenance data.

C. Shop Drawings: Shop Drawings shall be complete with installation details.
   1. Show details that indicate sizes, lettering, graphics, and construction details of each type of sign.
   2. Show features of components, including but not limited to edge conditions, profiles, accessories, finishes, and textures.
   3. Show layout, profiles, sign mounting types, heights, anchorage methods, and attachment devices.

D. Sample of two sign types for verification of materials, color, pattern, overall quality, and for adherence to drawings and requirements indicated.

1.5 QUALITY ASSURANCE

A. Manufacturer specializing in manufacturing the products specified in this section with minimum five years experience. Obtain signs from one source and a single manufacturer.

B. Installer Qualifications: Minimum two years documented experience in work of this Section.

C. Mock-Up: Provide a mock-up for evaluation of material, workmanship.
   1. Construct areas designated by Architect.
   2. Do not proceed with remaining work until material, details and workmanship are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.
   4. As approved by Architect, mockup may be incorporated into finished work.
1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's recommendations for delivery, storage and handling.

B. Materials shall be delivered to the location in unopened, labeled factory containers. Upon delivery, materials shall be inspected for damage. Deficient materials shall not be used.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer’s absolute limits.

1.8 WARRANTY

A. Provide manufacturer's warranty against defects in materials or workmanship for minimum 5 years.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Interior signage shall equal to Innerface (1-800-445-4796), Signature System, and shall match or equal that shown on the drawings and the specification here within.

B. Alternate manufacturers meeting these specifications are acceptable.

2.2 SIGN STANDARDS

A. Typography

1. Type style: see drawings. Copy shall be a true, clean, accurate reproduction of typeface(s) specified. Upper and lower case or all caps shall be as indicated in Sign Type drawings and Signage Schedule. Letter spacing to be normal and interline spacing shall be set by manufacturer.

2. Arrows, symbols and logo art: To be provided in style, sizes, colors and spacing as shown in drawings and shall meet code requirements.

3. Grade II Braille utilizing perfectly round, clear insertion beads.

4. Text shall be dual language; English and Spanish

B. Color and Finishes

1. Colors, patterns and artwork: see drawings.

2. Message Background: see drawings.

3. Finishes shall meet current Federal ADA and all State and local requirements.

2.3 SIGNS

A. Architectural Signage System

1. The signage shall incorporate a decorative laminate face with applied graphics including all tactile requirements in adherence to ADA specifications.

2. All signs, including work station and room ID's, overheads and flag mounts, directionals and directories shall have a matching appearance and constructed utilizing the same manufacturing process to assure a consistent look throughout.

3. Safe Room signage shall conform to requirements identified on drawings.

B. General

1. All text shall be Helvetica font. Heights as indicated on drawings.

2. Title 24 Braille: Braille dots shall be half hemispherical domed and protruding a minimum 0.025".
C. Materials and Construction
1. Sign face shall be 0.035" (nominal) standard grade, high pressure surface laminate. A painted sign face shall not be acceptable.
2. The sign shall incorporate balanced construction with a core sandwiched between laminates to prevent warping. An acrylic substrate shall not be acceptable. Laminate on the sign face only shall not be acceptable.
3. Tactile lettering shall be precision machined, raised 1/32", matte PETG and subsurface colored for scratch resistance.
4. Sign and backer edge shall be treated with a hot wax seal moisture integrity.
5. Signage with replaceable inserts shall accommodate an 8-½” wide insert printed on standard width paper and shall not have an end cap enclosing the insert. Replacement of the insert shall not require any mechanism and shall be easily replaced.
6. Insert components shall have a .080 thickness non-glare acrylic window and shall be inlaid flush to sign face for a smooth, seamless appearance.
7. The signage shall include module options allowing for inserts, notice holders, occupancy sliders, marker, magnetic, and cork in boards. All modules shall be flush to sign face for a smooth, seamless appearance.
8. The laminates (front and back) shall be precision machined together to a 90-degree angle. Edges shall be smooth, void of chips, burrs, sharp edges and marks.
9. The signage shall utilize an acrylic sphere for Grade II Braille inserted directly into a scratch resistant, high pressure laminate sign face. Braille dots are to be pressure fit in high tolerance drilled holes.
10. Text, graphics, border and Braille shall be raised from background.
11. The signage shall utilize a pressure activated adhesive. The adhesive shall be nonhazardous and shall allow for flexing and deflection of the adhered components due to changes in temperature and moisture without bond failure.
12. All signs shall be provided with appropriate mounting hardware. Hardware shall be finished and architectural in appearance and suitable for the mounting surface.
13. Some signs may be installed on glass. A blank backer is required to be placed on the opposite side of the glass to cover tape and adhesive. The backer shall match the sign in size and shape.

D. Printed Inserts
1. The signage contractor shall provide and install all signage inserts as required on drawings.
2. Manufacturer shall provide a template containing layout, font, color, artwork and trim lines to allow Owner to produce inserts on laser or ink jet printer. The template shall be in an Acrobat or Word format (.pdf).

PART 3 EXECUTION

3.1 SITE VISITS

A. Site visits – 3 site visits shall be required by the sign contractor.
1. Prior to submission of bid for site assessment and evaluation.
2. Post award for the purposes of meeting with Owners and project manager.
3. Final walk-through and punchlist.

B. Programming – sign contractor shall perform all wayfinding & programming. Programming shall include location plan, message schedule, and/or plots, fire/evacuation maps and insert graphics. All programming materials shall be submitted for approval.

3.2 CODE COMPLIANCE

A. It shall be the responsibility of the successful bidder to meet any and all local, state, and federal code requirements in fabricating and installing signs.
3.3 DELIVERY, STORAGE, PROTECTION
A. Package to prevent damage or deterioration during shipment, handling, storage and installation. Products should remain in original packaging until removal is necessary. Store products in a dry, indoor location.

3.4 EXAMINATION
A. Installer shall examine signs for defects, damage and compliance with specifications. Installation shall not proceed until unsatisfactory conditions are corrected.
B. Inspect conditions of substrate and other conditions which may affect installation of signage.
C. Do not begin installation until substrates are within manufacturer’s specified tolerances and have been prepared in accordance with manufacturer’s instructions.
D. If substrate preparation is the responsibility of another installer, do not proceed with installation. Notify Architect of unsatisfactory preparation immediately.
E. Commencement of work is deemed as acceptance of installation conditions.

3.5 INSTALLATION
A. General: Installation locations shall be in accordance with ADA specifications. Locate signs where indicated using mounting methods in compliance with manufacturer’s written instructions per required method.
1. The signage contractor shall coordinate installation schedules with the Owner and/or Construction Manager.
2. Installation shall be performed by manufacturer’s personnel trained and certified in manufacturer’s methods and procedures.
3. The signage contractor shall submit a CAD generated location plan noting the location of all signage and cross referenced to message schedule or plots for architect’s approval.
4. Install in accordance with manufacturer’s printed installation instructions, and in proper relationship with adjacent work.
5. Installer to conduct a pre-installation to verify copy and sign location. Each location shall be noted using a low tack vinyl reproduction of actual sign. Full scale renderings of directories and directionals shall also be provided. Any location discrepancy or message issues shall be submitted to Architect for review.
6. Signs shall be level, plumb, and at heights indicated with sign surfaces free from defects.
7. Upon completion of the work, signage contractor shall remove unused or discarded materials, containers and debris from site.
8. Protect installed products until completion of project.

3.6 SCHEDULES
A. Refer to Room Finish Schedules & Drawings for signage locations and designations.

3.7 STANDARDS MANUAL
A. Manufacturer shall provide a comprehensive Standards Manual in both a paper and PDF format. The manual shall include all graphic standards, sign type descriptions, renderings showing color, pattern and finish, engineering drawings, location plans, plots, artwork, insert templates, mounting detail, and reorder information.

END OF SECTION
SECTION 104413
FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Fire extinguishers.
   2. Extinguisher cabinets.
   3. Accessories.

B. Related Requirements:
   1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
   2. Section 013000 - Submittal Procedures: For administrative and procedural requirements for processing of submittals during the construction phase.
   3. Section 017800 - Closeout Procedures: For administrative and procedural requirements for completion of the Work.

1.02 REFERENCES

A. Reference Standards:
   1. ASTM International (ASTM):
   2. International Code Council (ICC):
   3. Intertek Testing Services/Warnock-Hersey International (ITS/WHI)
      a. NFPA 10-2010, Standard for Portable Fire Extinguishers: For criteria covering installations for Class A, B, C, D, and K hazards as well as the selection, inspection, maintenance, recharging, and testing of portable fire extinguishing equipment.
   5. Underwriters Laboratories, Inc. (UL)

1.03 ACTION SUBMITTALS

A. Submit in accordance with Section 013000:
   1. Product Data:
      a. Cabinets: Materials description for fire extinguisher cabinets include roughing-in dimensions, details showing mounting methods, relationships to surrounding construction, door hardware, cabinet type and materials, trim style and door construction, door style and materials.
      b. Extinguishers: Materials description for fire extinguishers; include ratings and classifications.
      c. Installation instructions for each product specified.
   2. Shop Drawings:
      a. Small-scale plans showing locations of fire extinguisher cabinets and individual fire extinguishers.
      b. Schedules showing each type of cabinet and extinguisher to ensure proper fit and function.
      c. Indicate installation procedures and accessories required for a complete installation.
1.04 INFORMATIONAL SUBMITTALS
A. Warranty: Sample of special warranty.

1.05 QUALITY ASSURANCE
A. Comply with standards referenced in Article 1.02 - REFERENCES.
B. Provide fire extinguishers, cabinets and accessories produced by a single manufacturer.
C. Provide fire extinguishers of type approved by UL, State Fire Marshal's Office, and local regulatory agencies, if any.
D. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, and handle fire protection specialties and related materials using means and methods that will prevent damage, deterioration, or loss.
   1. Deliver components in manufacturer's original packaging, properly labeled for identification.

PART 2 - PRODUCTS
2.01 FIRE PROTECTION SPECIALTIES MANUFACTURERS
A. Acceptable Manufacturers:
   J. L. Industries, Inc., a division of Activar Construction Products Group
   9702 Newton Av S
   Bloomington, MN  55431
   (800) 554-6077
   (952) 835-6850
   (952) 835-2218 (FAX)
   SALES@ACTIVARCPG.COM
   www.activarcpg.com

B. Substitutions: Manufacturers seeking approval of their products shall submit for approval prior to bidding in accordance with General Requirements.

2.02 FIRE EXTINGUISHERS
A. Multi-Purpose Chemical Type: Extinguisher unit containing a fluidized and siliconized mono ammonium phosphate powder; nonconductive and nontoxic.
   1. Construction: Heavy duty steel cylinder with metal valve and siphon tube, O-ring seal, replaceable valve stem seal, visual pressure gage, pull pin and upright squeeze grip.
   2. Finish: Factory powder-coated; Red.
   4. Model Identification and UL Rating: Cosmic 10E; 4A-80BC
   5. Provide ABC extinguishers at all non-Kitchen locations.

B. Accessories:
   1. Mounting Brackets:
      a. Standard Brackets: Provide manufacturer's standard steel bracket, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated.

2.03 EXTINGUISHER CABINETS
A. Cabinet with Steel Trim and Door: Ambassador Series, Models 1012 and 2012
2. Components:
   a. Tub: Cold-rolled steel.
      1) Finish: Factory-applied powder coat paint finish.
   b. Door and Trim Construction: Cold-rolled steel; flush doors with 5/8 inch (15.88 mm) door stop attached by continuous hinge and equipped with zinc-plated handle with roller catch.
      1) Finish: Factory-applied powder coat paint finish.
   c. Trim Style and Depth:
      1) Semi-Recessed Cabinet:
         a) Rolled Edge: 4 inch (101.60 mm)
3. Fire-Rating: None

2.04 CABINET DOOR STYLES, GLAZING TYPES, AND ADDITIONAL OPTIONS
A. Door Style: Style S21 - Solid; no glazing; with pull handle.
B. Additional Options:
   1. Wall Signs and Cabinet Lettering:
      a. Text: FIRE EXTINGUISHER; vertical
      b. Color(s): Red.
   2. Door Hardware:
      a. ADA flush pull.

2.05 SOURCE QUALITY CONTROL
A. Ship extinguishers to the Project site fully charged, EXCEPT those which contain water as an extinguishing agent, if any.
B. Obtain Fire Extinguishers and Fire Extinguisher Brackets from same manufacturer to ensure compatibility.

PART 3 - EXECUTION

3.01 EXAMINATION
A. Examine walls and partitions for suitable framing depth and blocking where recessed and semi-recessed cabinets will be installed, and blocking where surface mounted cabinets will be installed.
   1. Notify the Contractor in writing of conditions detrimental to proper and timely completion of the installation.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION
A. Install cabinets in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.
   1. Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.
   2. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.
   3. Maintain fire ratings where cabinets are recessed into fire-rated wall systems.
B. Cabinet Lettering:
   1. Location: Face of door framing.
   2. Apply lettering at the factory.

3.03 FIELD QUALITY CONTROL

A. Ensure that each extinguisher is fully charged, and that inspection of each extinguisher has been performed, as evidenced by the National Association of Fire Equipment Distributors certification tag, just prior to turnover.

3.04 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.

E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Design, fabrication, and installation of welded extruded aluminum walkway cover systems.

B. Products Furnished but not Installed Under this Section: Column sleeves (styrofoam blockouts) and anchor bolts.

1.02 REFERENCES

A. The Aluminum Association (AA):

B. American Architectural Manufacturers Association (AAMA):
   1. AAMA 611, Voluntary Specification for Anodized Architectural Aluminum.

C. American Society of Civil Engineers (ASCE):

D. American Society for Testing and Materials (ASTM):
   1. ASTM B 209, Specification for Aluminum and Aluminum- Alloy Sheet and Plate.

E. American Welding Society (AWS):

1.03 SYSTEM DESCRIPTION

A. Design Requirements:
   2. Comply with the wind requirements of ASCE 7.
   3. Provide an all welded extruded aluminum system complete with internal drainage. Non-welded systems are not acceptable.
   4. Provide expansion joints to accommodate temperature changes of 120 degrees F. Provide expansion joints with no metal to metal contact.

B. Performance Requirements:

1.04 SUBMITTALS

A. Product Data: Manufacturer’s product information, specifications, and installation instructions for walkway cover components and accessories.

B. Shop Drawings: Include plan dimensions, elevations, and details.
C. Samples:
   1. Verification: 2-inch-square samples of each finish selected on the substrate specified.

D. Design Data: Design calculations and drawings bearing the seal of a Registered Professional Engineer, licensed in the State of Oklahoma. Design calculations shall state that the walkway cover system design complies with the wind requirements of ASCE 7, the stability criteria of applicable building code, and all other governing criteria.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: At least ten years of experience in the design, fabrication, and erection of extruded aluminum walkway cover systems.

B. Installer Qualifications: Walkway covers shall be installed by manufacturer, third party installation is not acceptable.

PART 2 PRODUCT

2.01 MANUFACTURERS

A. The design is based on products fabricated by: Peachtree Protective Covers, Inc., 1477 Rosedale Drive, Hiram, GA 30141, 770-439-2120, fax 770-439-2122.
   1. Comparable products by the following manufacturers also will be acceptable:
      a. Dittmer Architectural Aluminum.
      b. Avadek Walkway Cover Systems.
   2. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.02 MATERIALS

A. Aluminum Members: Extruded aluminum, ASTM B 221, 6063 alloy, T6 temper.

B. Fasteners: Aluminum, 18-8 stainless steel, or 300 series stainless steel.

C. Protective Coating for Aluminum Columns Embedded in Concrete: Clear acrylic.

D. Grout:
   1. Portland Cement: ASTM C 150, Type I.

E. Gaskets: Dry seal santoprene pressure type.

F. Aluminum Flashing: ASTM B 209, Type 3003 H14, 0.040 inch, minimum.

2.03 MIXES

A. Grout: 1 part portland cement to 3 parts sand, add water to produce a pouring consistency.

2.04 FABRICATION

A. General:
   1. Shop Assembly: Assemble components in shop to greatest extent possible to minimize field assembly.
   2. Welding: In accordance with ANSI/AWS D1.2.
   3. Bent Construction: Factory assemble beams to columns to form one-piece rigid bents. Where used make welds smooth and uniform using an inert gas shielded arc. Perform
suitable edge preparation to assure 100% penetration. Grind welds only where interfering with adjoining structure to allow for flush connection. Field welding is not permitted. Rigid mechanical joints can be used if supported by engineering calculations and/or testing.

4. Deck Construction: Fabricate from extruded modules that interlock in a self-flashing manner. Positively fasten interlocking joints creating a monolithic structural unit capable of developing the full strength of the sections. The fastenings must have minimum shear strength of 350 pounds each. Assemble deck with sufficient camber to offset dead load deflection.

B. Columns: Provide radius-cornered tubular extrusions with cutout and internal diverter for drainage where indicated. Circular downspout opening in column not acceptable.

C. Beams: Provide open-top tubular extrusion, top edges thickened for strength and designed to receive deck members in self-flashing manner.

D. Deck: Extruded self-flashing sections interlocking into a composite unit. Provide welded plate closures at deck ends.

E. Fascia: Manufacturer’s standard shape. Provide fascia splices where continuous runs of fascia are jointed. Locate splices to be in line with bents and fasten in place on hidden or non-vertical surfaces.

F. Factory Finishing: Finish designations prefixed by AA comply with system established by the AAMA for designating aluminum finishes.

1. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system, except with a minimum dry film thickness of 1.5 mils (0.04 mm), medium gloss), complying with AAMA 2603. Apply baked enamel complying with paint manufacturer’s specifications for cleaning, conversion coating, and painting. Color shall match existing “Green” metal panel color at existing school.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that all concrete, masonry, and roofing work in the vicinity is complete and cleaned.

3.02 ERECTION

A. Erect protective cover true to line, level, and plumb. Protect aluminum columns embedded in concrete with clear acrylic. Fill downspout columns with grout to the discharge level to prevent standing water. Install weep holes at top of concrete in non-draining columns to remove condensation.

B. Provide hairline miters and fitted joints.

3.03 CLEANING

A. Clean all protective cover components promptly after installation.

3.04 PROTECTION

A. Protect materials during and after installation.

END OF SECTION
SECTION 124920
MANUAL ROLLER SHADES

PART 1 - GENERAL

1.01 DESCRIPTION
A. Manual roller shades

1.02 REFERENCES
A. ASTM International (ASTM):
2. ASTM E 22 - Recommended Practice for Conducting Long Time High Temperature Tension Test of Metallic Materials.

B. National Fire Protection Association (NFPA):
1. NFPA 70 - National Electrical Code.

C. Underwriters Laboratories Inc. (UL).

1.03 SUBMITTALS
A. Submit under provisions of Section 013000.

B. Product Data: Latest edition of Manufacturer's literature including:
1. Performance data and installation procedures meeting the requirements herein. Including installation details, styles, material descriptions, profiles, features, finishes and operating instructions.
   a. Preparation instructions and recommendations.
   b. Storage and handling requirements and recommendations.
   c. Mounting details and Installation methods.

C. Maintenance Data: Submit instructions and precautions for cleaning and maintenance; operating hardware and controls as applicable.

D. Manufacturer’s Material Safety Data Sheet (MSDS) for each product being used.

E. Submit working hand sample or mock up shade (mock up shade may be used as a final shade if approved).

F. Shop Drawings: Submit manufacturer's shop drawings, including plans, elevations, sections, product details and finishes, installation details, operational clearances, wiring diagrams if applicable, and relationship to adjacent work.

G. Window Treatment Schedule: Submit a schedule with same room designations indicated on the Drawings; including but not limited to opening sizes and key to typical mounting details. Indicate side Control Loop shall be installed.

H. Samples:
1. Submit two 4” x 6” samples of shade fabric material indicating color.
2. Submit two 4” x 6” samples of the fascia material indicating color.
1.04 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Engaged in manufacturing of products of similar type to that specified, with a minimum of 10 years successful experience.

B. Installer Qualifications: Minimum 2 years successful experience installing similar products.

C. Single Source Requirements: To the greatest extent possible, provide products specified in this section from a single manufacturer.

1.05 DELIVERY, STORAGE AND HANDLING

A. Product to be delivered in manufacturer’s original packaging.

B. Products to be handled and stored to prevent damage to materials, finishes and operating mechanisms. Store in a clean, dry area, laid flat to prevent sagging and twisting of packaging.

1.06 PROJECT CONDITIONS, COORDINATION AND SEQUENCING

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer’s recommended limits.
   1. Building shall be enclosed; windows, frames and sills shall be installed and glazed.
   2. Wet work shall be complete and dry.
   3. Ceilings, window pockets, electrical and mechanical work above window covering shall be complete.

1.07 WARRANTY

A. Minimum 5 year.

PART 2 - PRODUCTS

2.01 MANUFACTURER AND PRODUCT DESCRIPTION

A. InPro
   1. Clickeze
   2. Arid solar screen fabric
   3. Fabric Color: Charcoal/Sable

B. Springs Window Fashions (SWF) Contract
   1. Shading Systems
   2. Double-Take T300
   3. Fabric Color: Grey/Bronze

C. Substitution Request: Not permitted

2.02 MANUAL ROLLER SHADES

A. Product: manual roller shade
   1. Shade fabric shall be flame retardant, fade and stain resistant, anti-static, anti-microbial.
a. Passes NFPA 701-1999 FR  
b. Passes ASTM-G21 and G22  
c. Shades with railroaded fabric will have heat-welded seams.  
d. Fabric Style: 3% Openness  
e. Shading Coefficient with single ¼” clear glass: 0.65-0.68  
f. All shades within a room shall be from the same dye lot

2. **Roller tube** shall be extruded aluminum engineered with a channel to accept fabric spline. The tube size will be determined by the manufacturer based on window size and fabric selection.

3. **Clutch** system shall be made of glass-reinforced, polyester thermopolymer (PBT) for wear resistance, smooth operation and corrosion resistance. The clutch is comprised of multi-banded, steel springs that lock the shade in any position when operating the control loop. The clutch mechanism is bi-directional and never requires adjustment or lubrication.

4. **Control loop** shall be a #10 stainless steel bead chain. Bead stops attached to the chain protect the shade from over rotation. Bead stop shall be placed so that no more than the hembar shows below fascia when shade is fully rolled up.
   a. Length of chain shall be from mechanism to 48-inches above finished floor.

5. **Idler** end shall be made of high strength, glass-reinforced, polyester thermopolymer (PBT) for wear resistance, smooth operation and corrosion resistance.

6. **Lift assist system** shall be a heavy-duty torsion spring located inside the roller tube. The mechanism reduces the pull force allowing easy lifting of larger shades.

7. **Spline system** shall consist of a PVC spline heat-welded to the shade fabric and inserted into a channel on the roller tube. The spline system allows for adjustability on-site and ease in changing fabric panels in the field.


9. **Battens** shall be enclosed in a heat-welded pocket providing additional stabilizing on large shades. Batten placement will be determined by the manufacturer based on window size and fabric selection.

10. **Installation brackets** shall be .125” thick steel and can accommodate overhead, side and face mounting. Optional dual shade brackets shall hold two shades in one bracket assembly. Coupled shades shall be connected with a linking bracket mechanism.

11. **Mounting:**
   a. Typically outside mounted.
   b. Measure so a run of fascias are butting next to each other with no gaps and out to wall on ends.
   c. Control loop shall typically be on the right side of the window unless access does not meet accessibility codes.

**2.03 ACCESSORIES**

A. **Fascia panel** shall be 4.25” or 7.625” dual shade snap-on design and made of 062” thick extruded 6063 T-5 aluminum alloy

1. Finish: either a powder-coated finish to match window mullion that is bronze or a clear anodized finish for window mullions of a color other than bronze, see drawings for specific colors.
2. Brackets shall be universal and shall be clear anodized finish.

B. **End Caps.** Same finish as fascia shall be placed on all fascia’s with exposed ends. This may be a gap between fascia ends of 1-1/2 inch or more.

C. **Locking Chain Guide.** User to identify each location per window due to odd situations.

**2.04 FABRICATION**

A. Fabricate shades to hang flat without buckling or distortion.

**PART 3 – EXECUTION**

**3.01 PREPARATION**

A. Installer shall be responsible for inspection of jobsite, approval of mounting surfaces, blocking for shade brackets or pocket assemblies, suspended acoustical or gypsum ceiling for recessed shades, verification of field measurements and installation conditions. Installation shall commence when satisfactory conditions are met.

B. Do not proceed with installation until substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

C. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

**3.02 INSTALLATION**

A. Install window treatments in accordance with manufacturer's instructions including the following.
   1. Install with adequate clearance to permit smooth operation of the shades throughout entire operational range.
   2. Adjust and balance window coverings to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

B. Provide manual roller shades where indicated on Room Finish Schedule. Connecting Corridor windows do not require roller shades.

**3.03 CLEANING AND PROTECTION**

A. Clean surfaces after installation in accordance with manufacturer's written instructions. Do not use cleaning methods involving heat, bleach, abrasives, or solvents.

B. Protect installed products until completion of project. Repair damaged or improperly installed before Substantial Completion.

**END OF SECTION**
PART 1 - GENERAL

1.1 DESCRIPTION:

A. Work Included: Provide plumbing where shown on the Drawings, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to:
   1. Domestic hot and cold water piping system.
   2. Drain, waste, and vent systems.
   3. Gas piping system.
   4. Plumbing fixtures and trim as shown on the Drawings.

B. Related Work: Documents affecting Work of this Section include, but are not necessarily limited to: General Conditions, Supplementary, and Sections in Division 1 of these Specifications.

C. Drawings: The mechanical drawings show the general arrangement of piping, equipment, and appurtenances and shall be followed as closely as actual building construction, site conditions, and the work of other trades will permit. The mechanical work shall conform to the requirements shown on all of the drawings. General and structural drawings shall take precedence over mechanical drawings. Because of the small scale of the mechanical 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.

1.2 QUALITY ASSURANCE:

A. 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.

B. Codes and Regulations:
   1. In addition to complying with the specified requirements, comply with pertinent regulations of governmental agencies having jurisdiction, all applicable laws, codes, and ordinances including those of the state, county and city.
   2. The Work shall also comply with all applicable requirements of the International Building, Plumbing and Mechanical Codes, and all locally accepted amendments to these codes.
   3. In the event of conflict between or among specified requirements and pertinent regulations, the more stringent requirement will govern.
   4. Non-compliance: Should the contractor perform any work that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards, and utility company regulations, he shall bear all costs arising in correcting the deficiencies.

C. Certificate of Final Inspection: Under each applicable section of the specifications, the contractor shall, upon completion of the work under that section, furnish a certificate of final inspection from the department having jurisdiction.
1.3 EXAMINATION OF SITE:

A. Visit the site, inspect the existing Conditions and check the Drawings and Specifications so as to be fully informed of the requirements for completion of the Work.

B. Lack of such information shall not justify a request for extra compensation to the contract price.

1.4 MATERIAL AND EQUIPMENT:

A. All materials and equipment shall be new, those of the same type shall be by the same Manufacturer, and shall be of the best quality and design and free from defects.

B. A Manufacturer's nameplate affixed in a conspicuous place will be required on each major component of equipment stating Manufacturer's name, address and catalog number.

C. Manufacturer's name and model numbers used herein and on the Drawings establish type and quality required. Equal products may be considered if submitted in writing to the Engineer/Architect for approval 10 days prior to bid date. The Contractor shall be responsible for assuring the items and equipment substituted for those shown on the Drawings will physically fit in the space allocated.

D. Delivery and Storage: Equipment and materials shall be delivered to the site and stored in original containers, suitably sheltered from the elements, but readily accessible for inspection until installed. All items subject to moisture damage (such as controls) shall be stored in dry, conditioned spaces.

E. Protection: Equipment shall be tightly covered and protected against dirt, water and chemical or mechanical injury. Damage or defects developing before acceptance of the work shall be made good at the contractor's expense.

F. Dimensions: It shall be the responsibility of the contractor to insure that items to be furnished fit the space available. He shall make necessary field measurements to ascertain space requirements, including those for connections, and shall furnish and install sizes and shapes of equipment so that the final installation shall suit the true intent and meanings of the drawings and specifications.

G. Manufacturer's Directions: Shall be followed completely in delivery, storage, protection and installation of all equipment and materials. The contractor shall promptly give notice in writing of any conflict between any requirement of the Contract Documents and the manufacturer's directions and shall obtain written instructions before proceeding with the work. Should the contractor perform any work that does not comply with the manufacturer's directions or such written instructions, he shall bear all costs arising in correcting the deficiencies.

1.5 SUBMITTALS:

A. Comply with pertinent provisions of Division 1.

B. Product Data: After the Contractor has received the Owner's Notice to Proceed, submit:
   1. Materials list of items proposed to be provided under this Section.
2. Manufacturer's Specifications, catalog cuts, and other data needed to prove compliance with the specified requirements.
3. Shop Drawings and other data as required to indicate method of installing and attaching equipment, except where such details are fully shown on the Drawings.
4. All sheets of the submittal shall have the job name stamped or permanently written neatly on them and shall be assembled in an indexed brochure. The descriptive material shall be arranged in the brochure in the same order as found in the specifications. Each brochure shall be submitted in a hardback, 3-ring binder. The leading sheet of the descriptive material for each item shall be full size, of heavy paper, with a numbered outside tab, and an index sheet showing the location in the brochure.
5. Manufacturer's regular catalog sheets will not be acceptable under these requirements unless they indicate completely all of the specification requirements. Where drawings cover several sizes or types of construction, they shall clearly indicate the size or type of construction to be used on the project. In cases where several sizes of the same type of equipment are required to be furnished, the submittal shall include a schedule identifying each piece of equipment, complete with all capacity information needed to compare every submittal item with its respective specified item. Special features shall be listed on a separate typewritten sheet.
6. Brochures shall contain a certification by the Contractor that the equipment or materials are suitable for conditions shown and specified; that the equipment or materials are believed to be in conformity with the plans and specifications, except as may be specifically described; be signed by the Contractor. Brochures received not in conformity with these requirements will be returned for required action.
7. Finding "APPROVED" or "APPROVED AS NOTED" shall not eliminate responsibility for compliance with the plans and specifications, unless specific attention has been called, in writing, to the proposed deviations at the time of transmittal of the brochures and such deviations have been found acceptable, nor shall it eliminate the responsibility for freedom from errors of any sort in the data submitted. Discovery of such deviations at or after installation shall be cause for immediate replacement at no additional cost to the Owner.
8. No material or equipment so governed shall be ordered until found acceptable by the Architect/Engineer/Owner.
9. Electronic submittals shall follow the above requirements and be assembled in a PDF format when issued for review.
10. All above requirements will be provided when submittals are presented for review. If submittal requirements are not followed, review of submittal will not proceed until requirements are complete.

C. Sterilization Certificate: Upon completion of water line sterilization, deliver to the Architect two copies of an acceptable "Certificate of Performance" for that activity.

D. Record Drawings:
1. Comply with pertinent provisions of Division 1.
   a. Record Drawings- The contractor shall furnish to the owner CAD record drawings consisting of three (3) sets of 11" x 17" prints (To be bound in O&M Manuals), one (1) full size set of prints and one (1) disk, showing the piping and ductwork for the HVAC and plumbing systems. Piping sizes, rerouting, etc., for both under floor and above ceiling piping shall be shown. Also, provide a blue-line of the site plan, clearly marked, to indicate any and all changes in sanitary sewer, domestic cold water and natural gas piping to the building.
      1) CAD Record drawings shall incorporate all change and field orders. (No separate or supplemental drawings).
2) All equipment schedules to be revised to reflect installed manufacturer model numbers and capabilities.

2. Include a copy of the Record Drawings in each copy of the operation and maintenance manual as described below. (Original document shall be reproducible paper.)

E. Manuals: Upon completion of the Work of this Section, deliver to the Architect two copies of an operation and maintenance manual compiled in accordance with the provisions of Division 1 of these Specifications. Include within each manual:
1. Copy of the approved record documents for this portion of the Work.
2. Copies of all warranties and guarantees.
3. Description of equipment control and seasonal operation, including schedule of required maintenance.

1.6 PRODUCT HANDLING:
A. Comply with pertinent provisions of Division 1.

1.7 INSPECTION:
A. Make written notice to the Architect adequately in advance of each of the following stages of construction:
   1. In the underground Condition prior to placing concrete floor slab, when all associated Work is in place.
   2. When all rough-in is complete, but not covered.
   3. At completion of the Work of this Section.

B. When material and/or workmanship is found to not comply with the specified requirements, within three days after receipt of notice of such non-compliance, remove the non-complying items from the job site and replace them with items complying with the specified requirements, all at no additional cost to the Owner.

1.8 CLEANING, TESTING AND PLACING IN SERVICE:
A. Immediately prior to final inspection, the Contractor shall make a final cleanup of dirt and refuse resulting from his Work and shall assist in keeping the premises clean at all times.

B. Immediately prior to final inspection, the Contractor shall clean all material and equipment installed under this Contract. Dirt, dust, plaster, stains and foreign matter shall be removed from all surfaces. Damaged finishes shall be touched up and restored to their original Condition.

C. Mechanism of all equipment shall be checked, adjusted and tested for proper operation. Protective devices and parts shall be checked and tested for specified and required application and adjusted as required to produce the intended performance.

1.9 ADJUSTMENT AND INSTRUCTION:
A. Energize all systems, equipment and fixtures and check for proper operation.
B. The Contractor's service personnel shall instruct the Owner's Representative in the proper operation of all systems.

1.10 GUARANTEE:

A. The Contractor guarantees all Work against any defects due to faulty workmanship or material and that all raceways, ducts, and piping are free from foreign material, obstructions, holes, or breaks of any nature.

B. Upon written notice from the Architect or Owner, the Contractor shall promptly remedy without cost to the Owner any defects occurring within a period of one (1) year from the date of final acceptance.

1.11 WARRANTY:

A. The Contractor shall properly execute in the Owner's name all Manufacturer's standard warranty certificates applying to equipment installed on the project and shall deliver said certificates to the Architect at completion of the job. All warranty cards shall also be properly executed and delivered to the supplier or Manufacturer's representative for Manufacturer's records. Standard warranties for equipment shall not be less than one (1) year.

PART 2 - PRODUCTS

2.1 PIPE SCHEDULE:

A. Drain, Waste, and Vent System:
   1. For sanitary Work below the floor and outside underground:
      a. Provide service weight cast iron pipe and fittings or Schedule 40 PVC.
      b. Soil lines 5'-0" or more away from the structures may be Schedule 40 PVC.
   2. Above ground:
      a. Provide service weight cast iron pipe and fittings with No-Hub joints. Schedule 40 PVC.

B. Water System (domestic piping):
   1. Above ground, provide Type "L" copper with sweated connections.
   2. Below grade, provide Type "K" copper with sil-fossed connections. Schedule 40 PVC may be used for water service, if allowed by local codes.
   3. Below grade water service piping, provide PEX ASTM F 877, SDR 9 tubing.

C. Gas Piping:
   1. Underground piping equal to Republic X-Tru-Coat plastic coated black steel pipe with protective wrap over joints.
      a. Piping 2" and smaller: Threaded fittings.
      b. Piping 2-1/2" and larger: Welding fittings.
   2. Above ground piping shall be black steel.
   3. Gas service piping up to the building shall be continuous plastic pipe meeting ASTM D2513 and D2517.
2.2 MATERIALS:

A. Cast Iron Soil Pipe and Fittings:
   1. Provide service weight cast iron conforming to ASTM A74 and CISPI 30l, or provide hubless type per above standards. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be listed by NSF International.

B. Galvanized:
   1. Provide standard weight complying with ASTM A53 and A120 for above ground piping. (Galvanized not allowed underground or under slab floors.)

C. Copper Pipe:
   1. Provide copper pipe conforming to ASTM B42 and B302. (Type "M" copper not allowed underground or under slab floors.)

D. Copper Tube:
   1. Provide copper tube conforming to ASTM B75, B88, and B251. (Type "M" copper not allowed underground or under slab.)

E. Polyvinyl Chloride Pipe:
   1. Provide PVC pipe conforming to ASTM D2665 for waste, vent, and drainage pipe above and underground within 5'-0" of the building.
   2. Provide PVC pipe conforming to ASTM D2265 for building sewer pipe.

F. PEX Tubing
   1. PEX Distribution System: ASTM F 877, SDR 9 tubing.
   2. Fittings for PEX Tube: ASTM F 1807, metal-insert type with copper or stainless-steel crimp rings and matching PEX tube dimensions.
   3. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F 877; with plastic or corrosion-resistant-metal valve for each outlet.
   4. Provide Pexrite pipe guide for underground risers through concrete slab to provide vertical pipe penetration. Use of pipe guide does not eliminate inclusion of pipe sleeve through concrete slab

G. Black Steel Pipe:
   1. Provide black steel pipe conforming to ASTM A53 and A120.

H. Fittings:
   1. 2" and smaller provide standard cast iron threaded fittings.
   2. 2-1/2" and larger provide standard Butt Welding fittings.

I. Unions:
   1. For copper lines, provide copper unions.
   2. For connections in iron pipe lines:
      a. 2" and smaller provide ground joint brass-to-iron fittings.
      b. 2-1/2" and larger provide standard cast iron with flanged ends and gaskets.

2.3 VALVES:

A. All valves of the same type shall be by the same Manufacturer.

B. Gate Valves: Provide solid wedge disc, rising stem, 200# WOG; non-rising stem valves may be used only where there is insufficient clearance. Sweat joint valves shall be used on all copper pipes.
1. 2" and smaller, rising stem: Provide Hammond #IB-640, bronze, screwed, B-62 bronze body and stem, malleable iron handwheel.
2. 2" and smaller, non-rising stem: Provide Hammond IB-645, bronze, screwed, B-62 bronze body and stem, malleable iron handwheel.

C. Globe Valves: Provide replaceable composition disc suitable for 200°F water.
1. 2" and smaller: Provide Hammond #IB-413T, bronze, screwed, malleable iron hand wheel.

D. Ball Valves: Provide large port ball of chrome plated, bronze or stainless steel construction, screwed ends, quarter turn operation, lever or C-handle operator. Valve shall be rated for 150 psi steam, 600 psi WOG. Valve shall have blow out proof stem and adjustable packing nut.
1. 2" and smaller: Hammond #8501 Series or approved equal.

E. Gas Cocks:
1. 2" and smaller: Provide bronze, screwed, lubricated square head valve equal to Resun #R-1430.
2. 2-1/2" and larger: Provide Nordstrom #142 or #143.

F. Check Valves:
1. 2" and smaller: Provide Hammond #IB-940, bronze, screwed, Y-pattern, 200# WOG, swing check type.

G. Strainers: Provide Y-pattern, 200# WOG, 20 mesh stainless perforated screen free area, equal to 4 times pipe area.
1. 2" and smaller: Provide Wilkins #YSBR Series, screwed.

H. Plumbing Fixture Service Valves:
1. 1/2" angle valve with wheel handle stop, 1/2" I.P.S. female inlet, 3/8" tube compression fitting outlet, 3/8" chrome plated flexible riser and chrome plated escutcheon plate. Chicago Faucet #1015 or equal.

2.4 FLASHING:

A. Where pipes of this Section pass through the roof, flash with Semco, #1100-4 seamless 4 lb. flashing, with steel reinforced "Vari-Pitch" boot and cast iron counterflashing sleeve or equal method approved by the Architect.

2.5 PIPE HANGERS:

A. Water Piping:
1. Provide Fee and Mason #212 split ring hangers with supporting rods.
2. Copper plated hangers or hangers with dielectric isolators to be installed for copper pipe.

B. Soil and Waste Piping:
1. Provide Fee and Mason #212 adjustable ring hangers with supporting rods.
2. Use Fee and Mason #241 riser clamps at each floor and as required.

C. Gas Piping:
1. Provide Fee and Mason #241 split ring hangers with supporting rods.
2.6 CLEANOUTS:

A. Exterior:
1. Provide Wade W-6030-Z, or Smith #4253 with XH cast iron top in concrete areas.

B. Floors:
1. Provide Wade W-6030-1 or Smith #4023 with round nickle bronze top in finished room floors.
2. Provide Wade W-6030-Z or Smith #4223 with round cast iron top in unfinished room floors.
3. Provide "flush-with-floor" type cleanouts, with adjustable watertight covers and integral anchoring flange with clamping collar where waterproofing membrane is used.

C. Finished Walls:
1. Provide Wade W-8460-R6 or Smith #4532 with round chrome plate or stainless steel access plate and screw.

D. Provide cleanout plugs of extra heavy bronze.

2.7 ACCESS BOXES:

A. Walls:
1. Provide Wade W-8480-ST or Smith #4730 with polished chrome plate face in tile walls.
2. Provide Wade W-8490-AKL, Smith #4760-AKL or #4765-AKL with bonderized prime-coated steel face and with Allen locks in walls of other finished rooms.

B. Ceilings:
1. Provide Acorn DW Series bonderized prime-coated steel face with Allen lock.

2.8 TRAPS:

A. For lavatories and sinks, except service sinks, provide chrome plated cast brass traps with brass nuts. Provide deep seal traps where required and/or shown on the Drawings.

B. For handicap lavatories, provide off-set tailpiece ahead of P-trap.

2.9 WATER HAMMER ARRESTORS:

A. Provide Smith #5000 series or Precision Plumbing Products, Inc. stainless steel.

2.10 INSULATION:

A. Insulate hot water, cold water, and condensate piping with ½” thick glass fiber preformed pipe insulation with factory applied all purpose glass fiber reinforced flame retardant kraft paper and aluminum foil self sealing lap.

B. Elbows and fittings to be insulated with factory preformed PVC jacketed insulation material to match thickness of pipe insulation.
C. Valve bodies shall be insulated with Armstrong Armaflex type “FR” or equal insulation with vapor barrier. Factory preformed insulation enclosures may be substituted for field applied insulation.

D. Insulated waste traps receiving cooling coil condensate and piping for a minimum of 10 feet after trap with ½ inch Armstrong Armaflex type “FR” or equal insulation with vapor barrier.

E. Where shown on the Drawings or required by governmental agencies having jurisdiction, at lavatories for handicapped persons provide TRUEBRO Inc. Handi Lav-Guard model #102W and #105W white finish insulation on hot water supply, cold water supply, tailpiece, and trap.

2.11 FIXTURES AND EQUIPMENT:

A. Provide plumbing fixture, trim, (exposed trim to be chrome plated) and equipment as shown on the "Plumbing Fixture Schedule" in the Drawings. China fixture shall be of the best grade vitreous ware without pit holes and blemishes. The Architect reserves the right to reject any pieces which, in his opinion, are faulty.
   1. For the purpose of identification only one Manufacturer's model numbers are used throughout the schedule shown on the Drawings.
   2. Approved Manufacturers: American Standard, Crane, Kohler, or Eljer.

B. Non-Freeze Hose Bibbs (FPHB):
   1. Provide 3/4” non-freeze type of cast bronze construction with lock shield cap and loose key operator to suit wall size.
   2. Hose bibb to have integral backflow preventer, pressure relief valve and vacuum breaker.
   3. Approved equal by Wade (W-8620), Zurn or Woodford.

C. Cover Plates (Escutcheons):
   1. Provide chrome plated brass equal to Beaton Corbin Company style 2-BC for copper tube and 13-BC for standard pipe.

D. Floor Drains:
   1. Provide floor drains where indicated on the Drawings complete with deep seal P-trap as listed below for various floor conditions:
      a. Linoleum or asphalt tile floor - Wade W-1100-STD-1 with nickle bronze raised lip strainer.
      b. Quarry tile or Terrazzo floor - Wade W-1100-G-1 with nickle bronze square strainer.
      c. General - Wade W-1100 with type B nickle bronze strainer:
         1) 3” drain to have 6” strainer;
         2) 4” drain to have 8” strainer.
      d. Manufacturers - Zurn, Wade, or J.R. Smith.

2.12 SLEEVES:

A. Where pipes pass through concrete, masonry, or stud walls, or pass through ceilings, provide 20-gauge galvanized sheet metal sleeve large enough to allow for free movement of the pipes with expansion.
2.13 WATER HEATER (ELECTRIC):

A. Provide A.O. Smith series ELC domestic electric water heater sized as noted on the Drawings or of approved equal by P.V.I., Crane, National, State or approved equal.

B. Water heater features to include glass lining bonded to heavy steel tank; tank constructed and guaranteed to 150 psi working pressure, screw-in type direct immersion heating elements, magnesium anode, factory insulated, cold rolled steel jacket with baked enamel finish, thermostat, 1 year commercial warranty.

C. Provide Watts XL Series pressure/temperature relief valve with AGA label.

2.14 CIRCULATING PUMP (HOT WATER RECIRCULATION):

A. General: Circulating pump shall be of the in-the-line booster type, horizontal mounting, of the capacity listed on the Drawings.

B. Features: Bronze body construction, mechanical seal, brass impeller, steel shaft with thrust collar supported by two horizontal sleeve bearings (oil lubricated), drip-proof-sleeve bearing non-overloading motor mounted on rubber isolators.

2.15 OTHER MATERIALS:

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS:

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

3.2 PLUMBING SYSTEM LAYOUT:

A. Lay out the plumbing system in careful coordination with the Drawings, determining proper elevations for all components of the system and using only the minimum number of bends to produce a satisfactorily functioning system.

B. Follow the general layout shown on the Drawings in all cases except where other Work may interfere.

C. Lay out pipes to fall within partition, wall, or roof cavities, and do not require furring other than as shown on the Drawings. Do not install domestic water lines in exterior walls without proper considerations of required insulation and routing.

D. Slots, Chases, Openings, and Recesses: Through floors, walls, ceilings, and roofs as specified in new structure 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. No cuts shall be made into any structural element, beam or column, without written approval. Opening in existing structures will be provided by the trade requiring same.

E. Locations: Of pipes, ducts, switches, panels, equipment, fixtures, etc., shall be adjusted to accommodate the work to interferences anticipated and encountered. The contractor shall determine the exact route and location of each pipe, duct and electrical raceway prior to fabrication.

1. Right-of-Way: Lines which pitch shall have the right-of-way over those which do not pitch. For example, plumbing drains shall normally have right-of-way. Lines whose elevations cannot be changed shall have the right-of-way over lines whose elevations can be changed.

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 and sanitary vents, etc., as required to effect these offsets, transitions and changes in direction.

3.3 TRENCHING AND BACKFILLING:

A. Perform trenching and backfilling associated with the Work of this Section in strict accordance with the provisions of Division 2 of these Specifications.

B. Cut bottom of trenches to grade. Make trenches 12" wider than the greatest dimension of the pipe.

C. Bedding and Backfilling:

1. Install piping promptly after trenching. Keep trenches open as short a time as practicable.

2. Under the building, install pipes on a 6" bed of damp sand. Backfill to bottom of slab with damp sand.

3. Outside the building, install underground piping on a 6" bed of damp sand. Backfill to within 12" of finish grade with damp sand. Backfill remainder with native soil.

4. Do not backfill until installation has been approved and Project Record Documents have been properly annotated.

5. Provide bare copper trace wire 6 inches above all buried plastic pipe.

6. Provide continuous plastic banner labeled CAUTION-GAS PIPING 12 inches above all buried gas piping.

3.4 INSTALLATION OF PIPING AND EQUIPMENT, GENERAL:

A. General:

1. Proceed as rapidly as the building construction will permit. Install piping parallel and perpendicular to building walls and partitions.

2. Thoroughly clean items before installation. Cap pipe openings to exclude dirt until fixtures are installed and final connections have been made.

3. Cut pipe accurately, and work into place without springing or forcing, properly clearing windows, doors, and other openings. Excessive cutting or other weakening of the building will not be permitted.

4. Show no tool marks or threads on the exposed plated, polished, or enameled connections from fixtures. Tape all finished surfaces to prevent damage during construction.
5. Make changes in directions with fittings; make changes in main size with eccentric reducing fittings. Unless otherwise noted, install water supply and return piping with straight side of eccentric fittings at top of the pipe.

6. Run horizontal sanitary piping at a uniform grade of 1/4" per ft., unless otherwise noted. Branch connections and changes in direction to be made with 45 degree "Y" fittings or long sweep ells.

7. Run horizontal water piping with an adequate pitch upward in direction of flow to allow complete drainage.

8. Install vent connections on all fixtures, traps, and equipment connected to the soil and waste system and extend not less than 3'-6" above floor before turning horizontal. Extend vent through roof minimum 1'-0" above roof or adjacent wall within 18" of roof penetration.

9. Provide sufficient expansion loops, and devices necessary for a flexible piping system, whether or not shown on the Drawings. Make branch connections with offsets to provide for pipe movement.

10. Support piping independently at pumps, coils, tanks, and similar locations, so that weight of pipe will not be supported by the equipment.

11. Pipe drain lines from drip pans, air vents, relief valves and similar locations, to spill over an open sight drain, floor drain, or other acceptable discharge point, and terminate with a plain end, unthreaded pipe 2" above the drain.

12. Securely bolt all equipment, isolators, hangers, and similar items in place.

13. Support each item independently from other pipes. Do not use wire for hanging or strapping pipes.

14. Provide complete dielectric isolators between ferrous and non-ferrous metals.

15. Provide union and shut-off valves suitably located to facilitate maintenance and removal of equipment and apparatus.

16. Provide shut-off gas valve and union at each piece of gas fired equipment and service penetration through exterior wall and roof.

17. Valves, strainers, check valves, and fittings shall be full size of the line they serve unless noted otherwise.

18. Make change in pipe size noted on the plans after last fitting of larger pipe. When supply pipes are larger than equipment tappings, reduce size immediately prior to entry.

19. Install PEX piping with loop at each change of direction of more than 90 degrees.

B. Equipment Access:

1. Install piping, equipment, and accessories to permit access for maintenance. Reroute pipe and/or relocate items as necessary to provide such access, and without additional cost to the Owner.

2. Provide access doors where valves, motors, or equipment requiring access for maintenance are located in walls or chases or above ceilings. Coordinate location of access doors with other trades as required.

3.5 PIPE JOINTS:

A. Copper Tubing:

1. Cut square, remove burrs, and clean inside of female fitting to a bright finish.
   a. Apply solder flux with brush to tubing.
   b. Remove internal parts of solder-end valves prior to soldering.

2. Provide dielectric unions at points of connection of copper tubing to ferrous piping and equipment.

3. For joining copper tubing, use:
   a. Water piping 3" and smaller : 95-5 solder, non lead bearing.

B. Screwed Piping:
1. Deburr cuts.
   a. Do not ream exceeded internal diameter of the pipe.
   b. Thread to requirements of ANSI B2.1.
2. Use teflon tape on male thread prior to joining other services.
3. Use litharge and glycerin on joint prior to cleaning for air and oil piping.

C. Plastic Piping:
1. Mechanical joints shall be made with an Elastomeric thread seal on male thread. Joint shall be clean and free of dirt and made in accordance with Manufacturer's instructions. (DWV piping to conform to ASTM D3212.)
2. Solvent Cementing:
   a. Clean joint surfaces free of dirt and moisture.
   b. Prime joint with colored primer past extend of joint.
   c. Apply cement to all joint surfaces and make joint while cement is still wet.
   d. Use Solvent Cement for particular pipe material and make joint in accordance with Manufacturer's instructions.
3. Threaded joints shall be made in using lubricant or tape approved for pipe material applied to male thread. Threads of joints shall conform to ANSI B2.1 and shall be clean of dirt immediately prior to making joint.

D. Joints for PEX Piping: Crimped joints. Join according to ASTM F 1807.

E. Welded Piping:
1. Welded pipe to be joined in accordance with American Welding Society Code using butt-welded single V beveled 45 degrees to within 1/16" of inside wall. Use welding fittings for changes of direction and intersection of lines.

F. Leaky Joints:
1. Remake with new material.
2. Remove leaking section and/or fitting as directed.
3. Do not use thread cement or sealant to tighten joint.

3.6 PIPE SUPPORTS:

A. Support suspended piping with clevis or trapeze hangers and rods.

B. Space hangers and support for horizontal steel pipes according to the following schedule:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Maximum Spacing on Centers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/4&quot; and smaller</td>
<td>8'-0&quot;</td>
</tr>
<tr>
<td>1-1/2&quot; to 3&quot;</td>
<td>10'-0&quot;</td>
</tr>
<tr>
<td>4&quot; to 5&quot;</td>
<td>14'-0&quot;</td>
</tr>
</tbody>
</table>

C. Space hangers and supports for horizontal copper tubing according to the following schedule:

<table>
<thead>
<tr>
<th>Tube Size</th>
<th>Maximum Spacing on Centers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot; and smaller</td>
<td>6'-0&quot;</td>
</tr>
<tr>
<td>1-1/2&quot;</td>
<td>7'-0&quot;</td>
</tr>
<tr>
<td>2&quot;</td>
<td>8'-0&quot;</td>
</tr>
</tbody>
</table>

D. Space hangers and supports for horizontal cast iron soil pipe 5'-0" on center.

E. Space hangers and supports for horizontal PVC plastic pipe 4'-0" on center.
F. Install vinyl-coated hangers for PEX piping with the following maximum horizontal spacing and minimum rod diameters:
   1. 2” NPS and Smaller: 32 inches with 3/8-inch rod.

G. Provide sway bracing on hangers longer than 18”.

H. Support vertical piping with riser clamps secured to the piping and resting on the building structure. Provide at each floor unless otherwise noted.

I. Provide insulation continuous through hangers and rollers. Protect insulation by galvanized steel shields.

J. Arrange pipe supports to prevent excessive deflection, and to avoid excessive bending stress.

K. Support piping from inserts or anchors in concrete slabs. Provide the inserts under this Section and arrange for the placing under Section 03300 of these Specifications. Use expansions inserts only where approved by the Architect.

L. Hubless Piping:
   1. Provide hangers on the piping at each side of, and within 6” of, hubless pipe coupling so the coupling will bear no weight.
   2. Do not provide hangers on couplings.
   3. Provide hangers adequate to maintain alignment and to prevent sagging of the pipe.
   4. Make adequate provisions to prevent shearing and twisting of the pipe and the joint.

3.7 SLEEVES AND OPENINGS:

A. Provide sleeves for each pipe passing through walls, partitions, floors, roofs, and ceilings.
   1. Set pipe sleeves in place before concrete is poured.
   2. For uninsulated pipe, provide sleeves two pipe sizes larger than the pipe passing through, or provide a minimum of 1/2” clearance between inside and outside of the pipe.
   3. For insulated pipe, provide sleeves of adequate size to accommodate the full thickness of pipe covering, with clearance of packing and caulking.

B. Caulk the space between sleeve and pipe or pipe covering, using a noncombustible, permanently plastic, waterproof, non-staining compound which leaves a smooth finished appearance, or pack with noncombustible cotton, rope, or fiberglass to within 1/2” of both wall faces, and provide the waterproof compound described above.

C. Finish and Escutcheons:
   1. Smooth any rough edges around sleeves with plaster or spackling compound.
   2. Provide 1” wide chrome or nickle plated escutcheons in all pipes exposed to view where passing through walls, floors, partitions, ceilings, and similar locations.
      a. Size the escutcheons to fit pipe and covering.
      b. Hold escutcheons in place with set screw.

D. Pipe openings through the Safe Room wall or roof shall be installed with shielding as required by FEMA regulations for prevention of projectile penetration through wall opening. Refer to Structural and Architectural drawings for means and methods of protection to be coordinated with for the installation of plumbing piping.
3.8 CLEANOUTS:

A. Accessible cleanouts shall be installed in all horizontal waste lines at no greater than 50 ft. intervals and at the base of all vertical stacks.

B. Secure the Architect’s approval of locations for cleanouts in finished areas prior to installation.

C. Provide cleanouts of same nominal size as the pipes they serve; except where cleanouts are required in pipes 4” and larger, provide 4” cleanouts.

D. Make cleanouts accessible. After pressure tests are made and approved, thoroughly graphite the cleanout threads.

3.9 VALVES:

A. Provide valves in water and gas systems. Locate and arrange so as to give complete regulation of apparatus, equipment, and fixtures.

B. Provide valves in at least the following locations:
   1. In branches and/or headers of water piping serving a group of fixtures.
   2. On both sides of apparatus and equipment.
   3. For shutoff of risers and branch mains.
   4. For flushing and sterilizing the system.
   5. Where shown on the Drawings.

C. Locate valves for easy accessibility and maintenance.

3.10 WATER HAMMER ARRESTORS:

A. Provide water hammer arrestors on hot water lines and cold water lines.
   1. Install in upright position at all quick closing valves, solenoids, isolated plumbing fixtures, and supply headers at plumbing fixture groups.
   2. Locate and size as specified or as shown on the Drawings and, where not shown, locate in accordance with Plumbing and Drainage Institute Standard WH-201.
   3. Install water hammer arrestors behind access panels.

B. Where fixtures are not protected by water hammer arrestors, provide air compression chambers equal to twelve (12) pipe diameters, 18” minimum on all water supply connections.

3.11 BACKFLOW PREVENTION:

A. Protect plumbing fixtures, faucets with hose connections, and other equipment having plumbing connection, against possible back-siphonage.

3.12 PLUMBING FIXTURE INSTALLATION:

A. Installation:
   1. Set fixtures level and in proper alignment with respect to walls and floors, and with fixtures equally spaced.
   2. Provide supplies in proper alignment with fixtures and with each other.
3. Provide flush valves in alignment with the fixture, without vertical or horizontal offsets.
4. Install all fixture supports before wall finish is applied.

B. Grout wall and floor mounted fixtures watertight where the fixtures are in contact with walls and floors.

C. Caulk deck-mounted trim at the time of assembly, including fixture and casework mountings. Caulk self-rimming sinks installed in casework.

D. All fixtures shall be cleaned before setting and the installation shall be left ready for use.

3.13 WATER HEATER:

A. Installation:
   1. Set tank level with proper clearances and arranged for easy access adjustment of controls, and shut-off valves.
   2. Provide shut-off valves and dielectric unions on both hot water and cold water lines.
   3. Provide relief line from pressure and temperature relief valve to nearest floor drain, or approved receptor.
   4. Install all auxiliary equipment such as thermometers, gauges, temperature control valves, etc., as noted on the Drawings.

3.14 DISINFECTION OF WATER SYSTEMS:

A. Sterilize domestic hot and cold water systems to meet Health Department requirements.
   1. Prior to treatment, flush the system of all dirt and foreign matter.
   2. Fill system with water treated with 50 ppm of chlorine. Leave treated water in the systems for 24 hours.
   3. Open all valves and faucets several times during flushing and treatment filling to insure full circulation.
   4. Test the chlorine content at the end of treatment period and if chlorine content is greater than 10 ppm, flush the system. If chlorine content is found to be less than 10 ppm, repeat the sterilization process. Take samples from several points in the system.
   5. After sterilization, flush the system with clean water until the chlorine is less than 0.1 ppm.

B. After final flushing, obtain Health Department Certificate of Approval on samples of water taken from the systems. (Use a testing agency approved by the Health Department.) Test shall show negative for coliform organisms.

C. If analysis results are not satisfactory, repeat the disinfection procedures and retest until specified standards are achieved.

3.15 INSTALLATION OF PUMPS:

A. General: Install pumps where shown, in accordance with Manufacturer's written instructions and recognized industry practices to ensure that pumps comply with
requirements and serve intended purposes. Comply with NEMA standards and requirements of NEC.

B. Vibration Isolation: Install units on vibration mounts as shown. Comply with Manufacturer’s indicated installation method and with other applicable Sections of this Division.

C. In-line Pumps: Pumps shall be supported from structure with all-thread rod, angle iron and isolators or on wall bracket with isolators. Pump is not to be supported by piping. Provide isolation and balance valves and check valve.

D. Field Quality Control:
   1. Field Test: Upon completion of pump installation, and after motor has been energized from normal power source, bleed air from pump casing and test pump to demonstrate compliance with requirements. When possible, field-correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.

E. Electrical Connections:
   1. Grounding: Provide positive electrical pump and motor grounding in accordance with applicable requirements of the NEC.

3.16 OTHER TESTING AND ADJUSTING:

A. Provide personnel and equipment, and arrange for and pay the costs of, all required tests and inspections required by governmental agencies having jurisdiction.

B. Test the following systems at the pressures listed:
   1. Gas piping: Test under 30 psi air pressure.
   2. Domestic water: Test under 130 psi hydrostatic pressure.
   3. Soil and waste:
      a. Above ground test with 12 ft. water head;
      b. Underground test with 8 ft. water head.

C. Where tests show materials or workmanship to be deficient, replace or repair as necessary, and repeat the tests until the specified standards are achieved.

D. Adjust the piping systems to optimum standards of operation.

END OF SECTION
SECTION 230000
HEATING, VENTILATING, AND AIR CONDITIONING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Work Included: Provide heating, ventilating, and air conditioning systems where shown on the Drawings, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to:

1. Rooftop packaged air-cooled, gas/electric conditioning systems, complete with direct-expansion cooling section, burner gas valve and heat exchanger, dampers, damper operators, mounting frame, operating and safety controls, blowers, motors, compressors, condensers, filters, and related items.

2. Mini-Split system direct expansion heat pump heating and cooling system with controls, safety controls, blowers, motors, electric strip heaters, compressors, coils, filters, and related items.

3. Air conditioning supply and return ductwork system with grilles, diffusers, registers, dampers, sheet metal hardware, and related items.

4. Exhaust systems including, motors, ductwork, grilles, registers, controls and related items.

5. FEMA rated wall louvers.

6. Coordination of equipment startup and operation with Owner’s Building Management System Installer.

7. Air systems balance for air quantities shown on the plans.

8. Acoustical and thermal insulation of ducts, piping, and equipment.

B. Related Work: Documents affecting Work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of this Specification.

C. Drawings: The mechanical drawings show the general arrangement of all piping, equipment, and appurtenances and shall be followed as closely as actual building construction, site conditions, and the work of other trades will permit. The mechanical work shall conform to the requirements shown on all of the drawings. General and structural drawings shall take precedence over mechanical drawings. Because of the small scale of the mechanical 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.

1.2 QUALITY ASSURANCE:

A. 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.

B. Codes and Regulations:

1. In addition to complying with the specified requirements, comply with pertinent regulations of governmental agencies having jurisdiction, all applicable laws, codes, ordinances including those of the state, county and city.
2. The Work shall also comply with all applicable requirements of the National Fire Protection Association, International Building, Plumbing and Mechanical codes, and all locally accepted amendments to these codes.

3. In the event of conflict between or among specified requirements and pertinent regulations, the more stringent requirement will govern.

4. Pay all fees, taxes, licenses and permits for inspection and certification for the execution of this Work.

5. Non-compliance: Should the contractor perform any work that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards, and utility company regulations, he shall bear all costs arising in correcting the deficiencies.

C. Certificate of Final Inspection: Under each applicable section of the specifications, the contractor shall, upon completion of the work under that section, furnish a certificate of final inspection from the department having jurisdiction.

1.3 EXAMINATION OF SITE:

A. Visit the site, inspect the existing Conditions and check the Drawings and Specifications so as to be fully informed of the requirements for completion of the Work.

B. Lack of such information shall not justify a request for extra compensation to the contract price.

1.4 MATERIAL AND EQUIPMENT:

A. All materials and equipment shall be new, of the same type and Manufacturer, and shall be of the best quality and design and free from defects.

B. A Manufacturer’s nameplate affixed in a conspicuous place will be required on each major component of equipment stating Manufacturer’s name, address and catalog number.

C. Manufacturer’s name and model number used herein and on the Drawings establish type and quality required. Equal products may be considered if submitted in writing to the Engineer/Architect for approval 10 days prior to bid date. The Contractor shall be responsible for assuring the items and equipment substituted for those shown on the Drawings will physically fit in the space allocated.

D. Delivery and Storage: Equipment and materials shall be delivered to the site and stored in original containers, suitably sheltered from the elements, but readily accessible for inspection until installed. All items subject to moisture damage (such as controls) shall be stored in dry, conditioned spaces.

E. Protection: Equipment shall be tightly covered and protected against dirt, water and chemical or mechanical injury. Damage or defects developing before acceptance of the work shall be made good at the contractor's expense.

F. Dimensions: It shall be the responsibility of the contractor to insure that items to be furnished fit the space available. He shall make necessary field measurements to ascertain space requirements, including those for connections, and shall furnish and install sizes and shapes of equipment so that the final installation shall suit the true intent and meanings of the drawings and specifications.
G. Manufacturer’s Directions: Shall be followed completely in delivery, storage, protection and installation of all equipment and materials. The contractor shall promptly give notice in writing of any conflict between any requirement of the Contract Documents and the manufacturer’s directions and shall obtain written instructions before proceeding with the work. Should the contractor perform any work that does not comply with the manufacturer’s directions or such written instructions, he shall bear all costs arising in correcting the deficiencies.

1.5 SUBMITTALS:

A. Comply with pertinent provisions of Division 1.

B. Product Data: Within 35 calendar days after the Contractor has received the Owner’s Notice to Proceed, submit:
   1. Materials list of items proposed to be provided under this Section.
   2. Manufacturer’s Specifications, catalog cuts, and other data needed to prove compliance with the specified requirements.
   3. Shop Drawings and other data as required to indicate method of installing and attaching equipment, except where such details are fully shown on the Drawings.
   4. All sheets of the submittal shall have the job name stamped or permanently written neatly on them and shall be assembled in an indexed brochure. The descriptive material shall be arranged in the brochure in the same order as found in the specifications. Each brochure shall be submitted in a hardback, 3-ring binder. The leading sheet of the descriptive material for each item shall be full size, of heavy paper, with a numbered outside tab, and an index sheet showing the location in the brochure.
   5. Manufacturer's regular catalog sheets will not be acceptable under these requirements unless they indicate completely all of the specification requirements. Where drawings cover several sizes or types of construction, they shall clearly indicate the size or type of construction to be used on the project. In cases where several sizes of the same type of equipment are required to be furnished, the submittal shall include a schedule identifying each piece of equipment, complete with all capacity information needed to compare every submittal item with its respective specified item. Special features shall be listed on a separate typewritten sheet.
   6. Brochures shall contain a certification by the Contractor that the equipment or materials are suitable for conditions shown and specified; that the equipment or materials are believed to be in conformity with the plans and specifications, except as may be specifically described; be signed by the Contractor. Brochures received not in conformity with these requirements will be returned for required action.
   7. Finding "APPROVED EQUAL" or "NO EXCEPTION TAKEN" shall not eliminate responsibility for compliance with the plans and specifications, unless specific attention has been called, in writing, to the proposed deviations at the time of transmittal of the brochures and such deviations have been found acceptable, nor shall it eliminate the responsibility for freedom from errors of any sort in the data submitted. Discovery of such deviations at or after installation shall be cause for immediate replacement at no additional cost to the Owner.
   8. No material or equipment so governed shall be ordered until found acceptable by the Architect/Engineer/Owner.
   9. Electronic submittals shall follow the above requirements and be assembled in a PDF format when issued for review.
   10. All above requirements will be provided when submittals are presented for review. If submittal requirements are not followed, review of submittal will not proceed until requirements are complete.
C. Record Drawings:
   1. Comply with pertinent provisions of Division 1.
      a. Record Drawings- The contractor shall furnish to the owner CAD record drawings consisting of three (3) sets of 11” x 17” prints (To be bound in O&M Manuals), one (1) full size set of prints and one (1) disk, showing the piping and ductwork for the HVAC and plumbing systems. Piping sizes, rerouting, etc., for both under floor and above ceiling piping shall be shown. Also, provide a blue-line of the site plan, clearly marked, to indicate any and all changes in sanitary sewer, storm sewer, domestic cold water and natural gas piping to the building. In addition to these drawings, a complete set of approved ductwork shop drawings for the FEMA space shall be included in this set of drawings.
         1) CAD Record drawings shall incorporate all change and field orders. (No separate or supplemental drawings).
         2) All equipment schedules to be revised to reflect installed manufacturer model numbers and capabilities.
   2. Include a copy of the Record Drawings in each copy of the operation and maintenance manual described below. (Original document shall be reproducible paper.)

D. Manuals: Upon completion of this portion of the Work, and as a Condition of its acceptance, deliver to the Architect two copies of an operation and maintenance manual compiled in accordance with the provisions of Division 1 of these Specifications. Include within each manual:
   1. Copy of the approved record documents for this portion of the Work.
   2. Copies of all warranties and guarantees.
   3. Description of HVAC equipment control and seasonal operation, including schedule of required maintenance.

1.6 PRODUCT HANDLING:

A. Comply with pertinent provisions of Division 1.

1.7 INSPECTION:

A. Make written notice to the Architect adequately in advance of each of the following stages of construction:
   1. In the underground condition prior to placing concrete floor slab, when all associated Work is in place.
   2. When all rough-in is complete, but not covered.
   3. At completion of the Work of this Section.

B. When material and/or workmanship is found to not comply with the specified requirements, within three days after receipt of notice of such non-compliance, remove the non-complying items from the job site and replace them with items complying with the specified requirements, all at no additional cost to the Owner.

1.8 CLEANING, TESTING AND PLACING IN SERVICE:

A. Immediately prior to final inspection, the Contractor shall make a final cleanup of dirt and refuse resulting from his Work and shall assist in keeping the premises clean at all times.
B. Immediately prior to final inspection, the Contractor shall clean all material and equipment installed under this Contract. Dirt, dust, plaster, stains and foreign matter shall be removed from all surfaces. Damaged finishes shall be touched up and restored to their original Condition.

C. Mechanism of all equipment shall be checked, adjusted and tested for proper operation. Protective devices and parts shall be checked and tested for specified and required application and adjusted as required to produce the intended performance.

1.9 ADJUSTMENT AND INSTRUCTION:

A. Energize all systems, equipment and fixtures and check for proper operation.

B. HVAC system shall be placed in operation and balanced to provide air flow as indicated on the Drawings.

C. The Contractor’s service personnel shall instruct the Owner’s Representative in the proper operation of all systems.

1.10 GUARANTEE:

A. The Contractor guarantees all work against any defects due to faulty workmanship or material and that all raceways, ducts and piping are free from foreign material, obstructions, holes or breaks of any nature.

B. Upon written notice from the Architect or Owner, the Contractor shall promptly remedy without cost to the Owner any defects occurring within a period of one (1) year from the date of final acceptance.

1.11 WARRANTY:

A. The Contractor shall properly execute in the Owner’s name all Manufacturer’s standard warranty certificates applying to equipment installed on the project and shall deliver said certificates to the Architect at completion of the job. All warranty cards shall also be properly executed and delivered to the supplier or Manufacturer’s representative for Manufacturer’s records. Standard warranties for equipment shall not be less than one (1) year.

PART 2 - PRODUCTS

2.1 SHEET METAL DUCTWORK:

A. For interior heating, ventilating, and air conditioning systems, provide best grade, prime, open hearth, galvanized sheet metal ducts fabricated and installed to pertinent ASHRAE and SMACNA standards, or to the requirements of governmental agencies having jurisdiction, whichever requirement is more stringent.

B. Round ductwork to be constructed of best grade prime, open hearth galvanized steel with spiral seams. For systems with less than .75” W.G. pressure, round duct with longitudinal snap lock seams and beaded sleeve transverse joints may be installed.
2.2 FLEXIBLE DUCT:

A. Provide factory fabricated insulated low pressure flexible duct with the following attributes as manufactured by Thermaflex, Wire Mold, Metalflex, or Flexmaster.
   1. Helix wire flexible core.
   2. 2” fiberglass blanket insulation of 3/4 lb. density with continuous sealed vapor barrier jacket.
   3. Accessories shall include strap clamps, spin-in duct taps, air scoops and dampers as required.
   4. Composite assembly, including insulation and vapor barrier, shall meet all requirements of UL 181, including flame spread of 25 or less and smoke developed rating of 50 or less as set forth in NFPA Bulletin 90-A, and bearing UL label as a Class 1 air duct.

2.3 DUCTWORK FABRICATION:

A. All interior ductwork and fittings shall be fabricated in accordance with recommendations as outlined in current ASHRAE and SMACNA Standards.

B. Gauges and reinforcing in accordance with current SMACNA Standards for greatest dimensions of duct or housing.

C. Lap metal ducts in direction of air flow. Hammer down edges and slip joints to leave smooth duct interior.

D. Cross break all rectangular ducts 18” and larger. Omit cross breaking if two gauge heavier metal is used in duct construction.

E. Transverse Joints: Ductwork up to 24”, use s-drive, pocket, or bar slip. Ductwork 25” to 40”, use joints forming outside ribs. Other joint connections of equivalent mechanical strength and air tightness may be used if approved by the Engineer.

F. Construct elbows with radius of not less than 1-1/2 times width of duct on center line or square elbows with air foil turning vanes. Round duct elbows shall be of the smooth radius type. For round duct systems with less than .75” W.G. pressure, jointed elbows may be installed.

G. Branch ducts shall be tied to main trunk duct through radius take-off and splitter damper, or 45 degree branch and curved blade extractor. Round branch duct tappings to be of the conical or spin-in type with air scoop and volume damper for supply air on 12” round and smaller. Flanged or bellmouth taps used for larger ducts as noted on the Drawings.

H. Transitions shall be constructed per SMACNA Standards and shall not exceed 20 degrees for diverging air flows or 30 degrees for contracting air flows.

I. Plenums shall be fabricated in accordance to duct gauges and shall be reinforced per SMACNA standards.

2.4 DUCT HANGERS AND SUPPORTS:

A. Hangers shall be galvanized steel band iron or angle iron and galvanized threaded rod. Wall supports shall be galvanized steel band iron or fabricated angle bracket.
2.5 **DUCT INSULATION:**

A. **General:**
   1. Provide materials complying with NFPA Bulletin 90-A, as determined by UL method NFPA 225-ASTM E84, and complying with the governing code, with flame spread rating less than 25 and smoke developed rating less than 50.
   2. Where vapor barriers are used, provide intact and continuous throughout with all joints sealed.
   3. Manufacturer of duct liners shall print density and thickness on face of duct liner.
   4. **Acceptable Manufacturers:**
      a. Owens/Corning Fiberglass
      b. Johns-Manville
      c. Certainteed
      d. Armstrong

B. **Ductliner (Interior Rectangular Duct):** Insulate internal supply, return and exhaust ducts with 1” glass fiber with a minimum density of 1.5 pounds per cubic foot. Liner to be coated to prevent fiber erosion at air velocities up to 4000 f.p.m.

C. **Ductwrap (Round Duct):** Insulate externally all round ducts and fresh air ducts with 2” thick, 1 pound density, fiberglass ductwrap with factory applied reinforced aluminum foil vapor barrier.

2.6 **DUCTWORK ACCESSORIES:**

A. **Acceptable Manufacturers:**
   1. Air Balance, Inc.
   2. Ruskin
   3. Carnes
   4. Pottorff
   5. Krueger
   6. United Enertech
   7. Nailor Industries

B. **Access Doors:** Access doors shall be installed for inspection, service, and maintenance of balance dampers, fire dampers, filters, etc. Doors shall be 12” x 12” for handhole and 24” x 24” for manhole where required. Access doors shall have gasket seals, insulated core and shall be secured air tight.

C. **Flexible Connections:** Duct connections to fans and where noted elsewhere on plans shall be sound isolation of fire resistant, water proof, and mildew-resistant canvas. Connections shall not be less than 4” long, shall have suitable metal collar frame on each end, and shall be made with at least 1” slack material.

D. **Opposed Blade Dampers:**
   1. Construct of galvanized steel blades a maximum width of 6” set in 18-gauge galvanized steel frame with blade stops. Damper blades to be equipped with rigid linkage bar and pivoted using noncorrosive bearings of oilite or nylon.
   2. Single or parallel multiple blade dampers shall be of the same quality of construction, but shall not be used unless noted on the Drawings.
   3. All balance dampers shall have a minimum of 2 inch stand-off handle.

E. **Back Draft Dampers:** Construct of all aluminum parallel blades a maximum width of 4-1/2” with felt or vinyl tips, 16-gauge aluminum frame with blade stops. Damper blades to
be pivoted using noncorrosive bearing of oilite or nylon and shall have blade linkage with adjustable counterbalance as noted.

F. Fire Dampers: Dampers shall bear UL label Class “B” and built in full conformance with standards of the National Fire Protection Association Standard #90A. Construct damper with interlocking blades which will form a solid curtain of steel when closed. When open, the blades are compactly grouped in a 2-1/4” wide frame. Dampers shall meet requirements for vertical or horizontal installation, spring closure, and 160° fusible link.

2.7 AIR OUTLETS:

A. Provide and install grilles, registers, and diffusers as scheduled on the Drawings with accessories as noted.

B. Acceptable Manufacturers:
   1. Metalaire
   2. Titus
   3. Tuttle & Bailey
   4. Barber Colman
   5. Krueger
   6. Nailor Industries
   7. Price

C. Flanged frame grilles, registers, and diffusers to have gasket seals.

D. Provide insulated plenums, adaptor boxes or square to round transitions for connection to flexible duct runouts where required.

2.8 FEMA LOUVERS:

A. Provide and install FEMA rated parallel blade louver constructed from .25 aluminum. Blades installed at 3 inch by 3 inch by ¼ inch thick inverted V style extruded aluminum. Louver shall be minimum 5.25” deep with 1/2” x .063 basket weave aluminum bird screen. Provide louver sized, finished and with accessories such as mounting clips, mullions, drip mouldings as noted on the Drawings.

B. Acceptable Manufacturers:
   1. Ruskin
   2. Carnes
   3. United Enertech
   4. Greenheck
   5. Pottorff

2.9 ROOF HOODS:

A. Provide and install all aluminum roof hoods with bird screens as sized and noted on the Drawings. Backdraft dampers and other accessories to be furnished and installed as noted on the Drawings.

B. Acceptable Manufacturers:
   1. Penn
   2. Greenheck
3. Cook
4. Carnes
5. Or as provided by fan Manufacturer when installed in conjunction with exhaust or supply fan systems.

2.10 VIBRATION ISOLATION:

A. Vibration isolation shall be of the type and deflection for the duty indicated on the Drawings. The vibration isolator supplier shall confirm equipment weights and revolutions (Frequency) with actual products approved and installed by Division 23 Contractor.

B. All vibration isolators and bases shall be treated for resistance to corrosion.

C. Size type and deflection of isolators shall conform to recommendations set forth in ASHRAE standards.

D. Approved Manufacturers:
   1. Amber Booth
   2. Mason Industries, Inc.
   3. Consolidated Kinetic Corporation

2.11 FANS:

A. Fans shall be of the type and capacity as scheduled on the Drawings. All fans bear seal of ratings certified by A.M.C.A. Fans shall be furnished and installed with accessories, special coatings, special materials and construction, and controls as noted on the Drawings.

B. Approved Manufacturers:
   1. Penn
   2. Greenheck
   3. Cook
   4. Twin City

2.12 MINI-SPLIT SYSTEM HEAT PUMP:

A. Provide heating and cooling split system fan coil air handling unit, evaporator/condenser coil in fan unit, air cooled outdoor heat pump unit with reversing valve, of the capacities and voltage as scheduled on the Drawings.

B. Fan coil outdoor heat pump unit shall be of the same Manufacturer and matched for the capacities scheduled on the Drawings. Performance ratings shall comply with those scheduled for the outdoor and coil entering air design data listed on the Drawings.

C. Fan Coil Features:
   1. Cabinet: Constructed of cold-rolled steel finished with baked enamel and fully insulated; duct connection flanges; filter frame and access door; and removable access panels for servicing.
   2. Fan: Direct drive, multi-speed blower, dynamically and statically balanced; fan motor overload protection; resilient mounting.
3. DX Coil: Copper tube and mechanically bonded aluminum fins; refrigerant metering device; refrigerant line fittings; condensate drain pan with primary and secondary drain line fittings.

4. Electric Heater: Factory installed; heaters greater than 10 KW shall have current overload protection by fuses or circuit breaker in accordance with N.E.C. Article 424-22; heater over 10 KW shall be wired for 2 stage operation and sequenced off and on in 5 KW increments; all heaters shall have thermal overload protection; 60 VA control circuit; 24 volt transformer and voltage terminal board.

D. Heat Pump Features: Galvanized heavy gauge steel with enamel finish housing; hermetic spring isolated compressor with crankcase heater and noise shield; thermal and current-sensitive overload protection; compressor internal high pressure protection; outdoor coil construction of copper tube with mechanically bonded aluminum fins; coil refrigerant metering device mounted at liquid service valve; direct drive, propeller condenser fan with factory lubricated, inherently protected, and resiliently mounted motor; low pressure switch; suction line accumulator; pressure relief device; automatic defrost control; liquid line solenoid valve; charging valves; liquid line filter dryer; compressor and condenser fan starters; EER and C.O.P. ratings to meet local code requirements for unit performance.

E. Accessories: Extra set of filters to install after final acceptance; relays; transformers for control wiring; unit thermostat control as described in Temperature Control Section; precharged refrigerant lines when applicable for distance and routing.

F. Approved Manufacturers:
   1. Lennox, no exceptions

2.13 REFRIGERANT PIPING:

A. Precharged and factory insulated refrigerant lines shall be installed for distances less than 50 feet and direct, unconcealed pipe routing. Refrigerant piping shall be type "L" copper, refrigerant grade with wrought copper fittings and insulated with AP Armaflex Black LapSea.

B. Pipe sizes shown on the Drawings are for estimating purposes only. Equipment Manufacturer shall verify size of refrigerant piping for system installation.

C. Refrigerant system shall include liquid filter dryer, strainer, charging valves, relief valves, check valves, sight glass, solenoid valves, and thermostatic expansion valves.

2.14 ROOF TOP UNITS (GAS HEAT AND ELECTRIC DX COOLING):

A. Provide package air cooled, electric DX cooling, single zone, gas fired heating unit with capacities and voltage as scheduled on the Drawings.

B. Unit Features: Insulated galvanized steel cabinet with baked enamel finish, aluminized steel with heat exchanger with end shot burners, redundant gas valve, intermittent pilot ignition, A.G.A. approved for outdoor application, evaporator and condenser coils with aluminum plate fins mechanically bonded to seamless copper tubes, hermetic compressors with motor overload protection, crankcase heater and vibration isolators, centrifugal forward curve indoor fan with motor and drive, condensing propeller fans with direct drive motor, low temperature operation to 0° F, short cycling protection, freezestat.
C. Provide factory installed pressure relief damper and enthalpy controlled economizer damper section on units as noted in the Roof Top Unit Schedule.

D. Approved Manufacturers:
   1. Lennox, no exceptions

2.15 TEMPERATURE CONTROL:

A. Energy management system and controls interface with equipment controls provided under this work to be provided by the Owner’s contracted controls vendor. Owner shall provide mechanical contractor thermostat for equipment start-up and testing by mechanical contractor.

B. Thermostats: Thermostats shall be Owner’s approved manufacturer and model number without exception.

C. Sensors: Include the following:
   1. Electronic Sensors: Combination Temperature/CO2 and Temperature/CO2/Humidity sensors and detectors, CO sensors, and occupancy sensors shall be vibration and corrosion resistant, and be suitable for wall or duct mounting.

D. Electric Motor Actuators: Permanent split-capacitor or shaded-pole type with gear trains completely oil immersed and sealed.
   1. Dampers: Direct coupled with spring return, brushless DC motor, manual override, position indicator, integral adjustable range stop, UL listed, self centering shaft.
   2. Actuators to be designed for minimum 60,000 full-stroke cycles at rated torque.
   3. Review other sections of project manual and drawings to identify motor actuators being provided with equipment or specified dampers and conditions where motor actuators are to be provided under this section of work for Instrumentation and Controls.

E. Dampers: AMCA-rated, parallel- or opposed-blade design to suit application. Refer to “Duct Accessories” section of Project Manual Specifications for description.

F. Control Cable: Electronic and fiber-optic cable for control wiring as specified in Division 26 Specification.

2.16 OTHER MATERIALS:

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect/Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS:
A. Examine the areas and Conditions under which Work of this Section will be performed. Correct Conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory Conditions are corrected.

3.2 COORDINATION:

A. Coordinate as required with other trades to assure proper and adequate provision in the Work of those trades for interface with the Work of this Section.

B. Slots, Chases, Openings, and Recesses: Through floors, walls, ceilings, and roofs as specified in new structure 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. No cuts shall be made into any structural element, beam or column, without written approval. Opening in existing structures will be provided by the trade requiring same.

C. Locations: Of pipes, ducts, switches, panels, equipment, fixtures, etc., shall be adjusted to accommodate the work to interferences anticipated and encountered. The contractor shall determine the exact route and location of each pipe, duct and electrical raceway prior to fabrication.
   1. Right-of-Way: Lines which pitch shall have the right-of-way over those which do not pitch. For example, plumbing drains shall normally have right-of-way. Lines whose elevations cannot be changed shall have the right-of-way over lines whose elevations can be changed.
   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 and sanitary vents, etc., as required to effect these offsets, transitions and changes in direction.

3.3 PREPARATION:

A. Holes in Concrete:
   1. Provide sleeves, accurately dimensioned and shaped to permit passage of items of this Section.
   2. Deliver all such sleeves, with accurate setting Drawings and setting information, to the trades providing the surfaces through which such items must penetrate, and in a timely manner to assure inclusion in the Work.

B. Flashing:
   1. Where items of this Section penetrate the roof, outer walls or waterproofing of any kind, provide under this Section all base flashing and counterflashing required at such penetration.
   2. Provide on each pipe passing through the roof a 4 lb. seamless lead flashing and counterflashing assembly. Penetrations through sheet metal roofs shall be installed per roofing Manufacturer's recommendations.

3.4 EQUIPMENT INTERFACE:

A. Provide all required shutoff valves, unions, and final connections of piping to the Work of this Section.
B. For electrically operated equipment, verify the electrical characteristics actually available for the Work of this Section and provide equipment meeting those characteristics.

3.5 DUCTWORK INSTALLATION:

A. Rigidly support all interior ductwork using angle iron and galvanized threaded rods or galvanized strap hangers spaced to carry the load but not less than 5'-0" on centers and secured to the building structure in a method approved by the Architect. All hangers shall be installed truly vertical. Ductwork shall be hung level except where Architectural or structural Conditions dictate otherwise.

B. Flexible ductwork shall not exceed 8'-0" runout total length from tapping to diffuser connection. Make smooth radius bends and secure duct at each end using a method of mechanical fastening with air tight seal. Support duct from resting on ceiling using strap hangers.

C. Clean duct system of dirt and debris prior to operating any fan connected to the duct system. Cap all floor outlets and open ductwork during construction until final connections are made.

D. Duct openings through the Safe Room wall or roof shall be installed with shielding as required by FEMA regulations for prevention of projectile penetration through wall opening. Refer to Structural and Architectural drawings for means and methods of protection to be coordinated with for the installation of refrigerant piping.

E. Duct sizes shown on the Drawings are internal clear dimensions. The Contractor shall adjust for thickness of duct liner required.

3.6 DUCT HANGER AND SUPPORT INSTALLATION:

A. Duct hangers and supports to be secured to the building structure via a method approved by the Architect.

B. Hanger Minimum Sizes:
   1. Up to 30" wide: 1" x 16 ga. at 5 feet spacing.
   2. 31" to 48" wide: 1-1/2" x 16 ga. at 5 feet spacing.

C. Horizontal Duct on Wall Supports Minimum Sizes:
   1. Up to 18" wide: 1-1/2" x 16 ga. galvanized steel strap or 1" x 1" x 1/8" angles at 8 feet spacing.
   2. 19" to 40" wide: 1-1/2" x 1-1/2" x 1/8" angles at 4 feet spacing.

D. Vertical Duct on Wall Supports Minimum Sizes:
   1. At 6'-0" spacing:
      a. Up to 24" wide: 1-1/2" x 16 ga.
      b. 25" to 36" wide: 1" x 1" x 1/8"

3.7 INSULATION:

A. Duct liner shall be adhered to interior sides of ductwork with minimum 50% coverage of fire retardant adhesive. Coat all exposed edges with adhesive. Use mechanical fasteners, (12-gauge impale anchor tabs or equal) maximum 16" on centers. Cut off
excess fastener length and cover with brush coat of mastic. Liner shall be cut to fit and be without gaps at all joints. Just before sections of ductwork are hung, coat end butt joints of duct liner with adhesive and hang immediately.

B. Ductwrap shall be firmly secured to ductwork with adhesive applied in 6” widths on 16” centers. Securely fasten insulation in place with 16-gauge annealed tie wire spirals wound 16” on center for straight duct runs and half hitched around duct on 4” centers for elbows and fittings OR tape longitudinal seams on straight duct runs with 2” tape. Butt insulation and seal joints and breaks with 2” tape or foil adhered to vapor barrier. Do not stretch or compress insulation excessively during application.

3.8 DUCTWORK ACCESSORIES:
A. Install items in accordance with Manufacturer's instructions and accepted methods.

3.9 AIR OUTLETS:
A. Install all grilles, registers, and diffusers and their accessories in accordance with Manufacturer's instructions and accepted methods.
B. Paint interior of all ductwork visible behind air outlets matt black.
C. Review requirements of outlet sizes, finish, mounting, and air patterns prior to installation. Coordinate location of outlets and make necessary adjustments to conform with Architectural features, symmetry, and light locations. Refer to grille, register and diffuser list for additional requirements.

3.10 FEMA LOUVERS:
A. Set louvers in openings, caulk, and connect to ductwork as shown on the plans. Install per Manufacturer's instruction and Architectural details to achieve required FEMA rating of louver installation.

3.11 ROOF HOODS:
A. Set roof hoods on factory or field built curbs and connect to ductwork as shown on the Drawings. Flash, caulk, and seal weather tight per Manufacturer's instructions and Architectural details.

3.12 VIBRATION ISOLATION:
A. Install vibration isolators in accordance with Manufacturer's instructions.

3.13 EXHAUST FANS:
A. Install fans in accordance with Manufacturer's instructions and accepted methods.
B. Set roof mounted fans on factory or field built curbs and connect to ductwork as shown on the Drawings. Fans manufactured for sloped roofs to be flashed into roofing per
Manufacturer's instructions. Flash, counterflash, caulk, and seal water tight per Manufacturer's instructions and Architectural details.

C. Vibration isolation shall be included in all fan mounting methods as required in the "Vibration Isolation" Section of these Specifications above and as detailed on the Drawings.

3.14 Mini-SPLIT SYSTEM HEAT PUMP:

A. Install in accordance with code requirements and Manufacturer's instruction, adhering to required clearances for operation and servicing. Division 23 Contractor to complete ductwork, refrigerant piping, mounting and condensate connections for a fully functional system. Division 26 Contractor to rough-in and make final connections of required electrical and control wiring.

B. Refrigerant system to be tested and fully charged and complete for a fully functional system.

3.15 REFRIGERANT PIPING:

A. Install refrigerant piping parallel and perpendicular to building structure. Route piping as directly between equipment as possible, using only the minimum number of bends required. Support and hang piping as described in Section 220000, Item 2.05 A and 3.06 C. Joints and fittings to be sweat with SIL-FOS or equivalent silver bearing solder.

B. Test refrigerant system with Nitrogen at 300 psi.

C. Pipe openings through the Safe Room wall or roof shall be installed with shielding as required by FEMA regulations for prevention of projectile penetration through wall opening. Refer to Structural and Architectural drawings for means and methods of protection to be coordinated with for the installation of refrigerant piping.

3.16 ROOF TOP UNITS:

A. Install in accordance with code requirements and Manufacturer’s instructions adhering to required clearances for operation and servicing. Division 23 Contractor to complete ductwork, gas piping, and condensate connections for a fully functional system. Division 26 Contractor to rough-in and make final connections of required electrical and control wiring.

B. Set roof mounted unit on factory curb or rails as noted on the Drawings. Flash, counterflash, caulk and seal weather tight per Manufacturer’s instructions and Architectural details.

C. Ground mounted units shall be set on reinforced concrete pads or elevated pipe columns and support beams as noted on the Drawings.

D. Vibration isolation shall be included as specified in 3.14 above and detailed on the Drawings.

3.17 TEMPERATURE CONTROL:
A. Division 26 Contractor shall furnish and install all control wiring from HVAC unit and controller. Final connections for controls shall be by Owner contractors controls vendor.

B. Owner contracted controls vendor shall provide room temperature/CO2/Humidity and CO sensors installed on strike side of room entry door from corridor with Temperature/CO2/Humidity sensor at 48 inches AFF and CO sensor mounted at 60 inches AFF. Coordinate final location of all sensors with Owner’s representative. Room controller to be installed in the ceiling space above the entry door.

C. Owner’s BMS System Installer shall implement all features of controls to specified requirements and as appropriate to sequence of operation.

D. Owner’s BMS System Installer shall connect and configure equipment to achieve sequence of operation specified.

E. Verify location of sensors and thermostats and other exposed control sensors with plans and room details and Owner’s Representative before installation. Locate at elevations as noted on the drawings. ADA accessible controls shall be mounted in compliance with Federal Register Department of Justice ADA Accessibility Guidelines for Buildings and Facilities for front and side access to controls. Classroom thermostats to be located in compliance with ADA requirements.

F. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

G. Install guards with locking covers on sensors and thermostats in the following locations:
   1. Entrances.
   2. Public areas.
   3. Gymnasiums
   4. Where indicated.

H. Install automatic dampers according to Division 23 Section listing "Duct Accessories."

I. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

J. Install labels and nameplates to identify control components.

K. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.

L. Install electronic and fiber-optic cables according to Division 26 Section "Control/Signal Transmission Media."

M. Install raceways, boxes, and cabinets according to Division 26 Section "Raceways and Boxes."

N. Install building wire and cable according to Division 26 Section "Conductors and Cables."

O. Install signal and communication cable according to Division 26 Section "Control/Signal Transmission Media."
   1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
   2. Install cable in raceway or J-Hooks
3. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
4. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
5. Number-code or color-code conductors per Owner’s color code requirements for identification and service of control system.
6. Minimum 10 conductor cables for units under 17 1/2 tons and less. Provided 14 conductor cable for units above 17 1/2 tons.

P. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

Q. Ground equipment.

R. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

S. Inspect field-assembled components and equipment installation, including electrical connections. Replace damaged or malfunctioning controls and equipment. Report results in writing. Coordinate with Test and Balance Contractor to provide system under full operation and control at time of final balance work.
1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment, and retest.
3. Calibration test electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
4. The Owner shall engage a factory-authorized service representative to perform startup service and evaluation of the control system. The Contractor shall coordinate operation of the installed equipment with the service representative.
   a. Start, test, and adjust control systems.
   b. Demonstrate compliance with requirements, including calibration and testing, and control sequences.
   c. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.
   d. Verify software including automatic restart, control sequences, scheduling, reset controls, and occupied/unoccupied cycles.
5. Train Owner's maintenance personnel to adjust, operate, and maintain control systems and components.
   a. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
   b. Provide operator training on data display, alarm and status descriptors, requesting data, executing commands, calibrating and adjusting devices, resetting default values, and requesting logs.
6. Occupancy Adjustments: Within one year of date of Substantial Completion, provide up to three Project site visits, when requested by Owner, to adjust and calibrate components and to assist Owner's personnel in making program changes and in adjusting sensors and controls to suit actual conditions.

3.18 TESTING AND ADJUSTING:
A. Test and adjust each piece of equipment and each system as required to assure proper air balance and operation.
   1. Test and regulate ventilation and air conditioning systems to conform to the air volumes shown on the design Drawings.
   2. Make tests and adjustments in apparatus and ducts for securing the proper volume and face distribution of air for each grille and ceiling outlet.
   3. Where required, provide pulleys for fans at no additional cost to the Owner, and set to drive the fan at the speed to give the indicated volume.
   4. For each system, take the following data in tabulated form:
      a. Air volumes at all supply, return, and exhaust outlets
      b. Total cfm supplied
      c. Total cfm returned
      d. Total outdoor air cfm supplied
      e. Total cfm exhausted

B. Submit two sets of test and balance reports to the Architect for approval.

C. Eliminate noise and vibration, and assure proper function of all controls, maintenance of temperature, and operation in accordance with the approved design.

3.19 INSTRUCTIONS:

A. Upon completion of this portion of the Work, and prior to its acceptance by the Owner, provide a qualified representative and fully instruct the Owner’s maintenance personnel in the proper operation and maintenance of items provided under this Section.

B. Demonstrate the contents of the approved operation and maintenance manual required in the “Submittals” Section of these Specifications.

END OF SECTION
SECTION 260450 - ELECTRICAL DEMOLITION

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.

B. Section 024100 – Minor Demolition for Remodeling.

C. Refer to drawings outlining the scope of work and general conditions and requirements in addition to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Demolition and removal of selected portions of the building electrical distribution system as well as portions of the building telecommunications and data systems, fire alarm systems and security systems. In addition, associated controls, electrical wiring, specialty system interfaces, and other building infrastructure is affected by this work.

2. Patching and repairs to adjacent surfaces and adjoining spaces not specifically included in the demo drawings but affected by the removal of systems and or sub-systems related to or served by systems serving affected areas.

3. Contractor shall provide Temporary Electrical Service and lighting for all trades during course of demolition and construction.

4. Maintain existing fire alarm system in service to include Fire Alarm pull station at all exit egress stairwells and corridors and magnetic door releases for separation of smoke compartments. All smoke detection will be covered during daytime working hours and uncovered by completion of work shift.

5. This section does not include the demolition of asbestos or other hazardous materials identified during the process of demolition of the building and building systems. The Contractor shall notify the Architect and Owner when suspicious materials are identified which might be hazardous and request the Owner to test the identified materials and remove materials if found to be hazardous before the Contractor continues with demolition of the building.

1.3 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.

B. Remove and Salvage: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Owner's designated storage area.

C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.
D. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Architect, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

1.4 MATERIALS OWNERSHIP

A. The Owner has exclusive rights to all salvage and shall be asked prior to removal of any salvage item. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.

1. The Owner's representative shall identify in addition to those items noted on the drawings, any other equipment or materials which he has interest in retaining or salvaging.

2. The Contractor shall review and coordinate with the Owner to identify materials to be salvaged and the location that salvaged materials are to be moved for Owner's storage.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections, for information only, unless otherwise indicated.

B. Inventory of items to be removed and salvaged.

C. Inventory of items to be removed by Owner.

D. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by selective demolition operations.

E. Record drawings at Project closeout according to Division 1 Section "Contract Closeout."

1. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

1.6 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Engage an experienced firm that has successfully completed selective demolition Work similar to that indicated for this Project.

B. Regulatory Requirements: Comply with governing EPA notification regulations before starting selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
1.7 PROJECT CONDITIONS

A. Owner will occupy portions of the building immediately adjacent to selective demolition area. Conduct selective demolition so that Owner's operations will not be disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations. Provide temporary electrical services to adjacent areas that might be affected per Owner’s directive.

B. Owner assumes no responsibility for actual condition of buildings to be selectively demolished.
   1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
   2. Asbestos will be selectively removed by Owner before start of Work.

C. Storage or sale of removed items or materials on-site will not be permitted.

1.8 SCHEDULING

A. Arrange selective demolition schedule so as not to interfere with Owner's on-site operations.

1.9 WARRANTY

A. Existing Special Warranty: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in Section 01700.

B. Include required temporary equipment to maintain existing electrical power to facility with complete coordination with the Owner’s representative for time of work and outages scheduled without disruption to daily operations.

C. Include required temporary materials and equipment to maintain existing fire protection system within area of remodel and construction. Notify Owner and coordinate with Owner’s safety personnel times during the work when areas of the existing building are not fully protected by the building fire protection system. A fire watch shall be provided during all hours of building occupancy (24 hours per day, 7 days per week) whenever fire protection system is not fully operational within area of demolition and remodel.

D. Include required temporary materials and equipment to maintain active portions of the building infrastructure systems that must stay in operation during demolition and remodel work to serve adjacent spaces. All temporary work shall be suitable for continued operation even if the proposed remodel work is not completed.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Survey existing conditions and correlate with requirements indicated to determine extent of demolition.

B. Coordinate with owner to determine which security system devices such as; cameras, key pads, etc to remove for reuse in remodel phase of contract.

C. Verify that abandoned wiring and equipment serve only abandoned facilities and remove all abandoned wiring from the floor.

D. Demolition Drawings are based on casual non-destructive field observation. Report discrepancies to Owner before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

F. Verify that building systems serving the area of demolition have been disconnected, terminated, and capped to prevent damage to the building or harm to personnel.

G. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

H. When unanticipated mechanical, electrical, or structural elements that conflict with the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Architect.

I. Survey the condition of the building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during selective demolition.

J. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 BUILDING INFRASTRUCTURE SYSTEMS

A. Maintain existing building infrastructure systems indicated to remain in service and protect them against damage during selective demolition operations.

1. Do not interrupt existing building systems serving occupied or operating facilities, except when authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions, as acceptable to Owner and to governing authorities.

2. Provide not less than 72 hours' notice to Owner if shutdown of service is required during changeover.

B. Building Systems Requirements: Locate, identify, disconnect, and seal or cap off indicated building infrastructure systems services serving building to be selectively demolished.

1. Owner will arrange to shut off indicated building systems when requested by Contractor.
2. Where building systems are required to be removed, relocated, or abandoned, provide bypass connections to maintain continuity of service to other parts of the building before proceeding with selective demolition.

3. Remove existing branch systems noted to be demolished back to the active main remaining in service. Cap, valve, or plug and seal, or terminate the remaining portion of pipe or conduit after bypassing.

3.3 PREPARATION

A. Disconnect all electrical systems in walls, floors, and ceilings scheduled for removal. Verify that removal of systems will not impact adjacent areas that are to remain in use.

B. Maintain existing fire alarm system in operation until new system components and devices have been installed and approved by local authorities having jurisdiction.

C. Maintain existing systems serving areas adjacent to area of demolition so as to not affect Owner operations.

D. In the event that it becomes necessary to interrupt electrical systems serving areas adjacent to demolition area, contractor shall notify owner not less than 72 hours prior to shutdown.

E. Provide temporary services during interruptions to existing utilities or building infrastructure, as acceptable to Owner and to governing authorities.

F. Contractor shall inform Owner prior to bid of required upgrading of existing fire alarm system to accept new work and provide line item bid for work.

3.4 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Provide temporary lighting and GFI protected power, during demolition and remodel phases of contract. Utilize existing to be relocated normal power, panelboard feeders for temporary power panels.

B. Verify that removal of branch circuit conductor feeders will not disrupt services in adjacent spaces prior to taking offline for removal. Coordinate any required shutdown with Owner a minimum of 72 hours in advance of shutdown and do not proceed without written acknowledgement from owner. Provide temporary services during shutdown per Owner’s direction.

C. Ensure complete removal of all abandoned conduit and conductors in area of demolition. Remove abandoned conduit, except abandoned conduit above all ceiling finishes within the demo area. Cut conduit flush with walls and floors indicated to remain, and patch surfaces.

D. Remove abandoned wiring to junction box in ceiling and terminate in areas of partial demolition. Tag and identify all circuits that are abandoned in panels that are to remain that are in adjacent areas not specifically covered in these documents or scheduled for demolition. Provide new temporary panel schedule for affected electrical panels indicating all spare circuits.

E. Identify and tag all circuits that are fed from or to adjacent floors or spaces, indicating from where they are fed or where they feed.

F. Repair adjacent construction and finishes damaged during demolition and extension work.
G. Remove completely all abandoned Lighting in all areas of demolition. Identify capacity of existing system feeders and all spare circuits in panels that are to remain.

H. Identify on record drawings the locations of existing panelboard feeders, locations of panelboards in adjacent areas that serve demolition area, and circuits and or locations served by equipment in the demolition area.

I. Provide written report to the Owner, Architect, and Engineer of Record detailing all above required identification requirements.

3.5 DEMOLITION AND EXTENSION OF EXISTING FIRE ALARM, AND SECURITY SYSTEMS

A. Do not interrupt existing building fire alarm system serving areas adjacent to demolition area without Owners written approval. Maintain existing fire alarm system devices in service and on floors where work is being done to include maintaining fire alarm manual pull stations at all exit egress stairwells and corridors. Coordinate any interruptions in service with Owner and Authorities Having Jurisdiction a minimum of 72 hours in advance of required shutdown. All smoke detection will be covered during daytime working hours and uncovered by completion of work shift.

B. Existing Fire Alarm Control Panel shall be replaced entirely with new system indicated in drawings.

C. Determine sequence of removing existing FACP to coincide with new addition. Reuse existing backboxes and raceways in existing concealed walls.

D. Remove existing devices during unoccupied periods only.

E. Remove existing manual pull stations at exit doors once the new Secure Entry Project is completed.

F. Coordinate with Owner to determine components of security system to salvage for their use or use in the remodel phase of work.

G. Identify, tag, and preserve communications lines for fire alarm system circuits from this floor to main fire alarm control panel.

H. Verify that removal of branch circuit conductor feeders will not disrupt services in adjacent spaces prior to taking offline for removal.

I. Identify existing systems capacity to determine how many system devices can be installed per system before panels will need to be upgraded.

J. Identify on record drawings all locations of existing fire alarm distribution points, control panels, annunciators, and devices to remain in operation throughout construction.

K. Identify on record drawings the location of all security cameras removed and there model #'s and note what type of cabling is used to interconnect camera system.

L. Provide written report to the Owner, Architect, and Engineer of Record detailing all above required identification requirements.

3.6 DEMOLITION AND EXTENSION OF EXISTING TELEPHONE, DATA AND Central TV
DISTRIBUTION SYSTEMS

A. Schedule removal of existing MDF closet low-voltage systems with TPS Representative Tim Youngblood prior to Work. Removal shall be done prior to the HVAC systems being turned “OFF”. Removal of the existing systems shall be provided by the contractor. Equipment shall be de-commissioned per TPS Standards, removed from service, packaged and returned to Owner in working order.

B. Identify and tag all telecommunications feeders feeding this floor for future use in remodel phase of contract. Identify capacity and number of circuits available for use in remodel phase of contract.

C. Identify all telecommunication feeders that pass through demolition area that may or may not require relocation during remodel phase of contract. Identify type and style of distribution cable for coordination during remodel phase of project.

D. Identify all telecommunication lines that emanate from areas to be demolished that provide communication to other adjoining floors or spaces.

E. Remove to junction box in ceiling and terminate all abandoned Data, and Telephone, wiring in all areas of demolition.

F. Identify on record drawings all locations of existing telecommunications lines that have been terminated but remain active and those that pass through, stop at, or start in areas of demolition. Identify where trunk lines for TV Distribution systems pass through areas of demolition and where TV distribution points are located for future reuse during remodel phase of contract.

G. Provide written report to the Owner, Architect, and Engineer of Record detailing all above required identification requirements.

END OF SECTION 260450
SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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. Building wires and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:
   1. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2 and 3 control cables.
   2. Section 271500 "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.3 DEFINITIONS

A. VFC: Variable frequency controller.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.
   B. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Aluminum and Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658. Aluminum allowed ONLY for service entrance conductors from utility transformer secondary terminations to building main switchboard.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THW-2 and Type THHN-2-THWN-2.

D. Multiconductor Cable: (Limited use only) Comply with NEMA WC 70/ICEA S-95-658 for armored cable, Type AC with ground wire.

2.2 CONNECTORS AND SPLICES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   1. AFC Cable Systems; a part of Atkore International.
   3. ILSCO.
   4. O-Z/Gedney; a brand of Emerson Industrial Automation.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-2-THWN-2, single conductors in raceway.
B. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.

E. Feeders Installed below Raised Flooring: Armored cable, Type AC.

F. Feeders in Cable Tray: Type THHN-2-THWN-2, single conductors in raceway.

G. Exposed Branch Circuits, Including in Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.

H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway.

I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.

J. Branch Circuits Installed below Raised Flooring: Armored cable, Type AC.

K. Branch Circuits Installed in Millwork or Lighting Fixture Whips: Metal-clad cable, Type MC.

L. Branch Circuits in Cable Tray: Type THHN-2-THWN-2, single conductors in raceway.

M. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

N. VFC Output Circuits: Type XHHW-2 in metal conduit.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.
3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
   1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Test and Inspection Reports: Prepare a written report to record the following:
   1. Procedures used.
   2. Results that comply with requirements.
   3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519
SECTION 260523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

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. RS-485 cabling.
   2. Low-voltage control cabling.
   3. Control-circuit conductors.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.
B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
C. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
B. Source quality-control reports.
C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

Tulsa Public Schools
Macarthur Elementary Classroom Addition 2018
Allied Engineering Group, LLC
2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PERFORMANCE REQUIREMENTS

A. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262 by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.

1. Flame Travel Distance: 60 inches or less.
2. Peak Optical Smoke Density: 0.5 or less.
3. Average Optical Smoke Density: 0.15 or less.

B. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.

C. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

2.3 BACKBOARDS

A. Description: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels in Section 061000 "Rough Carpentry."

B. Painting: Paint plywood on all sides and edges with flat latex paint. Comply with requirements in Section 099123 "Interior Painting."

2.4 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CMG.

1. Paired, two pairs, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1685.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
2.5 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1685.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.6 CONTROL-CIRCUIT CONDUCTORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. General Cable; General Cable Corporation.
2. Service Wire Co: .

B. Class 1 Control Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway, complying with UL 44.

C. Class 2 Control Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway, complying with UL 83.

D. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF, in raceway, complying with UL 83.

E. Class 2 Control Circuits and Class 3 Remote-Control and Signal Circuits That Supply Critical Circuits: Circuit Integrity (CI) cable.

1. Smoke control signaling and control circuits.

2.7 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Cable will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Test cables on receipt at Project site.
3.2 INSTALLATION OF RACEWAYS AND BOXES

A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.
2. Flexible metal conduit shall not be used.

B. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.

C. Install manufactured conduit sweeps and long-radius elbows if possible.

D. Raceway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed, or in the corner of the room if multiple sheets of plywood are installed around perimeter walls of the room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard if entering the room from overhead.
4. Extend conduits 3 inches above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

E. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1 and NFPA 70.

B. General Requirements for Cabling:

1. Terminate all conductors and optical fibers; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
2. Cables may not be spliced.
3. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems." Install lacing bars and distribution spools.
5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
7. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems." Monitor cable pull tensions.
8. Support: Do not allow cables to lay on removable ceiling tiles.
9. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.

C. Installation of Control-Circuit Conductors:

1. Install wiring in raceways. Comply with requirements specified in Section 260533 "Raceways and Boxes for Electrical Systems."

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 30 inches apart.
3. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.

E. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Below each feed point, neatly coil a minimum of 72 inches of cable in a coil not less than 12 inches in diameter.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communications cable from potential EMI sources including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
   a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 5 inches.
   b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 12 inches.
   c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 24 inches.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
   b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 6 inches.
   c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   a. Electrical Equipment or Circuit Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 3 inches.
   c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.4 REMOVAL OF CONDUCTORS AND CABLES
A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified for future use with a tag.

3.5 CONTROL-CIRCUIT CONDUCTORS
A. Minimum Conductor Sizes:
   1. Class 1 remote-control and signal circuits; No 14 AWG.
   2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
   3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

3.6 FIRESTOPPING
A. Comply with requirements in Section 078413 "Penetration Firestopping."
B. Comply with TIA-569-B, Annex A, "Firestopping."
C. Comply with BICSI TDMM, "Firestopping" Chapter.

3.7 GROUNDING
A. For low-voltage control wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.8 FIELD QUALITY CONTROL
A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
C. End-to-end cabling will be considered defective if it does not pass tests and inspections.
D. Prepare test and inspection reports.

END OF SECTION 260523
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 grounding and bonding systems and equipment, plus the following special
    applications:
    1. Underground distribution grounding.
    2. Foundation steel electrodes.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS
   A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in
      "Field Quality Control" Article, including the following:
      1. Ground rods.
   B. Qualification Data: For testing agency and testing agency's field supervisor.
   C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS
   A. Operation and Maintenance Data: For grounding to include in emergency, operation, and
      maintenance manuals.
   1. In addition to items specified in Section 017823 "Operation and Maintenance Data,"
      include the following:
      a. Instructions for periodic testing and inspection of grounding features at based on
         NETA MTS.
         1) Tests shall determine if ground-resistance or impedance values remain
            within specified maximums, and instructions shall recommend corrective
            action if values do not.
         2) Include recommended testing intervals.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on
   Drawings or comparable product by one of the following:
   1. Burndy; Part of Hubbell Electrical Systems.
   2. ERICO International Corporation.
   3. ILSCO.
   4. O-Z/Gedney; a brand of Emerson Industrial Automation.

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70,
   by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by
   applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
   3. Bonding Conductor: Stranded copper conductor; Size per NFPA 70.
   4. Bonding Jumper: Bare copper tape, braided bare copper conductors terminated with
      copper ferrules; size per NFPA 70.

C. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in
   which used and for specific types, sizes, and combinations of conductors and other items
   connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire
   terminals, and long-barrel, two-bolt connection to ground bus bar.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, sectional type; 5/8 by 96 inches.
PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
   1. Bury at least 24 inches below grade.

C. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
   3. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.
a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
b. Perform tests by fall-of-potential method according to IEEE 81.

D. Grounding system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).

G. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526
SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."
PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Allied Tube & Conduit; a part of Atkore International.
      b. B-line, an Eaton business.
      c. Thomas & Betts Corporation; A Member of the ABB Group; Metal Framing Channels.
      d. Unistrut; Part of Atkore International.

B. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

C. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

D. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

   1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Hilti, Inc.
         2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
         3) MKT Fastening, LLC.
         4) Simpson Strong-Tie Co., Inc; Masterset Fastening Systems Unit.

   2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1) B-line, an Eaton business.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti, Inc.
4) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70 utilizing listed beam clamps and supports. Tie-wires shall not be an acceptable method of securing raceways.
C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer’s setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer’s written instructions.
3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529
PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section Includes:
      1. Metal conduits, tubing, and fittings.
      2. Nonmetal conduits, tubing, and fittings.
      3. Metal wireways and auxiliary gutters.
      4. Nonmetal wireways and auxiliary gutters.
      5. Surface raceways.
      7. Concrete Rectangular Floor Boxes – RFB4 Series.
      8. Handholes and boxes for exterior underground cabling.

   B. Related Requirements:
      1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
      2. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.

1.3 DEFINITIONS
   A. GRC: Galvanized rigid steel conduit.
   B. IMC: Intermediate metal conduit.
   C. EMT: Electrical metallic tubing.
   D. ENT: Electrical nonmetallic tubing.
   E. FMC: Flexible metal conduit.
   F. LFMC: Liquidtight flexible metal conduit.
   G. RNC: Rigid nonmetallic conduit.
1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems; a part of Atkore International.
2. Allied Tube & Conduit; a part of Atkore International.
3. Electri-Flex Company.
4. O-Z/Gedney; a brand of Emerson Industrial Automation.
5. Wheatland Tube Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. EMT: Comply with ANSI C80.3 and UL 797.

1. Fire Alarm EMT: Conduit and Fittings with bright red topcoat.

F. FMC: Comply with UL 1; zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:
   a. Material: Steel or die cast.
   b. Type: Setscrew or compression.
3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems; a part of Atkore International.
2. Anamet Electrical, Inc.
3. CANTEX INC.
4. Electri-Flex Company.
5. RACO; Hubbell.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. Continuous HDPE: Comply with UL 651B.

E. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   1. B-line, an Eaton business.
   2. Hoffman; a brand of Pentair Equipment Protection.
   3. MonoSystems, Inc.
   4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

   1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Screw-cover type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   1. Allied Moulded Products, Inc.
   2. Hoffman; a brand of Pentair Equipment Protection.
   3. Lamson & Sessions; Carlon Electrical Products.
   4. Niedax Inc.

B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
C. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

2.5 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Hubbell Incorporated; Wiring Device-Kellems; Hubbell Surface Metal raceway.
   b. MonoSystems, Inc.
   c. Panduit Corp.
   d. Wiremold / Legrand.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Crouse-Hinds, an Eaton business; Cooper Crouse-Hinds.
2. Hoffman; a brand of Pentair Equipment Protection.
3. Hubbell Incorporated.
4. O-Z/Gedney; a brand of Emerson Industrial Automation.
5. RACO; Hubbell.
6. Thomas & Betts Corporation; A Member of the ABB Group.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

J. Gangable boxes are allowed.

K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

L. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.7 CONCRETE RECTANGULAR FLOOR BOXES

A. Basis-of-Design Product: The design for floor boxes and fittings is based on the Resource RFB Floor Box Series manufactured by Legrand/Wiremold or products by one of the following:

1. Hubbell Incorporated; Wiring Device-Kellems.
2. Wiremold Company (The). (Legrand)
3. Carlon; Lamson & Sessions

B. RFB4-Cl-1 and RFB4-Cl-NA Series Floor Boxes: Manufactured from cast-iron and approved for use on grade and above grade floors. The box shall be 14-1/2" L x 11-7/8" W x 3-7/16" H. Provide the box with four (4) independent wiring compartments that allow capacity for up to four (4) duplex receptacles and/or communication services. The box shall permit tunneling from adjacent or opposite compartments. Two (2) of the four (4) compartments shall have a minimum wiring capacity of 27 cu in, and two (2) compartments shall have a minimum wiring capacity of 36 cu in. Four (4) compartments shall have a minimum of two (2) inches of space behind the device plates. The box shall include the following number of conduit hubs: four (4) 1-inch and four (4) 1-1/4-inch. The box shall be fully adjustable, providing a maximum of 1-7/8-inch pre-pour adjustment, and a maximum of 3/4-inch after-pour adjustment. The box shall include a series of device mounting plates that will accept both duplex power devices as well as plates that will accommodate Ortronics® workstation connectivity outlets and modular adapters, Legrand AVIP audio/video device plates, and other open system devices.

C. Activation Covers: Activation covers shall be manufactured of die-cast aluminum or die-cast zinc, and be available in a brushed aluminum finish, plated brass finish, or a powder-coated paint finish. Activation covers shall be available in flanged and flangeless versions. Covers shall be available with options for tile or carpet inserts, flush covers, or covers with one 1” trade size screw plug opening and one combination 1 1/4" and 2" trade size screw plug openings for furniture feed applications.

1. Flanged covers shall be 7 3/4" L x 6 9/16" W.
2. Flangeless covers shall be 6 3/4" L x 5 9/16" W.
D. Communication Modules Mounting Accessories: The floor box manufacturer shall provide a complete line of faceplates and bezels to facilitate mounting of UTP, STP (150 ohm), fiber optic, coaxial, and communication devices. The box shall provide a series of device mounting plates that will accommodate TPS Standard workstation connectivity outlets and modular inserts, the Pass and Seymour Network Wiring System, and other open system devices.

2.8 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armorcast Products Company.
   b. Carson Industries LLC.
   c. NewBasis.
   d. Oldcastle Precast, Inc.
   e. Quazite: Hubbell Power System, Inc.
   f. Synertech Moulded Products.

4. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
5. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
6. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
7. Cover Legend: Molded lettering, "ELECTRIC."
8. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

2.9 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.
PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: IMC.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: IMC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Raceways Embedded in Slabs:
   1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
   2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
   3. Arrange raceways to keep a minimum of 1/3 concrete depth or 2 inches of concrete cover in all directions.
   4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
   5. Change from ENT to GRC or IMC before rising above floor.

J. Stub-ups to Above Recessed Ceilings:
   1. Use EMT, IMC, or RMC for raceways.
   2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on metal service conduits.

N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
P. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

R. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

S. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where an underground service raceway enters a building or structure.
   3. Where otherwise required by NFPA 70.

T. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

U. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
   1. Use LFMC in damp or wet locations subject to severe physical damage.

V. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

W. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

X. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

Y. Locate boxes so that cover or plate will not span different building finishes.

Z. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

AA. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

BB. Concrete Rectangular Floor Boxes: The minimum concrete pour depth shall be 3 7/16” plus 1/16” above the top of the box for the RFB4, RFB4-4DB, RFB2, and the RFB2-OG Series Boxes; 2 7/16” plus 1/16” for the RFB4-SS and RFB2-SS Series Boxes; and 3 7/16” plus 13/16” above the top of the box for the RFB4-Cl-1 Box. The box shall contain four locations to accommodate leveling for pre-concrete pour adjustment and shall provide four leveling screws for the pre-pour adjustment. Activate minimum two communication ports.
3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
   a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
   b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
   c. For PVC stub-ups at equipment mounted on concrete bases with formed raceway opening to enter cabinets, enclosures and boxes. Install PVC End Bell on service conduits for conductors No. 4 AWG and larger prior to pulling conductors.
5. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
D. Install handholes with bottom below frost line, 24" below grade.
E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.
F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533
SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

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. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:


B. Sleeves for ConduitsPenetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. Sleeves for Rectangular Openings:

2. Minimum Metal Thickness:

   a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. **Basis-of-Design Product:** Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Advance Products & Systems, Inc.
   b. CALPICO, Inc.
   c. Metraflex Company (The).
   d. Pipeline Seal and Insulator, Inc.
   e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. **Basis-of-Design Product:** Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. HOLDRITE.
   b. Presealed Systems.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.


C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.
PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
   a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
   b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.

4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.

2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
C. Secure nailing flanges to concrete forms.
D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544
SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

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. Identification for raceways.
   2. Identification of power and control cables.
   3. Identification for conductors.
   5. Warning labels and signs.
   6. Instruction signs.
   7. Equipment identification labels.
   8. Miscellaneous identification products.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.
B. Comply with NFPA 70.
D. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.4 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
C. Coordinate installation of identifying devices with location of access panels and doors.
D. Install identifying devices before installing acoustical ceilings and similar concealment.
PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.2 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:
   1. Black letters on an orange field.
   2. Legend: Indicate voltage and system or service type.

C. Colors for Raceways Carrying Circuits at More Than 600 V:
   1. Black letters on an orange field.
   2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch-high letters on 20-inch centers.

D. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
   1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

2.5 FLOOR MARKING TAPE

A. 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.
2.6 UNDERGROUND-LINE WARNING TAPE

A. Tape:
   1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
   2. Printing on tape shall be permanent and shall not be damaged by burial operations.
   3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:
   1. Comply with ANSI Z535.1 through ANSI Z535.5.
   2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE, EMERGENCY.
   3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE, CONTROLS.

C. Tag: Site Utility or Site Electrical Drawings:
   1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
   2. Overall Thickness: 5 mils.
   3. Foil Core Thickness: 0.35 mil.
   5. 3-Inch Tensile According to ASTM D 882: 70 lbf, and 4600 psi.

2.7 WARNING LABELS AND SIGNS


B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Warning label and sign shall include, but are not limited to, the following legends:
   1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
   2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.8 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
   1. Engraved legend with black letters on white face.
   2. Punched or drilled for mechanical fasteners.
   3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
B. **Adhesive Film Label:** Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

### 2.9 EQUIPMENT IDENTIFICATION LABELS

A. **Engraved, Laminated Acrylic or Melamine Label:** Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

B. **Stenciled Legend:** In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch for Outdoor Equipment.

### 2.10 CABLE TIES

A. **General-Purpose Cable Ties:** Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. **Minimum Width:** 3/16 inch.
2. **Tensile Strength at 73 deg F:** According to ASTM D 638: 12,000 psi.
3. **Temperature Range:** Minus 40 to plus 185 deg F.
4. **Color:** Black except where used for color-coding.

### 2.11 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. **Paint:** Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. **Fasteners for Labels and Signs:** Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

### PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. **Location:** Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. **Self-Adhesive Identification Products:** Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. **System Identification Color-Coding Bands for Raceways and Cables:** Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors.
at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

I. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Self-adhesive vinyl labels. Install labels at 10-foot maximum intervals.

B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl tape applied in bands. Install labels at 30-foot maximum intervals.

C. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

2. Power.
3. UPS.

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service conductors.

   a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.

   b. Colors for 208/120-V Circuits:

      1) Phase A: Black.
      2) Phase B: Red.
      3) Phase C: Blue.

   c. Colors for 480/277-V Circuits:

      1) Phase A: Brown.
      2) Phase B: Orange.
      3) Phase C: Yellow.
d. **Field-Applied, Color-Coding Conductor Tape**: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

E. **Power-Circuit Conductor Identification, More than 600 V**: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation.

F. **Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.**

G. **Auxiliary Electrical Systems Conductor Identification**: Identify field-installed alarm, control, and signal connections.
   1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
   2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

H. **Locations of Underground Lines**: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
   1. Limit use of underground-line warning tape to direct-buried cables.
   2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

I. **Workspace Indication**: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

J. **Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting**:  
   2. Identify system voltage with black letters on an orange background.
   3. Apply to exterior of door, cover, or other access.
   4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:  
      a. Power transfer switches.
      b. Controls with external control power connections.

K. **Operating Instruction Signs**: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

L. **Emergency Operating Instruction Signs**: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

M. **Equipment Identification Labels**: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control
panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

   a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
   b. Outdoor Equipment: Stenciled legend 4 inches high.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

   a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets.
   c. Access doors and panels for concealed electrical items.
   d. Switchgear.
   e. Switchboards.
   f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
   g. Emergency system boxes and enclosures.
   h. Motor-control centers.
   i. Enclosed switches.
   j. Enclosed circuit breakers.
   k. Enclosed controllers.
   l. Variable-speed controllers.
   m. Push-button stations.
   n. Contactors.

N. Label information arrangement for 3-lines of text:

   1. Line one shall describe the panel or equipment name indicated on drawings/schedules. Example: "DP-XX, AHU-XX, T-XX, EF-XX, CU-XX," etc.
   2. Line two shall describe the first disconnecting means feeding this panel or equipment. Example: "Fed from DP-XX, Fed from RP-XX," etc.
   3. Line three indicates the location of disconnecting means as identified in Line two. Example: "First Floor Elect. Room #XXX."

END OF SECTION 260553
SECTION 260923 - LIGHTING CONTROL DEVICES

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. Time switches.
   2. Photoelectric switches.
   3. Indoor Vacancy/Occupancy Sensors.
   4. Low-Voltage High Definition PIR Ceiling-Mount Presence Detector.
   5. Lighting contactors.

B. Related Requirements:

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   1. Cooper Industries, Inc.
   2. Leviton Manufacturing Co., Inc.
   3. NSi Industries LLC.

B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.

   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Contact Configuration: SPST.

4. Programs: 1-Channel.
   a. For each channel, 7-day or full year load control, minimum 1,000 on/off operations with one-minute programming resolution; minimum 99 holiday event scheduling; automatic adjustment for daylight savings (with disable); automatic leap year compensation; manual override ON and OFF to the next scheduled event; LCD display in lockable, rated enclosure for the listed environment.

5. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.

6. Astronomic Time: Provide astronomical feature adjustable from 10 to 60 Northern and Southern latitudes with 1-99 minute adjustable offset from sunrise to sunset for All channels.

7. Battery Backup: Field replaceable lithium battery with minimum 8-year life for schedules and time clock.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Cooper Industries, Inc.
   2. Leviton Manufacturing Co., Inc.
   3. NSi Industries LLC.

B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
   3. Time Delay: Fifteen second minimum, to prevent false operation.
   5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.3 INDOOR OCCUPANCY SENSORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   2. Lithonia Lighting; Acuity Brands Lighting, Inc. Sensor Switch, Inc.
   3. Steinel America, Inc.

B. General Requirements for Sensors: Ceiling-mounted, solid-state indoor occupancy sensors – line voltage 120V.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes.

3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is line voltage 120V and rated for 5-Amps or 800 Watts.

4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.

5. Mounting:
   a. Sensor: Suitable for mounting in any position on a standard outlet box.
   b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
   c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.

7. Bypass Switch: Override the "on" function in case of sensor failure.

8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.

C. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.

1. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot-high ceiling.

D. Ultrasonic Type: Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy.

1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch-high ceiling.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch-high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 30 feet when mounted on a 10-foot-high ceiling in a corridor not wider than 14 feet.

E. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.

F. Low-Voltage High Definition Presence Detector (IR Quattro HD COM1-24/with TR-150 Power Pack and one(1) RC3 remote commissioning tool) Ceiling mounted; detect occupants in coverage area using PIR with four pyros (Infrared Pyroelectric detectors). The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
   1. Shall utilize passive infrared presence detection.
   2. Shall mount to a 4” square box, by 4” octagon box, Round 3.0 Mud-Ring or directly to the ceiling with quick mount tabs.
   3. Shall incorporate a real-time motion indicator LED which is visible from the front of unit while in test mode only.
   4. Infrared lens shall have 360° field of view.
   5. Shall operate at (18-24 VDC/VAC).
   6. Shall be for use with a building automation system or Steinel power pack.
   7. Shall incorporate manual ON/OFF & 1-10 volt dimming via a 2 wire momentary switch.
   8. Shall have an occupied time delay & DIM before ‘OFF’ time delay of up to 30 minutes.
   9. Shall incorporate Constant light level DIM control option via onboard photo cell and 1-10V dimming outputs to maintain the ambient light level.
   10. Shall have 4 pyros (Infrared Pyroelectric Detectors).
   11. Shall have a mechanical reach setting adjustment.
   12. Shall have a square coverage pattern with 4800 switch zones.
   13. Presence detection when mounted at 9’ shall be max. 25.5 X 25.5 ft (650.25 sq.ft.)
   14. Radial detection when mounted at 9’ shall be max. 25.5 X 25.5 ft (650.25 sq.ft.)
   15. Tangential detection when mounted at 9’ shall be max. 65.5 X 65.5 ft (4,290.25 sq.ft.).
   16. Acceptable mounting height shall be from 8’ to 32’.
   17. Shall interface with both a service and user wireless remote control.
   18. Shall have Manual ON mode (MAN) & Automatic ON mode (AUTO) options selectable via dip switch setting.
   19. Shall allow for either ‘ON’ only or ‘ON’ & ‘OFF’ manual switching.
   20. Shall have a ‘COM-Link’ feature enabling multiple sensors to link together via the communication link for pier to pier grouping achieving expanded detection zones with control set up functions set at only one primary sensor for the entire group.
   21. Shall have an IQ Mode that dynamically adjusts the ‘ON’ time delay by learning individual room occupancy.
   23. Shall be warranted free of defects in materials and workmanship for 5 years from date of purchase.

2.4 LIGHTING CONTACTORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. ASCO Power Technologies, LP; a division of Emerson Electric Co.
   2. Eaton Corporation.
   3. General Electric Company; GE Consumer & Industrial - Electrical Distribution; Total Lighting Control.
   4. Square D; a brand of Schneider Electric.

B. Description: Electrically operated and mechanically held, combination-type lighting contactors with nonfused disconnect, complying with NEMA ICS 2 and UL 508.
1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

2.5 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

C. Multiple Switching: The use of multiple switching shall be evaluated for each space and condition. Occupancy sensors shall not be used as the sole means of switching. Manual switches will be provided in all areas with single occupancy sensors.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."

   1. Identify controlled circuits in lighting contactors.
   2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

   1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

   1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
   2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
   3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 260923
SECTION 262416 - PANELBOARDS

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. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.
   1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
   2. Detail enclosure types and details for types other than NEMA 250, Type 1.
   3. Detail bus configuration, current, and voltage ratings.
   4. Short-circuit current rating of panelboards and overcurrent protective devices.
   5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
   6. Include wiring diagrams for power, signal, and control wiring.
   7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Field Quality-Control Reports:
   1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

C. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
B. Handle and prepare panelboards for installation according to NECA 407.

1.10 PROJECT CONDITIONS

A. Environmental Limitations:
   1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
   2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
      a. Ambient Temperature: Not exceeding minus 22 deg F to plus 104 deg F.
      b. Altitude: Not exceeding 6600 feet.

1.11 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.12 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.
   a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
   b. Outdoor Locations: NEMA 250, Type 3R.
   c. Type 4X, stainless steel.
   d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
   e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
3. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.

4. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.

5. Finishes:
   a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.


B. Incoming Mains Location: Top and bottom.

C. Phase, Neutral, and Ground Buses:
   2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
   3. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.

D. Conductor Connectors: Suitable for use with conductor material and sizes.
   2. Main and Neutral Lugs: Compression type.
   3. Ground Lugs and Bus-Configured Terminators: Compression type.
   4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
   5. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
   6. Gutter-Tap Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

E. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.


2.2 PERFORMANCE REQUIREMENTS

A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 2.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   1. Eaton.
3. **Square D; by Schneider Electric.**

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only As indicated and scheduled on drawings.

D. Branch Overcurrent Protective Devices: Bolt-on or Plug-in circuit breakers where individual positive-locking device requires mechanical release for removal, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

### 2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. **Basis-of-Design Product:** Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton.
3. Square D; by Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
5. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
   a. Standard frame sizes, trip ratings, and number of poles.
   b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
   c. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
   d. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
   e. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

### 2.5 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
PART 3 - EXECUTION

3.1 EXAMINATION
   A. Receive, inspect, handle, and store panelboards according to NECA 407.
   B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
   C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
   D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION
   A. Install panelboards and accessories according to NECA 407.
   B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
   C. Mount top of trim 90 inches above finished floor unless otherwise indicated.
   D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
   E. Install overcurrent protective devices and controllers not already factory installed.
   F. Install filler plates in unused spaces.
   G. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
   H. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
   I. Comply with NECA 1.

3.3 IDENTIFICATION
   A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."
   B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
   C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

C. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
   1. Measure as directed during period of normal system loading.
   2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
   3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
   4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416
SECTION 262726 - WIRING DEVICES

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. Receptacles, receptacles with integral GFCI, and associated device plates.
   2. Receptacles with integral surge-suppression units.
   3. Tamper-resistant receptacles.
   5. Snap switches and wall-box dimmers.
   6. Communications outlets.
   7. Pendant cord-connector devices.
   8. Cord and plug sets.
   9. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 DEFINITIONS
A. EMI: Electromagnetic interference.
B. GFCI: Ground-fault circuit interrupter.
C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
D. RFI: Radio-frequency interference.
E. SPD: Surge Protection Device.
F. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
   2. Cord and Plug Sets: Match equipment requirements.
1.5 ACTION SUBMITTALS
   
   A. Product Data: For each type of product.
   
   B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.6 CLOSEOUT SUBMITTALS
   
   A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   
   A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
      
      1. Hubbell Incorporated; Wiring Device-Kellems; Wiring Device-Kellems (Hubbell).
      2. Leviton Manufacturing Co., Inc.

   B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS
   
   A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   
   B. Comply with NFPA 70.
   
   C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
      
      1. Connectors shall comply with UL 2459 and shall be made with stranded building wire.
      2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES
   
   A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
      
      1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
         
         a. Hubbell Incorporated; Wiring Device-Kellems; HBL5352 (duplex).
         b. Leviton Manufacturing Co., Inc; 5891 (single), 5352 (duplex).
         c. Pass & Seymour/Legrand (Pass & Seymour); 5361 (single), 5362 (duplex).
B. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Hubbell Incorporated; Wiring Device-Kellems; BR20TR.
   b. Leviton Manufacturing Co., Inc; 800-SGG.
   c. Pass & Seymour/Legrand (Pass & Seymour); TR63H.

2. Description: Labeled shall comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, non-feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596, self-diagnostic.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Leviton Manufacturing Co., Inc; 7590.
   c. Pass & Seymour/Legrand (Pass & Seymour); 2095.

C. Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Hubbell Incorporated; Wiring Device-Kellems; GFTR20.
   b. Pass & Seymour/Legrand (Pass & Seymour); 2095TR.

2.5 USB RECEPTACLES

A. Duplex Convenience Receptacles with (2) USB Ports, 125V, 20A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Hubbell Incorporated; Wiring Device-Kellems; USB20X2.
   b. Pass & Seymour/Legrand (Pass & Seymour); TR5362USB.
   c. Leviton Manufacturing Co. INC; T5832.

B. 4-Port USB Only Receptacles, 125 V, 4.2 A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
2.6 SPD RECEPTACLES

A. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 1449, and FS W-C-596, with integral SPD in line to ground, line to neutral, and neutral to ground.

1. SPD Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.

2. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."

B. Duplex TVSS Convenience Receptacles:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Hubbell Incorporated; Wiring Device-Kellems; USB4.
   b. Pass & Seymour/Legrand (Pass & Seymour); TM8USB4.
   c. Leviton Manufacturing Co., Inc; USB4P.

2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 Configuration 5-20R.

2.7 PENDANT CORD-CONNECTOR DEVICES

A. Description:

1. Matching, locking-type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.

2.8 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.

2.9 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Single Pole:
      1) Cooper; AH1221.
      2) Hubbell; HBL1221.
      3) Leviton; 1221-2.
      4) Pass & Seymour; CSB20AC1.

   b. Two Pole:
      1) Cooper; AH1222.
      2) Hubbell; HBL1222.
      3) Leviton; 1222-2.
      4) Pass & Seymour; CSB20AC2.

   c. Three Way:
      1) Cooper; AH1223.
      2) Hubbell; HBL1223.
      3) Leviton; 1223-2.
      4) Pass & Seymour; CSB20AC3.

   d. Four Way:
      1) Cooper; AH1224.
      2) Hubbell; HBL1224.
      3) Leviton; 1224-2.
      4) Pass & Seymour; CSB20AC4.

C. Pilot-Light Switches, 20 A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Cooper; AH1221PL for 120 and 277 V.
   b. Hubbell; HBL1201PL for 120 and 277 V.
   c. Leviton; 1221-LH1.
   d. Pass & Seymour; PS20AC1RPL for 120 V, PS20AC1RPL7 for 277 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

D. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   b. Hubbell; HBL1557.
   c. Leviton; 1257.
   d. Pass & Seymour; 1251.
2.10 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters. Provide Lutron DIVA DVSCSTV-White.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472. Dimmer shall comply with the LED light manufacturer drivers and occupancy sensors.

C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.11 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: 0.035-inch-thick, satin-finished, Type 302 stainless steel.
   4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.12 FLOOR SERVICE FITTINGS

A. Type: Modular, flap-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Round, die-cast aluminum with satin finish.

D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.

2.13 FINISHES

A. Device Color:

   1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
   3. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

B. Wall Plate Color: For plastic covers, match device color.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:
   1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
   3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
   4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
   1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
   2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
   3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtailed.
   4. Existing Conductors:
      a. Cut back and pigtail, or replace all damaged conductors.
      b. Straighten conductors that remain and remove corrosion and foreign matter.
      c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:
   1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
   2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
   3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
   4. Connect devices to branch circuits using pigtailed that are not less than 6 inches in length.
   5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
   6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
   7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtailed for device connections.
   8. Tighten unused terminal screws on the device.
   9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:
   1. Install dimmers within terms of their listing.
   2. Verify that dimmers used for fan speed control are listed for that application.
   3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers’ device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

J. Manufactured Modular Furniture: Rough-in floor service outlets and coordinate with modular furniture wiring and provide multiwire conductor set and required breaker tie-handles. Coordinate furniture system dimensions and layout with Owner provided systems.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 “Identification for Electrical Systems.”

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Test Instruments: Use instruments that comply with UL 1436.
   2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:
   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 262726
SECTION 262813 - FUSES

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. Cartridge fuses rated 600-V ac and less for use in enclosed switches, enclosed controllers, and motor-control centers.
2. Spare-fuse cabinets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Dimensions and manufacturer’s technical data on features, performance, electrical characteristics, and ratings.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
4. Coordination charts and tables and related data.
5. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 MATERIALS MAINTENANCE SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.
D. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Bussmann, an Eaton business.
2. Littelfuse, Inc.
3. Mersen USA.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.3 PLUG-FUSE ADAPTERS

A. Characteristics: Adapters for using Type S, rejection-base plug fuses in Edison-base fuseholders or sockets; ampere ratings matching fuse ratings; irremovable once installed.

2.4 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch-high letters on exterior of door.
4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:
   1. Service Entrance: ClassJ, time delay.
   2. Feeders: ClassL, time delay.
   3. Motor Branch Circuits: ClassRK5, time delay.
   4. Other Branch Circuits: ClassRK5, time delay.
   5. Control Circuits: Class CC, fast acting.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813
SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Fusible switches.
   2. Nonfusible switches.
   3. Enclosures.

1.3 DEFINITIONS

A. GD: General duty.
B. HD: Heavy duty.
C. NC: Normally closed.
D. NO: Normally open.
E. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
   1. Enclosure types and details for types other than NEMA 250, Type 1.
   2. Current and voltage ratings.
   3. Short-circuit current ratings (interrupting and withstand, as appropriate).
   4. Include evidence of NRTL listing for series rating of installed devices.
   5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
   6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

C. Manufacturer's field service report.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NFPA 70.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.9 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton.
2. General Electric Company.
3. Square D; by Schneider Electric.

B. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with cartridge fuse interiors to accommodate indicated fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Hookstick Handle: Allows use of a hookstick to operate the handle.
5. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings]<Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. Eaton.
2. General Electric Company.
3. Square D; by Schneider Electric.
C. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
   2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
   3. Hookstick Handle: Allows use of a hookstick to operate the handle.
   4. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Eaton.
   2. General Electric Company.
   3. Square D; by Schneider Electric.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.


D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
   1. Instantaneous trip.
   2. Long- and short-time pickup levels.
   3. Long- and short-time time adjustments.

F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

G. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

H. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
I. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

J. Features and Accessories:
   1. Standard frame sizes, trip ratings, and number of poles.
   2. Lugs: Compression type, suitable for number, size, trip ratings, and conductor material.

2.4 MOLDED-CASE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Eaton.
   2. General Electric Company.
   3. Square D; by Schneider Electric.

B. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

C. Features and Accessories:
   1. Standard frame sizes and number of poles.
   2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
   3. Accessory Control Power Voltage: Remote mounted and powered; 24-V ac.

2.5 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
   1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
   2. Outdoor Locations: NEMA 250, Type 3R.
   4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
B. Install fuses in fusible devices.
C. Comply with NECA 1.
D. Install NEMA KS 1 enclosed switch where indicated for motor loads ½ HP and larger and equipment loads greater than 30A.
E. Install toggle disconnect switch, surface mounted, where indicated for motor loads less than 3/4 HP and equipment loads 30A and less.
F. Install flexible liquid tight conduit from toggle disconnect switch to stationary equipment.
G. Install control wiring from early break contacts in motor disconnect switch to variable frequency controllers to shut down controller when switch is open.
H. Install equipment on exterior foundation walls at least one inch (25 mm) from wall to permit vertical flow of air behind breaker and switch enclosures.
I. Support enclosures independent of connecting conduit or raceway system.

3.3 CONCRETE BASES
A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.
B. Concrete base is specified in Division 26 Section "Hangers and Supports for Electrical Systems," and concrete materials and installation requirements are specified in Division 3.

3.4 IDENTIFICATION
A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.5 FIELD QUALITY CONTROL
A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing and submit in close-out documents.
B. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
C. Acceptance Testing Preparation:
   1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

E. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

END OF SECTION 262816
SECTION 262913 - ENCLOSED CONTROLLERS

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 the following enclosed controllers rated 600 V and less:
   1. Full-voltage manual.
   2. Full-voltage magnetic.

B. Related Section:
   1. Section 262923 "Variable-Frequency Motor Controllers" for general-purpose, ac, adjustable-frequency, pulse-width-modulated controllers for use on variable torque loads in ranges up to 200 hp.

1.3 DEFINITIONS

A. CPT: Control power transformer.
B. MCCB: Molded-case circuit breaker.
C. MCP: Motor circuit protector.
D. N.C.: Normally closed.
E. N.O.: Normally open.
F. OCPD: Overcurrent protective device.
G. SCR: Silicon-controlled rectifier.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.

B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.
   1. Show tabulations of the following:
      a. Each installed unit's type and details.
      b. Factory-installed devices.
c. Nameplate legends.
d. Short-circuit current rating of integrated unit.
e. Listed and labeled for integrated short-circuit current (withstand) rating of OCPDs in combination controllers by an NRTL acceptable to authorities having jurisdiction.
f. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.

2. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for enclosed controllers and installed components.
2. Manufacturer's written instructions for setting field-adjustable overload relays.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.9 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
PART 2 - PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Eaton.
   b. General Electric Company.
   c. Square D; by Schneider Electric.

2. Configuration: Nonreversing.
3. Surface mounting.
5. Additional Nameplates: FORWARD and REVERSE for reversing switches.

C. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Eaton.
   b. General Electric Company.
   c. Square D; by Schneider Electric.

2. Configuration: Nonreversing.
3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type.
4. Surface mounting.
5. Green pilot light.

D. Integral Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Eaton.
   b. General Electric Company.
   c. Square D; by Schneider Electric.

2. Configuration: Nonreversing.
3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters and sensors in each phase, matched to nameplate full-load
current of actual protected motor and having appropriate adjustment for duty cycle; external reset push button; bimetallic type.

4. Surface mounting.
5. Green pilot light.
6. N.O. auxiliary contact.

E. Magnetic Controllers: Full voltage, across the line, electrically held.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Configuration: Nonreversing.
3. Contactor Coils: Pressure-encapsulated type with coil transient suppressors.
   a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
4. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
5. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with control power source of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
   a. CPT Spare Capacity: 100 VA.
6. Bimetallic Overload Relays:
   a. Inverse-time-current characteristic.
   b. Class 10 tripping characteristic.
   c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
   d. Ambient compensated.
   e. Automatic resetting.
7. N.C., isolated overload alarm contact.
8. External overload reset push button.

F. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Eaton.
   b. General Electric Company.
   c. Square D; by Schneider Electric.
3. Fusible Disconnecting Means:
   a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class J fuses.
b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

4. Nonfusible Disconnecting Means:
   a. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
   b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
   c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.

2.2 ENCLOSURES

A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.
   1. Dry and Clean Indoor Locations: Type 1.
   2. Outdoor Locations: Type 3R.
   4. Other Wet or Damp Indoor Locations: Type 4.

2.3 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
      a. Push Buttons: Recessed types; maintained as indicated.
      b. Pilot Lights: LED types; colors as indicated; push to test.
      c. Selector Switches: Rotary type.
   2. Meters: Panel type, 2-1/2-inch minimum size with 90- or 120-degree scale and plus or minus two percent accuracy. Where indicated, provide selector switches with an off position.

B. Reversible N.C./N.O. auxiliary contact(s).


D. Cover gaskets for Type 1 enclosures.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.
Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."

B. Seismic Bracing: Comply with requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in each fusible-switch enclosed controller.

E. Install fuses in control circuits if not factory installed. Comply with requirements in Section 262813 "Fuses."

F. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

G. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

3.4 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers and remote devices and facility's central control system. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic-control selection devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.
3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:
   1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

C. Tests and Inspections:
   1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
   2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
   3. Test continuity of each circuit.
   4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner before starting the motor(s).
   5. Test each motor for proper phase rotation.
   7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
   8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed controllers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.

C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Owner before increasing settings.

D. Set the taps on reduced-voltage autotransformer controllers at 50 percent.

E. Set field-adjustable switches and program microprocessors for required start and stop sequences in reduced-voltage solid-state controllers.
F. Set field-adjustable circuit-breaker trip ranges

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.

B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers, and to use and reprogram microprocessor-based, reduced-voltage solid-state controllers.

END OF SECTION 262913
SECTION 263353 - CENTRAL BATTERY INVERTERS

PART 1 - GENERAL

1.1 SUMMARY

A. The system shall consist of a solid-state inverter, a temperature compensated rectifier/battery charger, a 100% rated for continuous duty static switch, an internal maintenance bypass switch, battery plant, status/control panel, and synchronizing circuitry as described herein.

1.2 STANDARDS

A. The Central Lighting Inverter UPS shall meet the requirements of the following standards:

2. FCC rules and regulations of Part 15, Subpart J, Class A
3. Listed under UL 924, Standards for Lighting Inverter Equipment
4. NEMA PE 1 (National Electrical Manufacturers Association) - Lighting Inverter Systems
5. NEMA 250 (National Electrical Manufacturers Association) - Enclosures for Electrical Equipment (1000 Volts Maximum)
6. NFPA 70 – National Electrical Code
7. ISO 9001
8. Occupational Safety & Health Administration (OSHA)

1.3 SUBMITTALS

A. Submittals for engineering approval shall contain the following documentation:

B. Upon delivery of the Central Lighting Inverter (CLI) system the following submittals shall be included:

1. An Operators and Users Manual showing safe and correct operation of all central lighting inverter functions.

1.4 QUALIFICATIONS & QUALITY ASSURANCE

A. Manufacturers Certification: The manufacturer shall specialize in manufacturing of on-line, double conversion, single phase Central Lighting Inverter (CLI) modules specified in this document with a minimum of twenty years documented experience, and with a nation wide service organization. The manufacturer will use only ECM technology. The manufacturer shall comply with ISO 9001 and shall be designed to internationally accepted standards.

B. Factory Testing: Prior to shipment the manufacturer shall complete a documented test procedure to test all functions of the CLI module and batteries (via a discharge test) and guarantee compliance with the specification. The manufacturer shall provide a copy of the test report upon request.
C. Materials and Assemblies: All materials and parts comprising the CLI shall be new, of current manufacture, and shall not have been in prior service, except as required during factory testing. All active electronic devices shall be solid state and not exceed the manufacturers recommended tolerances for temperature or current to ensure maximum reliability. All semiconductor devices shall be sealed. All relays shall be provided with dust covers. The manufacturer shall conduct inspections on incoming parts, modular assemblies and final products.

1.5 DELIVERY, STORAGE AND HANDLING

A. All products shall be packaged in a manner to prevent penetration by debris and to allow safe delivery by all modes of ground transportation and air transportation where specified.

B. Prior to shipping all products shall be inspected at the factory for damage.

C. Equipment shall be protected against extreme temperature and humidity and shall be stored in a conditioned or protected environment.

D. Equipment containing batteries shall not be stored for a period exceeding three months without powering up the equipment for a period of eight hours to recharge the batteries.

1.6 ENVIRONMENTAL REQUIREMENTS

A. The CLI shall operate under the following environmental conditions:

1. Temperature:
   a. CLI Module (1). Operating: 0° to 40°C (32°F to 104°F) (2). Non-Operating: -20°C to +60°C (-4°F to 140°F)
   b. Batteries: 25°C (77°F)

2. Relative humidity (operating and storage): 5 to 95% non-condensing

3. Barometric Pressure:
   a. Up to 1000 meters above sea level
   b. Up to 2000 meters with ambient temperature less than 28°C
   c. Up to 12,000 meters above sea level non operating

4. Audible Noise: 45 dBA at 3 feet

1.7 WARRANTY

A. CLI Module: The CLI shall be covered by a full parts and labor warranty from the manufacturer for a period of twelve (12) months from date of installation or acceptance by customer or eighteen (18) months from date of shipment from the manufacturer, whichever occurs first.

B. Battery: The battery manufacturer’s warranty shall be passed through to the final customer and shall have a minimum period of one year, with 9 years prorated.
1.8 SERVICE AND SPARE PARTS

A. The manufacturer shall upon request provide spare parts kits for the CLI module in a timely manner as well as provide access to qualified factory trained service personnel to provide preventative maintenance and service on the central lighting inverter module when required.

1.9 MAINTENANCE, ACCESSIBILITY AND SELF DIAGNOSTICS

A. All CLI subassemblies, as well as the battery, shall be accessible from the front only. CLI design shall provide maximum reliability and minimum MTTR (mean time to repair). To that end, the CLI shall be equipped with a self-test function to verify correct system operation. The electronic CLI control and monitoring assembly shall therefore be fully microprocessor based.

1. Auto-compensation of component drift;
2. Self-adjustment of replaced subassemblies;
3. Extensive acquisition of information vital for computer-aided diagnostics (local or remote);

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS/PRODUCT

A. DSPM Defender 1 Emergency Lighting System or Engineer Approved Equal.

B. Engineer permits substitutions, subject to meeting all the requirements of this specification and having written approval no less than 10 days prior to bid closing.

2.2 PRODUCT SPECIFICATIONS

A. Central Lighting Inverter Design Requirements

1. Output Power Continuous Rating: The continuous output power rating of the CLI shall be as indicated on drawings (with additional power ranges listed on data sheet)
2. Input Voltage: 208VAC - 15%/+10%, single phase.
3. Output voltage(s): 120VAC-120VAC single phase.
4. Battery Autonomy: The CLI shall be capable of operating at full load for 120 minutes at unity power factor (PF) output at temperature of 25°C on battery power.
5. Battery Type: Valve regulated, sealed, Lead Calcium (AGM).

B. AC Input Characteristics

1. Input Frequency: 60 Hz
2. Power walk-in: 0 to 100% over a 10-second period.
3. Magnetizing Inrush Current: Less than nominal input current for less than one cycle.
4. Input Surge Protection: The CLI is equipped with standard input filter assembly will withstand surges per IEEE 587-1980/ANSI C62.41

C. AC Output Characteristics

1. Voltage Regulation: + 3% for no-load to full load and full 120 minute battery discharge mode.
2. Frequency: 60 Hz (+ 0.1Hz when free running).
3. Voltage Distortion: Maximum 5% total (THD) @ 100% linear loads.

4. Voltage Transient (Step Load) Response:
   a. + 5% for 50% step load change
   b. + 8% for 100% step load change
   c. + 3% for loss or return of AC input power or manual transfer at full load.

5. Voltage Recovery Time: Return to within 3% of nominal value within 50 milliseconds.

6. Non-Linear Load Capability: Output voltage total harmonic distortion shall be less than 8% when connected to a 100% non-linear load with a crest factor not to exceed 2.5%.

7. Slew Rate: 1 Hz/second maximum.


9. Inverter Overload Capability:
   a. 125% of rated load for 1 minute
   b. 145% of rated load for 1 second

10. Bypass Overload Capability: < 300% for one cycle; 150% for 30 seconds

11. (LED Monitor) Every 30 days a self testing / self-diagnostics will be activated. The system will log (store in memory) any alarms and make available through the front panel LED all information.

D. DC Bus

1. DC Bus Voltage: 2.3 VDC/cell nominal Float level. The battery charger will compensate for temperature changes in accordance with the battery manufacturer’s requirements. CLI will utilize our watch-dog interface software to control DC voltage; this control will extend life of batteries by 50%.

2.3 MODES OF OPERATION

A. The CLI module shall be designed to operate as a double conversion, on-line reverse transfer system in the following modes.

1. Normal: The inverter shall continuously supply power to the critical load. The rectifier/battery charger shall derive power from the utility AC source, supply DC power to the inverter and simultaneously float charging the battery.

2. Emergency: Upon failure of the utility AC power source, the critical load shall be supplied by the inverter, which, without any switching, shall obtain its power from the battery.

3. Recharge: Upon restoration of the utility AC power source (prior to complete battery discharge), the rectifier/battery charger shall power the inverter and simultaneously recharge the battery.

4. Bypass Mode: The static bypass transfer switch shall be used to transfer the load to the bypass without interruption to the critical power load. This shall be accomplished by turning the inverter off. Automatic re-transfer or forward transfer of the load shall be accomplished by turning the inverter on.

5. Manual Bypass Switch: A manual make before break internal bypass switch shall be provided to isolate the CLI inverter output and static bypass and connect the load directly to the utility until service personnel can arrive to repair unit.
2.4 COMPONENT DESCRIPTION

A. Rectifier / Battery Charger: Incoming AC power shall be converted to a regulated DC output voltage. The rectifier / battery charger shall provide high quality DC power to charge the batteries and power the inverter and shall have the following characteristics:

1. Input Current Limiting: The CLI shall be equipped with a system designed to limit the battery recharge current to conform to UL924 standard.
2. Modular Assembly: The rectifier/battery charger assembly shall be constructed of modular design to facilitate rapid maintenance.
3. Charging Levels: The battery charging circuitry shall be capable of being set for automatic battery recharge operation, float service and equalizing operation.
4. Temperature Compensated Charging: The battery charger shall enable temperature compensated charging and adjust the battery float voltage to compensate for the ambient temperature using a negative temperature coefficient of 3 mV per cell per degree Celsius at a nominal temperature of 25°C.
5. Capacity: The rectifier/battery charger shall have sufficient capacity to support a fully loaded inverter and fully recharge the battery to full capacity in accordance with UL 924 specifications.

B. Inverter: The CLI output shall be derived from a Pulse Width Modulated (PWM) IGBT inverter design. The inverter shall be capable of providing precise output power while operating over the battery voltage range. The inverter assembly shall be constructed as a modular assembly to facilitate rapid maintenance.

C. Static Bypass: The static bypass transfer switch shall be solid-state, rated for continuous 100% duty and shall operate under the following conditions:

1. Uninterrupted Transfer: The static bypass transfer switch shall automatically cause the bypass source to assume the critical load without interruption after the logic senses one of the following conditions:
2. Inverter overload exceeds unit's rating
3. Inverter failure
4. Automatic Uninterrupted Forward Transfer: The static bypass transfer switch shall automatically forward transfer power from the bypass to the rectifier / inverter, without interruption, after the CLI inverter is turned "ON", after an instantaneous overload-induced reverse transfer has occurred and the load current returns the CLI's nominal rating or less.

D. Microprocessor Controlled Logic: The full CLI operation shall be provided through the use of microprocessor controlled logic. All operation and parameters are firmware controlled. The logic shall include a self-test and diagnostic circuitry such that a fault can be isolated down to the printed circuit assembly or plug-in power assembly level.

E. Standard Communication Panel: The CLI will include a standard easy to use communication panel. Included will be a LED display. The CLI communication panel will include pushbuttons that will permit the user to safely command the CLI.

2.5 SYSTEM CONTROLS AND INDICATORS

A. Front Panel LED Display: The CLI control panel shall provide a LED display screen. The indication of CLI status, metering, battery status, alarm event log and advanced operational features will be available. The display provides access to:
B. System Parameters Monitored (data displayed): The visual display will display the following system parameters based on true RMS metering:

1. Measurements
   a. Input voltage indicator
   b. CLI output voltage indicator
   c. CLI output current indicators
   d. DC voltage indicators

2. Status indications and events
   a. Load on battery
   b. Load on CLI
   c. Load on automatic bypass
   d. Low-battery warning
   e. General Alarm
   f. Additional indications shall provide maintenance assistance

3. Time-stamped historical events: This function shall time-stamp and store all important status changes, anomalies and faults and make this information available for automatic or user-requested consultation; it shall interpret the events and indicate remedial measures if applicable.

4. Dry Contacts (Optional): The CLI shall be capable of providing optional relay contacts. The contacts will be a form “C” contact and will change state to indicate the operating status. The contacts will be rated at 2.0 A (125 VAC / 30 VDC). Contacts shall be programmed as:
   a. CLI on-line
   b. Load on Bypass
   c. CLI on Battery

2.6 MECHANICAL DESIGN AND VENTILATION

A. Enclosure: The CLI shall be housed in a freestanding enclosure. The mechanical structure of the CLI shall be sufficiently strong and rigid to withstand handling and installation operations without risk. Access to CLI subassemblies shall be through the front only. The sheet-metal elements in the structure shall be protected against corrosion by a suitable treatment, such as zinc electroplating, powder coating, epoxy paint or an equivalent.

B. Cable Access: The standard CLI available shall accommodate side, top and bottom entry cables.

C. Ventilation and Heat Rejection: The CLI shall be designed for forced air-cooling. Air inlets shall be provided from the front bottom of the CLI enclosure. Air exhaust shall be from the top or side portions of the unit.

2.7 BATTERY

A. The CLI module shall use a valve regulated sealed Lead Calcium heavy-duty industrial battery, designed for auxiliary power service in a CLI application. The primary battery shall be furnished with battery with impact resistant plastic case and housed in matching battery cabinet (18 KW or greater only).
1. Protection against Deep Discharge and Self-Discharge: The CLI shall be equipped with a device designed to protect the battery against deep discharge depending on discharge conditions, with isolation of the battery by a circuit breaker. In particular, a monitoring device shall adjust the battery shutdown voltage as a function of a discharge coefficient to avoid excessive discharge.

2. Battery Self-Tests: The battery monitoring system shall be to perform the following automatic functions:

   a. Battery circuit check

2.8 EXTERNAL MAINTENANCE BYPASS (Optional):

   A. The maintenance bypass provides a wrap around bypass configuration for total CLI isolation during maintenance. Maintenance bypass transfers shall be without interruption and shall have mechanical interlocks to protect the CLI from damage in the event of an out of sequence transfers.

PART 3 - EXECUTION

3.1 SITE TESTING START-UP

   A. The CLI system will be checked, start-up and tested by a manufacturer's qualified field service engineer.

3.2 MAINTENANCE TRAINING

   A. The manufacturer shall make available to the customer various levels of training ranging from basic CLI operation to CLI maintenance.

END OF SECTION 263353
SECTION 265119 – LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior solid-state luminaires that use LED technology.
   2. Lighting fixture supports.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.
B. CRI: Color Rendering Index.
C. SSL: Solid-State Luminaire.
D. Fixture: See "Luminaire."
E. IP: International Protection or Ingress Protection Rating.
F. LED: Light-emitting diode.
G. Lumen: Measured output of lamp and luminaire, or both.
H. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, arranged by designation.
B. Shop Drawings: For nonstandard or custom luminaires.
   1. Include plans, elevations, sections, and mounting and attachment details.
   2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.
C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved:
B. Product Certificates: For each type of luminaire.
1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion. Warranty shall cover all components comprising the luminaire. All warranty documentation shall be provided to customer prior to the first shipment.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS


B. Listing: cULus 1598 listed for damp locations.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

A. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

B. Indoor/IC Rated and listed for Damp Locations.

C. Other fixture types must be submitted to Owner prior to bidding or design where not indicated or specified.

D. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

E. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.

1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.2 LED TROFFER MANUFACTURERS

A. Pre-Approved Manufacturers Listed: Products of firms regularly engaged in the manufacture of recessed LED lighting fixtures of types and ratings required, whose products have been in
satisfactory use in similar service for not less than 5 years. The manufacturer of the lighting fixtures shall comply with the provisions of the appropriate code and standards. All fixtures shall be pretested before shipping. Provisions for a single fixture shipped to the project site shall become property of the Owner to test and evaluate the construction meets or exceeds the original fixture approved by the Owner and listed in the fixture schedule.

B. Conformance: Fixtures shall be manufactured in strict accordance with the Contract Drawings and Specifications.

C. Codes: Materials and installation shall be in accordance with the latest revision of the National Electrical Code and any applicable Federal, State, and local codes and regulations.

D. UL or CSA US Listing: All fixtures shall be manufactured in strict accordance with the appropriate and current requirements of the “Standards for Safety” to UL 8750 or others as they may be applicable. A listing shall be provided for each fixture type, and the appropriate label or labels shall be affixed to each fixture in a position concealing it from normal view.

E. Luminaire Flat Panel Edge Lit shall be DLC Premium Certified (Design Lights Consortium).

F. Specifications and scale drawings are intended to convey the salient features, function and character of the fixtures only, and do not undertake to illustrate or set forth every item or detail necessary for the work.

G. Base Bid Manufacturers: Are listed on fixture schedule and specification. Manufacturers listed without accompanying catalog numbers are responsible for meeting the quality standards and photometric distribution set by the specified product.

H. Alternate Manufacturers: Identification by means of manufacturers names and catalog numbers is to establish basic features, quality and performance standards. Any substitutions must meet or exceed these standards. The three listed manufacturers are pre-approved Owner’s standard fixtures and substitution request may not be allowed prior to bid.

2.3 LED LUMINAIRE SOURCE REQUIREMENTS

A. LED’s shall be manufactured by, Nichia, Cree, Samsung or Osram.

B. Lumen Output – minimum initial lumen output of the luminaire shall be as follows for the lumens exiting the luminaire in the 0-90-degree zone - as measured by IESNA Standard LM-79-08 in an accredited lab. Exact tested lumen output shall be clearly noted on the shop drawings.

1. Type 2x4: 40 Watt, Efficacy (lm/W) >124 @ 5000K for ceilings up to 9'-0".
2. Type 2x4: 48 Watt, Efficacy (lm/W) >123 @ 5000K for ceilings 9'-1" to 11'-0".
3. Type 2x2: 30 Watt, Efficacy (lm/W) >122 @ 5000K for ceilings up to 9'-0".
4. Type 2x2: 40 Watt, Efficacy (lm/W) >108 @ 5000K for ceilings 9'-1" to 11'-0".
5. Type 1x4: 30 Watt, Efficacy (lm/W) >120 @ 5000K.

C. Recessed Fixtures: Comply with NEMA LE 4.

A. Rated lamp life of 50,000 hours. Lumen output shall not decrease by more than 20% over the minimum operational life of 50,000 hours.

B. Individual LEDs shall be connected such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.
C. LED Boards shall be suitable for field maintenance or replacement with plug-in connectors at power supply/drive.

D. Light Color/Quality:
   1. Correlated Color temperature (CCT) range as per specification, luminaire sources and 5000K shall be correlated to chromaticity as defined by the absolute (X, Y) coordinates on the 2-D CIE chromaticity chart.
   2. The color rendition index (CRI) shall be 82 or greater.
   3. Chromaticity shift over 6,000 hours shall be <0.007 change in delta-u'v' average as demonstrated data set in IESNA LM-80-08 report.
   4. Lumen Maintenance Factor: >0.84 at 25°C, 50,000 hours and reported in TM-21 L70 Lifetime >60,000 hours.
   5. Binning: Per ANSI, 3-step MacAdam ellipse with abilities to produce uniform color across copious quantities of fixtures.

2.4 LED LUMINAIRE POWER SUPPLY AND DRIVE REQUIREMENTS

A. Driver: Instant start. 120 – 277 Volt, UL Listed, CSA Certified, Sound Rated A+. Driver shall be > 80% efficient at full load across all input voltages. Input wires shall be 18AWG solid copper minimum.
   1. Flat Panel Edge-lit LED: The electronics/power supply enclosure shall be external to the SSL luminaire and be accessible per UL requirements.

B. Dimming: Driver shall be suitable for full-range dimming. The luminaire shall be capable of continuous dimming without perceivable flicker over a range of 100% to 5% of rated lumen output with a smooth shut off function. Dimming shall be controlled by a 0-10V signal. Signal wires shall be 22 AWG solid copper minimum.

C. Compatible with Leviton dimming device(s): DS710-10Z or equal.

D. Electrical Characteristics:
   1. Power Factor: >0.93.
   2. Input Power: 120-277V, 50/60 Hz.
   3. Total Harmonic Distortion (THD): <20%.
   4. The surge protection which resides within the driver shall protect the luminaire from damage and failure for transient voltages and currents as defined in ANSI/IEEE C64.41 2002 for Location Category A, where failure does not mean a momentary loss of light during the transient event.

E. Material Usage: Drivers shall be (ROHS)-compliant.

2.5 LED FLAT PANEL CONSTRUCTION

A. Frame: LED strips mounted on edges enclosed in solid extruded aluminum frame, painted after formed with UV-stabilized acrylic optical lens with a full aluminum back. Construction seals conditioned air from the plenum or non-conditioned air. Housing shall be designed rigid to eliminate warping or bending for level installation. Frame corners conformed for seamless appearance.

B. Optical Lens/Diffusers:
   1. Acrylic: One hundred percent virgin UV-stabilized acrylic (PMMA) optical panel, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
C. Each luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply) and integral controls as per this specification.

D. Each luminaire shall be designed to operate at an average operating temperature -4°F to 104°F.

E. Humidity: 20% – 85% RH, Lighting Facts.

F. Luminaire housing to have no visible welding, screws, springs, hooks, rivets, bare LED’s or plastic supports in viewing angles at floor to ceiling placement.

G. The luminaire shall be a single, self-contained device, not requiring on-site assembly for installation. The power supply and circuit board for the luminaire shall be fundamental to the unit.

H. Driver disconnect shall be provided where required to comply with codes.

I. Finish: Polyester white powder coat painted with 92% high-reflective paint after fabrication.

J. Integral Grid Clips required on recessed mounted luminaires along with integral tie wire mounting points. Compatible with standard 15/16" and 9/16" T-Bar ceilings.

K. Luminaire to have air removal capability where specified.

2.6 LED LUMINAIRE CONSTRUCTION (KITCHENS)

A. Construction:
   1. Shallow 3-1/4" deep extruded aluminum housing with internal high angled distribution.
   2. Injection molded composite end plates securely attached with screws without gaps.
   3. Four suspension mounted points.
   4. Durable frame with high reflectance baked enamel finish.

B. Optics/Shielding: High optical grade acrylic lens.

C. Electrical System: Integral, high-efficiency driver. 120-277V 50/60 Hz. 0.9 Power Factor at full load. <20% THD at full load. Operating temperature -40°F - +104°F.

D. Efficacy: Less than 10’ ceiling heights (LPW): >150 at 43W. Greater than 10’ ceiling heights (LPW): >147 at 57W.

E. Color Temperature: 5000K minimum.

F. CRI: 80.

G. Options: Provide Wet Location/Wipe Down where located in dishwasher areas with hose-bibb.

2.7 LED HIGH EFFICIENT HIGH BAY LUMINAIRE CONSTRUCTION (GYMNASIUMS)

A. Construction:
   1. Full body construction, 22-Gauge.
   2. Stiffening brackets and side rails.
   3. Low-profile, lightweight design.
4. Suspension mounted with wire hook and chain set or cable mounting.
5. 16/3 AWG white power cord.

B. Optics/Shielding: Acrylic lens, wireguard and doorframe. LED system delivers wide distribution, uniformity & spacing.

C. Electrical System: Integral, high-efficiency driver. 120-277V 50/60 Hz. 0.9 Power Factor at full load. <20% THD at full load. Operating temperature -40°F - +104°F.

D. Efficacy: Medium Lumens for lower ceiling heights (LPW): >155 Lumens at 115W. High Lumens for higher ceiling heights (LPW): >161 Lumens at 146W.

E. Color Temperature: 5000K minimum.

F. CRI: 80.

2.8 LED TRADITIONAL HIGH BAY LUMINAIRE CONSTRUCTION (GYMNASIUMS)

A. Construction:
1. Die cast aluminum heat sink.
2. Tempered glass covers LED array.
3. Low-profile, lightweight design.
5. Spring lock hook with 6’ 16/3 AWG white power cord.
6. Factory calibrated to hang straight.

B. Optics/Shielding: 16” Anodized matte aluminum reflector. LED system delivers uniformity & spacing.

C. Electrical System: Integral, high-efficiency driver. 120-277V 50/60 Hz. 0.9 Power Factor at full load. <20% THD at full load. Operating temperature -40°F - +104°F.

D. Efficacy: Medium Lumens for lower ceiling heights (LPW): >127 Lumens at 160W. High Lumens for higher ceiling heights (LPW): >113 Lumens at 240W.

E. Color Temperature: 5000K minimum.

F. CRI: 80.

G. Accessories: Wire Guard for aluminum reflector. 15 amp120V Twist Lock Plug.

2.9 LED SUSPENDED DIRECT/INDIRECT LUMINAIRE CONSTRUCTION (LIBRARIES)

A. Frame: Housing is one piece die-formed cold rolled steel, forming 9”x2-1/2” curved profile. Modular 4’-0” and 8’-0” sections combined for continuous runs. Standard straight and optional beveled endcaps, die-cast aluminum mechanically attached without exposed fasteners.

B. Optics/Shielding: Precision formed optical assembly with One hundred percent virgin UV-stabilized acrylic (PMMA) optical panel, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation for direct/indirect optical distributions.

C. Direct/Indirect LED Source: Field replaceable LED sources for maintaining minimum 61% downlight, 39% up-light.
D. Efficacy (LPW): >101 Lumens at 46W.
E. Color Temperature: 4000K minimum.
F. CRI: <85.

2.10 LED LUMINAIRE SUPPORT COMPONENTS
A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.
F. Drywall Grid Adapter: Provide adapter frame for recessed fixture installation into drywall ceilings.
G. Surface or cable mounting capabilities with accessory kits.
H. Pendant Kits: Joiners to accept stems, single aircraft cable and power cords with optional design types.

2.11 DOWNLIGHTING
A. Compact and efficient shallow recessed remodel housing optimized and listed for EISA compliant LED lamps.
   1. Housing:
      a. Single wall die-formed shallow aluminum housing.
      b. Interlocking collar to maintain aperture geometry.
      c. Integral air-tight gasket between fixture and finished ceilings.
      d. Removable from plaster frame to provide access.
      e. Suitable for light commercial shallow ceiling applications. For installation in insulated ceilings and non-insulated ceilings with airtight code compliant construction.
      f. Available with a variety of trims and finishes.
   2. Socket Plate:
      a. Rigid socket plate adjusts to locks without tools for lamp sizes indicated.
      b. Removeable socket plate and bracket for trims.
   3. Plaster Frame:
      a. Galvanized steel frame. Housing adjust to 3/8” to 1” ceiling thickness.
      b. (2) regressed locking screws for securing hangar bars.
      c. Integral air-tight gasket housing.
   4. Socket:
      a. Porcelain socket with nickel plated brass screws shell.
      b. Snap-on springs secure socket in plate, and detachable when using trims.
   5. Compliance:
a. cULus Listed Damp Location.
b. cULus Listed for Wet Location, covered ceiling, with select trims.
c. cULus Listed for direct contact with insulation and combustible material other than spray foam insulation.
d. Air-Tite code compliant. Certified under ASTM E283; not exceeding 2.0 cfm (0.944 L/s) air leakage rate tested at a 1.57 psf (75 Pa) pressure differential.
e. RoHS compliant.

6. Lamp: Cree or Satco LED luminaire.

2.12 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.13 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

   a. Battery: Sealed, maintenance-free, nickel-cadmium type.
   b. Charger: Fully automatic, solid-state type with sealed transfer relay.
   c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
   d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
   f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
   g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

3. Master/Remote Sign Configurations:

   a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply for power connection to remote unit.
   b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.
2.14 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
8. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.
B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
C. Install lamps in each luminaire.
D. Supports: Sized and rated for luminaire weight.
E. Flush-Mounted Luminaire Support: Secured to outlet box.
F. Wall-Mounted Luminaire Support:
   1. Attached to structural members in walls.
   2. Do not attach luminaires directly to gypsum board.
G. Ceiling-Mounted Luminaire Support:
   1. Ceiling mount with two 5/32-inch- diameter aircraft cable supports adjustable to 120 inches in length.
   2. Ceiling mount with pendant mount with 5/32-inch- diameter aircraft cable supports adjustable to 120 inches in length.
   3. Ceiling mount with hook mount.
H. Suspended Luminaire Support:
1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Ceiling-Grid-Mounted Luminaires:
   1. Secure to any required outlet box.
   2. Secure luminaire using approved fasteners in a minimum of four locations, spaced near corners of luminaire.

J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

K. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
   2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
   3. Photometric Requirements:
      a. The performance shall be adjusted (depreciated) by using the LED manufacturer's data or the data from the IESNA Standard TM-21 test report, which ever one results in a higher level of lumen depreciation.
      b. The initial minimum illuminance level is achieved in 100% of the area of the specified lighting pattern.
      c. The measurements shall be calibrated to standard photopic calibrations.
      d. Luminaire shall be tested per IESNA LM 79-08.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 265119
SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

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. Grounding conductors.
      2. Grounding connectors.
      3. Grounding busbars.
      4. Grounding rods.

1.3 DEFINITIONS
   A. BCT: Bonding conductor for telecommunications.
   B. EMT: Electrical metallic tubing.
   C. TGB: Telecommunications grounding busbar.
   D. TMGB: Telecommunications main grounding busbar.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Shop Drawings: For communications equipment room signal reference grid. Include plans, elevations, sections, details, and attachments to other work.

1.5 INFORMATIONAL SUBMITTALS
   A. As-Built Data: Plans showing as-built locations of grounding and bonding infrastructure, including the following:
      1. Ground rods.
      2. Ground and roof rings.
      3. BCT, TMGB, TGBs, and routing of their bonding conductors.
   B. Field quality-control reports.
1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

   1. Installation Supervision: Installation shall be under the direct supervision of ITS Technician, who shall be present at all times when Work of this Section is performed at Project site.
   2. Field Inspector: Currently registered by BICSI as a registered communications distribution designer to perform the on-site inspection.

PART 2 - PRODUCTS

2.1 SYSTEM COMPONENTS

A. Comply with J-STD-607-A.

2.2 CONDUCTORS

A. Comply with UL 486A-486B.

B. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.

   1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
   2. Cable Tray Equipment Grounding Wire: No. 8 AWG.

C. Cable Tray Grounding Jumper:

   1. Not smaller than No. 10 AWG 26 kcmils and not longer than 12 inches. If jumper is a wire, it shall have a crimped grounding lug with one hole and standard barrel for one crimp. If jumper is a flexible braid, it shall have a one- or two-hole ferrule. Attach with grounding screw or connector provided by cable tray manufacturer.

D. Bare Copper Conductors:

   4. Bonding Cable: 28 kcmils, 14 strands of No. 17 AWG conductor, and 1/4 inch in diameter.
   5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
   6. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.3 CONNECTORS

A. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.
B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

C. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.
   1. Electroplated tinned copper, C and H shaped.

D. Signal Reference Grid Connectors: Combination of compression wire connectors, access floor grounding clamps, bronze U-bolt grounding clamps, and copper split-bolt connectors, designed for the purpose.

E. Busbar Connectors: Cast silicon bronze, solderless compression or exothermic-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch centers for a two-bolt connection to the busbar.

2.4 GROUNDING BUSBARS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. TMGB: Predrilled, wall-mounted, rectangular bars of hard-drawn solid copper, 1/4 by 4 inches in cross section, length as indicated on Drawings. The busbar shall be NRTL listed for use as TMGB and shall comply with J-STD-607-A.
   1. Predrilling shall be with holes for use with lugs specified in this Section.
   2. Mounting Hardware: Stand-off brackets that provide a 4-inch
   3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

C. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with J-STD-607-A. Predrilling shall be with holes for use with lugs specified in this Section.

2.5 GROUND RODS

A. Ground Rods: Copper-clad steel, sectional type; 5/8 by 96 inches in diameter.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the ac grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.

B. Inspect the test results of the ac grounding system measured at the point of BCT connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
D. Proceed with connection of the BCT only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Bonding shall include the ac utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.

B. Comply with NECA 1.

C. Comply with J-STD-607-A.

3.3 APPLICATION

A. Conductors: Install solid conductor for No. 8 AWG and smaller and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

1. The bonding conductors between the TGB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.
2. The bonding conductors between the TMGB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2 AWG minimum.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.

D. Conductor Support:

1. Secure grounding and bonding conductors at intervals of not less than 36 inches

E. Grounding and Bonding Conductors:

1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
2. Install without splices.
3. Support at not more than 36-inch intervals.
4. Install grounding and bonding conductors in 3/4-inch PVC conduit until conduit enters a telecommunications room. The grounding and bonding conductor pathway through a plenum shall be in EMT. Conductors shall not be installed in EMT unless otherwise indicated.

a. If a grounding and bonding conductor is installed in ferrous metallic conduit, bond the conductor to the conduit using a grounding bushing that complies with requirements in Section 270528 "Pathways for Communications Systems," and bond both ends of the conduit to a TGB.
3.4 GROUNDING ELECTRODE SYSTEM
A. The BCT between the TMGB and the ac service equipment ground shall not be smaller than No. 1/0 AWG.

3.5 GROUNDING BUSBARS
A. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 2 inches minimum from wall, 12 inches above finished floor unless otherwise indicated.
B. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

3.6 CONNECTIONS
A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than No. 6 AWG.
B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
C. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:
   1. Use crimping tool and the die specific to the connector.
   2. Pretwist the conductor.
   3. Apply an antioxidant compound to all bolted and compression connections.
D. Primary Protector: Bond to the TMGB with insulated bonding conductor.
E. Interconnections: Interconnect all TGBs with the TMGB with the telecommunications backbone conductor. If more than one TMGB is installed, interconnect TMGBs using the grounding equalizer conductor. The telecommunications backbone conductor and grounding equalizer conductor size shall not be less than 2 kcmils/linear foot of conductor length, up to a maximum size of No. 3/0 AWG 168 kcmils unless otherwise indicated.
F. Shielded Cable: Bond the shield of shielded cable to the TGB in communications rooms and spaces. Comply with TIA/EIA-568-B.1 and TIA/EIA-568-B.2 when grounding screened, balanced, twisted-pair cables.
G. Access Floors: Bond all metal parts of access floors to the TGB.

3.7 IDENTIFICATION
A. Labels shall be preprinted or computer-printed type.
   1. Label TMGB(s) with "fs-TMGB," where "fs" is the telecommunications space identifier for the space containing the TMGB.
   2. Label TGB(s) with "fs-TGB," where "fs" is the telecommunications space identifier for the space containing the TGB.
   3. Label the BCT and each telecommunications backbone conductor at its attachment point: "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"
3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer’s written instructions.

2. Test the bonding connections of the system using an ac earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing a TMGB and a TGB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.
   
   a. Measure the resistance between the busbar and the nearest available grounding electrode. The maximum acceptable value of this bonding resistance is 100 milliohms.

3. Test for ground loop currents using a digital clamp-on ammeter, with a full-scale of not more than 10 A, displaying current in increments of 0.01 A at an accuracy of plus/minus 2.0 percent.
   
   a. With the grounding infrastructure completed and the communications system electronics operating, measure the current in every conductor connected to the TMGB and in each TGB. Maximum acceptable ac current level is 1 A.

C. Excessive Ground Resistance: If resistance to ground at the BCT exceeds 5 ohms, notify Architect promptly and include recommendations to reduce ground resistance.

D. Grounding system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 270526
SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Surface pathways.
5. Boxes, enclosures, and cabinets.
6. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
2. Section 260533 "Raceways and Boxes for Electrical Systems" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.

1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
   1. Structural members in paths of pathway groups with common supports.
   2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Qualification Data: For professional engineer.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. General Requirements for Metal Conduits and Fittings:
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Comply with TIA-569-B.

B. GRC: Comply with ANSI C80.1 and UL 6.

C. IMC: Comply with ANSI C80.6 and UL 1242.

D. EMT: Comply with ANSI C80.3 and UL 797.

E. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
   1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
   2. Fittings for EMT:
      a. Material: Steel or die cast.
      b. Type: Setscrew or compression.
   3. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.

F. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. General Requirements for Nonmetallic Conduits and Fittings:
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Comply with TIA-569-B.

B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

C. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Wireway Covers: Screw-cover type unless otherwise indicated.

D. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE PATHWAYS

A. General Requirements for Surface Pathways:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

B. Surface Metal Pathways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets:

1. Comply with TIA-569-B.
2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

D. Metal Floor Boxes:

1. Material: Cast metal or sheet metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Nonmetallic Floor Boxes: Nonadjustable, round.
1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

H. Gangable boxes are allowed.

I. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
   2. Nonmetallic Enclosures:
      b. Finished inside with radio-frequency-resistant paint.
   3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

J. Cabinets:
   1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
   2. Hinged door in front cover with flush latch and concealed hinge.
   3. Key latch to match panelboards.
   4. Metal barriers to separate wiring of different systems and voltage.
   5. Accessory feet where required for freestanding equipment.
   6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND CABLING

A. General Requirements for Handholes and Boxes:
   1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
   2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   3. Comply with TIA-569-B.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. Standard: Comply with SCTE 77.
   3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
   4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
   5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "COMMUNICATIONS."
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

2.7 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

A. Outdoors: Apply pathway products as specified below unless otherwise indicated:

1. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
2. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Severe Physical Damage: GRC. Pathway locations include the following:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms.
3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Damp or Wet Locations: IMC.
5. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: EMT.
6. Boxes and Enclosures: NEMA 250 Type 1, except use NEMA 250 Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Pathway Size: 3/4-inch trade size. Minimum size for optical-fiber cables is 1 inch.

D. Pathway Fittings: Compatible with pathways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface pathways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

B. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

C. Complete pathway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Pathways Embedded in Slabs:
   1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot intervals.
   2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
   3. Arrange pathways to keep a minimum of 1 inch of concrete cover in all directions.
   4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
   5. Change from ENT to GRC or IMC before rising above floor.

J. Stub-ups to Above Recessed Ceilings:
   1. Use EMT, IMC, or RMC for pathways.
   2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

M. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

O. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

P. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.

Q. Surface Pathways:
   1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
   2. Install surface pathway with a minimum 2-inch radius control at bend points.
   3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

R. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
   1. 3/4-Inch Trade Size and Smaller: Install pathways in maximum lengths of 50 feet.
   2. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.
   3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

S. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.

T. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where an underground service pathway enters a building or structure.
   3. Where otherwise required by NFPA 70.

U. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

V. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.

2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
   c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
   d. Attics: 135 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.

4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer’s written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

W. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

X. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Y. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

Z. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

AA. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

BB. Set metal floor boxes level and flush with finished floor surface.

CC. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.

2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."

4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
   a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
   b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

5. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, but a minimum of 6 inches below grade. Align planks along centerline of conduit.

6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes with bottom below frost line, 16-inches below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

F. Field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."
3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage or deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.
271500

Premise Cabling Specifications
December 19, 2016

Table of Contents

Objective & General Information ........................................................................................................3

1 Premise Cabling Specifications .......................................................................................................4
   1A Functional Requirements ..............................................................................................................4
   1B Cabling from IDF ........................................................................................................................4
   1C Hardware ..................................................................................................................................5
   1D Voice Termination System .........................................................................................................7
   1E Data & VOIP ..............................................................................................................................7
   1F Wireless Systems .......................................................................................................................8
   1G Security Systems .......................................................................................................................9
   1H Video Systems ..........................................................................................................................10
   1I Lighting Systems ........................................................................................................................11
   1J Specifics for Trailers ....................................................................................................................12

2 Labeling Standard ...........................................................................................................................12
3 Communication Room Requirements ................................................................. 13
   3A MDF Room ....................................................................................................... 13
   3B IDF Room ........................................................................................................ 16
   3C Unacceptable Locations for Communication Rooms ..................................... 17

4 Deliverables .......................................................................................................... 18
   4A Vendor ................................................................................................................ 18
   4B Project Sign Off .................................................................................................. 18
Objective
This document establishes a structured cable system standard for Tulsa Public Schools. The design and installation should conform to the applicable Electronics Industry Association (EIA) and Telecommunications Industry Association (TIA) standards, Building Industry Consulting Service International (BICSI) guidelines. Proposed adjustments or exceptions to this “Premise Cabling Specification” document will need to be approved by the Tulsa Public Schools IT Project Manager prior to installation.

General Information
The Premise Wiring System will be a copper & fiber optic based TIA/EIA T568-A/B compliant infrastructure for voice & data communications. The CAT6 & fiber optic cabling shall be a certified Commscope or Uniprise solution.

Work Included
The specifications consist of furnishing all labor, equipment, supplies and materials. It includes performing all operations necessary for the complete installation of a Premise Wiring System in accordance with the accompanying drawings & specifications. The work shall include but not be limited to the following:

A. Furnish and install cable and terminations as specified. Terminate all pairs.
B. Furnish and install Cat6 Jack panels for termination of network cabling.
C. Furnish and install cabinets or racks and extend AC power to the same.
D. Furnish and install telephone 110 blocks and surge protection.
E. Furnish & install 110-C5 connecting blocks for feeder cables & 110-C4 blocks for station cables.
F. Furnish and install connectors and wall plates and terminate as specified.
G. Furnish and install all conduit, surface mounted raceway systems, boxes, cover plates and connector housings for all communications systems outlet locations.
H. Furnish and install all bridle rings and or D-rings, J-hooks required to support the data and phone cable as specified here in.

Acceptable Manufacturers
These specifications are based on equipment manufactured by or for specific manufacturers. It is not the intent of these specifications to limit or restrict submittion of proposals for products by other manufacturers but to maintain the current architecture and system integrity.

Vendor Qualifications
The installing Vendor must have a minimum of 3 years previous experience in Premise Wiring. The installing Vendor’s on site Project Lead shall be a registered Communications Distribution Designer (RCDD). The Vendor must have a current Commscope or Uniprise Certification. Change of the Project Lead shall not be acceptable without prior approval from the owner’s Project Lead. The installing Vendor is required to provide references. A Commscope, Uniprise, or Commscope vendor must be on site at all times when cabling.
Cat. 6 Applications for Premise Wiring
The specifications for premise wiring contained in this document adhere to the CAT6 standard. The CAT6 solution is the current standard for Tulsa Public schools

1 General Specifications for Premise Wiring

1A. Functional Requirements

This specification is built around a plenum rated copper and fiber optic cable based TIA/EIA T568-A/B compliant wiring infrastructure for telephone and data communications. Any use of this section will require authorization from the TPS IT Project Manager.

(Exception: A flooded cable and industrial modular jacks will be required where pathways to the users work stations are susceptible to moisture or water table fluctuations, in order to prevent corrosion. The vendor of the flush mounted floor boxes will require coordination with the Vendor to insure the mounting frame for these specific industrial data jacks meets functional requirements).

1B. Cabling from IDF

Data Cabling Fiber
The new IDF is located in Room 108. Provide one six strand armored multimode fiber optic cable directly to the site MDF located next to cafeteria and terminate all strands with LC connectors. Rack mounted fiber interconnect enclosures should be provided for the termination of the fiber optic cables that this Vendor will pull from the new IDF to the sites MDF.

Duplex, Multimode, six strand fiber cable
A. General purpose tight buffer multi-mode cable with glass size of 50 microns. (Zip cord type is not allowed). The product is to conform to TIA/EIA Horizontal Distribution fiber requirements.
B. Each strand will have a 900um diameter elastomeric buffer surrounded by aramid strength member.
C. Loaded minimum bend radius of 3 inches, unloaded minimum bend radius of 1 inch.
D. Maximum short-term load will be 100 lbs., long-term maximum load of 50 lbs.
E. The maximum attenuation in Db per kilometer at 850 nm will be 3.50 Db and at 1300 nm it will be 1.50 Db.
F. The minimum bandwidth at 850 nm will be 400 MHz and at 1300 nm it will be 400 MHz.

Data Cabling Copper
Provide TIA/EIA T568-A/B/B Cat 6 compliant UTP four pair cable for locations noted herein. Do not exceed a total footage of 300’ for any single run including the 10’ loop. As noted on the Room Matrix, provide Cat 6 UTP, blue cable directly to local data port
locations. If any run will exceed a maximum distant the Vendor will contact IT Project Manager for appropriate action to take.

**Voice Cabling Copper**
The new IDF is located in Room 108. Provide 2-25 pair Commscope or Uniprise Cat 6 UTP tie cables between the IDF and the site MDF. The site MDF is located next to cafeteria. Terminate on 50 pair blocks mounted with legs to the backboards provided. As noted on the Room Matrix, provide TIA/EIA 568A Cat 6 UTP, white cable directly to local phone port locations.

**Data Patch Cables:**
The IDF will require a Jack panel as well as wire management, vertical on each side of the rack and horizontal between each jack panel and each switch scheduled for install.
- The Vendor will provide each station to be patch in with the proper length Commscope or Uniprise Patch Cabling. The Patch Cables will be Cat 6 compliant, factory terminated with RJ 45 connectors in accordance with the TIA/EIA T568-A/B/B method. The patch cable will be formed neatly in the rack with Velcro style ties.
- The work station locations noted in the Room Matrix will require Cat 6 compliant Commscope or Uniprise Patch Cables, factory terminated with RJ 45 connectors in accordance with the TIA/EIA T568-A/B/B method.
- The Vendor will provide each station to be activated with a 10 foot Patch Cable. Provide quantity in IDF or MDF = equal to the number of jack panel ports and workstations = equal to the number of jacks.

**1C. Hardware**

**Racks and Cabinets:**
MDF Relay Racks – Data racks that are to contain multi-media components or larger data components must follow these specifications:

A. Four post open relay rack frame with 45 rack mount spaces with rear mounting rails.
B. 25” minimum internal depth; to accept standard 19” wide equipment.
C. Coordinate with the project electrical Vendor or project lead to hardwire Electrical power from the proper circuit to the MDW rack mounted power strips.
D. Provide surge protective AC power strips, shelves, etc. as required.
E. Color: Black with matte (satin) finish.
F. Provide Commscope or Uniprise Category 6 jumper cables for all active ports at this location. Install the cables using wire management in such a manner that there is no weight or stress on the connectors.
G. Provide vertical and horizontal wire management for all data racks and cabinets.

**Racks:**
IDF Relay Racks - Data racks that are to contain minimal components must follow these specifications:
A. Standard two post aluminum relay rack frame to accept standard 19” wide equipment.

_Do not place the rack in a permanent position without prior written consent from the owner’s project lead. The rack must be anchored._

B. Coordinate with the project electrical Vendor or project lead to hardwire Electrical power from the proper circuit to the IDF rack mounted power strips.

C. Provide surge protective AC power strips, shelves, etc. as required.

D. Color: Black with matte (satin) finish.

E. Provide Commscope or Uniprise Category 6 jumper cables for all active ports at this location. Install the cables using wire management in such a manner that there is no weight or stress on the connectors.

F. Provide vertical and horizontal wire management for all data racks and cabinets.

_Do not install any racks or cabinets without prior approval from the owner’s project lead. Any installations that have not been approved or are incorrectly located will be moved at the Vendor’s expense._

- #55053-703 (Chatsworth)  -- Black Rack with matte finish
- #30091-703 (Chatsworth)  -- Black vertical wire management
- #12853-701 (Chatsworth)  -- Black rack mount AC power strip 38”

Data Jack Panels
Each IDF\MDF will require a modular blank jack panel either 24 or 48 port based upon quantity of cables terminated. Terminate all Category 6 cabling on Commscope or Uniprise Cat6 compliant jack panels. Provide sufficient quantity of connection points for all Cat 6 active ports plus 20% open for spares. With each jack panel and associated switch location, provide a wire management panel with dimensions sufficient for the number of connections being supported.

Fiber Optic Connectors
Fiber Optic connectors will be provided for all fiber optic strands and will provide the following features:

A. Field installable LC compatible high-precision glass-in-ceramic ferrule accommodating all 125-micron multi-mode fibers.

B. Installation methods – Utilize quick drying UC epoxy, Hotmelt, or anaerobic method, mechanical crimp.

C. Typical average loss of 0.25dB and a maximum of 0.5 dB with no more than 0.2 dB loss after 1000 insertions.

Quantities As Required
Wall plates & Connectors
This Vendor will be responsible for providing all plates for communications boxes for interconnection to voice and data systems. This Vendor will also be responsible for providing blank inserts for every communications face plate having available unused ports. Provide sample color to the owner for approval prior to purchase. Coordinate these plates and connectors with the existing components and match those components.

- Wall plates – Provide single gang Commscope or Uniprise flush mount wall plates for all communication box locations shown on drawings.
  a. #M12L-246 ---- Ivory two port faceplate
  b. #M13L-246 ---- Ivory three port faceplate
  c. #M14L-246 ---- Ivory four port faceplate
  d. #M16L-246 ---- Ivory six port faceplate

- Provide j-boxes and faceplates for surface mounted raceway.
  a. #JBX3510EI-A ---- Junction box
  b. #LD10E16-A ---- Raceway

Data Outlets
Terminate each data outlet with one blue Commscope or Uniprise Cat 6 snap in jack. Use the TIA/EIA T568-A/B termination method. Provide blanks as necessary to fill all unused positions of the outlet.

1D. Voice Termination System

A. The telephone system will use 110 type blocks for all terminations. Provide quantity of termination hardware necessary to terminate all telephone system main equipment cabling.

  - All sites where the voice has been determined to be VOIP will use Data & VOIP Systems specifications found in section 1E of this document.
  - Renovated sites where the voice has been determined to be VOIP will adhere to the same standards as above.

B. Provide a single ¾” ACX piece of plywood sized to accommodate the telephone system main equipment and twice the number of blocks required. This backboard must be painted with fire retardant, high quality white paint. Coordinate the location the backboard is to be installed with the owner. Mount all termination blocks and related telephone main equipment to this backboard.

C. All ferrous hardware, screws and associated miscellaneous items will be galvanized or cadmium plated to prevent rust.

D. Provide surge protection block with one plug-in gas type module for each incoming line. Each protection block will be grounded through a #8 conductor to
a single star solid ground point. Protectors will be capable of clamping at a voltage of no more than (+) 15% of the sets operating voltage.

1E. Data & VOIP Systems

The Data Premise Wiring System will be a copper based **TIA/EIA T568-A/B/B compliant** infrastructure for data communications. The CAT6 cabling shall be a Certified Uniprise installation as required utilizing the following cabling:

- **CS-Uniprise** (#6540+Blue CPK) Cat 6 plenum Blue

Cabling from the MDF/IDF

Data Cabling– Provide TIA/EIA compliant 568B CAT6 UTP cable runs, not to exceed a maximum footage of 295’ each, including a 10’ maintenance loop. As noted on the Location Matrix, provide CAT6 CS-Uniprise (#6540+Blue CPK) blue cable directly to local data port locations. A 10’ cable loop should be left at the location of the cable drop and terminated to jack part number #UNJ600-BL – Cat6 jacks blue terminated to B standard. A white label with the IDF-Panel and port number will be placed on station end of the cable.

Data Jack panels & Patch Cables

Each IDF/MDF will require a modular blank jack panel either 24 or 48 port based upon quantity of cables terminated. The following Commscope part numbers should be used for the jack panels and jacks.

- #UNJ600-BL -- Cat6 jacks blue
- #M2000-24-1U(Commscope) -- 24-P modular blank jack panel
- #M2000-48-2U(Commscope) -- 48-P modular jack panel

The vendor will provide each terminated cable to be patch in with the proper length Commscope Patch Cabling. The Patch Cables will be CAT6 compliant, terminated with RJ 45 connectors in accordance with the TIA/EIA T568-A/B/B method. The patch cable will be formed neatly in the rack with Velcro style ties. The following Commscope part numbers should be used for the patch cables:

- #UNC6-BL-3F ---- Cat 6 3ft blue patch cable (only in wall racks)
- #UNC6-BL-5F ---- Cat 6 5ft blue patch cable
- #UNC6-BL-7F ---- Cat 6 7ft blue patch cable

1F. Wireless Premise Systems

The Wireless Premise Wiring System will be a copper based **TIA/EIA T568-A/B/B CAT6 compliant** infrastructure for data communications. The CAT6 cabling shall be a Certified Uniprise installation as required utilizing the following cabling:
Cabling from the MDF/IDF
Data Cabling – Provide TIA/EIA compliant 568B CAT6 UTP cable runs, not to exceed a maximum footage of 295’ each, including a 10’ maintenance loop. As noted on the Location Matrix, provide CAT6 CS-Uniprise (#6540+YELLOW CPK) yellow cable directly to local data port locations. A 10’ cable loop should be left at the location of the cable drop and terminated to jack part number # UNJ600-YL – Cat6 jacks yellow terminated to B standard. A yellow label with the IDF-Panel and port number will be placed on the ceiling grid directly below the station end of the cable.

Data Jack panels & Patch Cables
Each IDF/MDF will require a modular blank jack panel either 24 or 48 port based upon quantity of cables terminated. The following Commscope part numbers should be used for the jack panels and jacks.

- # UNJ600-YL -- Cat6 jacks yellow
- # 107984007 | M101SMB-B-246 – Ceiling biscuit jack Ivory
- #M2000-24-1U(Commscope) -- 24-P modular blank jack panel
- #M2000-48-2U(Commscope) -- 48-P modular jack panel

The vendor will provide each terminated cable to be patch in with the proper length Commscope Patch Cabling. The Patch Cables will be CAT6 compliant, terminated with RJ 45 connectors in accordance with the TIA/EIA T568-A/B/B method. The patch cable will be formed neatly in the rack with Velcro style ties. The following Commscope part numbers should be used for the patch cables:

- #UNC6-YL-3F ---- Cat 6 3ft yellow patch cable
- #UNC6-YL-5F ---- Cat 6 5ft yellow patch cable
- #UNC6-YL-7F ---- Cat 6 7ft yellow patch cable

1G. Specifications for Security Premise Wiring

The Security Premise Wiring System will be a copper based TIA/EIA T568-A/B/B compliant infrastructure for data communications. The CAT6 cabling shall be a Certified Uniprise installation as required utilizing the following cabling:

- CS-Uniprise (#6504+ORANGE CPK) Cat 6 plenum orange

Cabling from the MDF/IDF
Data Cabling – Provide TIA/EIA compliant 568B CAT6 UTP cable runs, not to exceed a maximum footage of 295’ each, including a 10’ maintenance loop. As noted on the Location Matrix, provide CAT6 CS-Uniprise (#6504+ORANGE CPK) orange cable.
directly to local data port locations. A 10’ cable loop should be left at the location of the cable drop and terminated to jack part number at both ends # UNJ600-OR – Cat6 jacks orange terminated to B standard. A orange label with the IDF-Panel and port number will be placed on the camera housing and the station end of the cable.

Data Jack panels & Patch Cables
Each IDF\MDF will require a modular blank jack panel either 24 or 48 port based upon quantity of cables terminated. The following Commscope part numbers should be used for the jack panels and jacks.

- # UNJ600-OR -- Cat6 jacks orange
- # 107984007 | M101SMB-B-246 – Ceiling biscuit jack Ivory
- #M2000-24-1U(Commscope) -- 24-P modular blank jack panel
- #M2000-48-2U(Commscope) -- 48-P modular jack panel

The vendor will provide each terminated cable to be patch in with the proper length Commscope Patch Cabling. The Patch Cables will be CAT6 compliant, terminated with RJ 45 connectors in accordance with the TIA/EIA T568-A/B/B method. The patch cable will be formed neatly in the rack with Velcro style ties. The following Commscope part numbers should be used for the patch cables:

- # UNC6-OR-3F ---- Cat 6 3ft orange patch cable
- # UNC6-OR-5F---- Cat 6 5ft orange patch cable
- # UNC6-OR-7F---- Cat 6 7ft orange patch cable
- #107984007---- Ivory bisect jack

1H. Specifications for Video Premise Wiring

The Wireless Premise Wiring System will be a copper based TIA/EIA T568-A/B/B compliant infrastructure for data communications. The CAT6 cabling shall be a Certified Uniprise installation as required utilizing the following cabling:

- CS-Uniprise (#6504+ GREEN CPK) Cat 6 plenum green

Cabling from the MDF/IDF
Data Cabling-- Provide TIA/EIA compliant 568B CAT6 UTP cable runs, not to exceed a maximum footage of 295’ each, including a 10’ maintenance loop. As noted on the Location Matrix, provide CAT6 CS-Uniprise (#6504+ GREEN CPK) green cable directly to local data port locations. A 10’ cable loop should be left at the location of the cable drop and terminated to jack part number # UNJ600-GR – Cat6 jacks green terminated to B standard. A label with the IDF-Panel and port number will be placed on both station end of the cable.

Data Jack panels & Patch Cables
Each IDF\MDF will require a modular blank jack panel either 24 or 48 port based upon quantity of cables terminated. The following Commscope part numbers should be used for the jack panels and jacks.

- # UNJ600-GR -- Cat6 jacks green
- #M2000-24-1U(Commscope) -- 24-P modular blank jack panel
- #M2000-48-2U(Commscope) -- 48-P modular jack panel

The vendor will provide each terminated cable to be patch in with the proper length Commscope Patch Cabling. The Patch Cables will be CAT6 compliant, terminated with RJ 45 connectors in accordance with the TIA/EIA T568-A/B/B method. The patch cable will be formed neatly in the rack with Velcro style ties. The following Commscope part numbers should be used for the patch cables:

- #UNC6-GR-3F---- Cat 6 3ft green patch cable
- #UNC6-GR-5F---- Cat 6 5ft green patch cable
- #UNC6-GR-7F ---- Cat 6 7ft green patch cable

11. Lighting Premise Systems

The Lighting Premise Wiring System will be a copper based TIA/EIA T568-A/B/B CAT6 compliant infrastructure for data communications. The CAT6 cabling shall be a Certified Uniprise installation as required utilizing the following cabling:

- CS-Uniprise (#6540+BROWN CPK)     Cat 6 plenum brown

Cabling from the MDF/IDF

Data Cabling – Provide TIA/EIA compliant 568B CAT6 UTP cable runs, not to exceed a maximum footage of 295’ each, including a 10’ maintenance loop. As noted on the Location Matrix, provide CAT6 CS-Uniprise (#6540+BROWN CPK) brown cable directly to local data port locations. A 10’ cable loop should be left at the location of the cable drop and terminated to jack part number # UNJ600-BR – Cat6 jacks yellow terminated to B standard. A brown label with the IDF-Panel and port number will be placed on the ceiling grid directly below the station end of the cable.

Data Jack panels & Patch Cables

Each IDF\MDF will require a modular blank jack panel either 24 or 48 port based upon quantity of cables terminated. The following Commscope part numbers should be used for the jack panels and jacks.

- # UNJ600-BR -- Cat6 jacks brown
- # 107984007 | M101SMB-B-246 – Ceiling biscuit jack Ivory
- #M2000-24-1U(Commscope) -- 24-P modular blank jack panel
1. #M2000-48-2U(Commscope) -- 48-P modular jack panel

The vendor will provide each terminated cable to be patch in with the proper length Commscope Patch Cabling. The Patch Cables will be CAT6 compliant, terminated with RJ 45 connectors in accordance with the TIA/EIA T568-A/B/B method. The patch cable will be formed neatly in the rack with Velcro style ties. The following Commscope part numbers should be used for the patch cables:

- #UNC6-BR-3F ---- Cat 6 3ft brown patch cable
- #UNC6-BR-5F ---- Cat 6 5ft brown patch cable
- #UNC6-BR-7F ---- Cat 6 7ft brown patch cable

1J. Premise Wiring Specifics for Trailers

A. A minimum of 1 voice and 6 data connections installed per trailer.
B. All Basic Link data cabling and all voice connectivity should come to the trailers from the nearest IDF/MDF. (Exceptions: 1. Fiber Optic link required for network connectivity should terminate at MDF. 2. No pairs available at IDF for voice.)
C. Aerial feeders are preferred over underground, depending on the availability of poles to flag or height restrictions.
D. Buried cabling will be placed in a 3-inch schedule 40 rigid, nonmetallic aboveground/underground conduit.
E. Voice and data wire will be run separate from fire alarm, security and intercom wire.
F. When the trailer or trailers are located over 300 ft. from the nearest MDF/IDF, a 4 strand Multimode Fiber Optic feeder should be installed from the MDF/IDF. The Fiber should then terminate in a small LIU. All station cabling will be brought to this point. This will require a Wall Mounted Rack and Jack panel.
G. All Voice cabling will need to come directly from the MDF room via 25 pr. and terminated on a 110 block at a predetermined area to be determined by the owner. Phone lines will be distributed from here.
H. All voice and data wiring, 110 blocks and panels, faceplates and fiber strands should be by standards set forth by Tulsa Public Schools.
I. Any point of entry made to trailers or buildings should be sealed.
J. Areas where any digging takes place should be level and free of debris (rocks, trash etc.) upon completion.

2 Labeling Standard

2A. Guidelines

<table>
<thead>
<tr>
<th>COLOR</th>
<th>CABLING</th>
<th>JACK</th>
<th>PATCH CABLES</th>
<th>USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLACK</td>
<td>6504+BLACK CPK</td>
<td>UNJ600-BK</td>
<td>UNC6-BK</td>
<td></td>
</tr>
</tbody>
</table>
A. The Tulsa Public Schools color code standard is as follows: blue for data, white for voice, yellow for wireless, green for video, DNA cabling turquoise (this a custom color for SecuraDyne” and orange for security cameras. The correct color label will be placed on the ceiling grid directly below any cables terminated above the ceiling. *The patch cables and jacks or outlets will follow the same standard.*

B. All cables shall be labeled on the insulation jacket on each terminating end.

C. All cable terminations shall be clearly and permanently labeled.

D. Labeling of the jack panels, jacks or outlets shall be provided on white labels with black typed characters. Any jack that is at ceiling level or above will use the color of patch cable for label with black type.

E. Hand written labels shall not be permitted.

F. Labeling should consist of MDF/IDF room #, panel location, port number, & destination room #. (MDF105-WPA-47-18) Patch panel labeling will be alphabetical starting at the top of the rack with A for each serves. Each service will have its own jack panel and destination (Data DPA, Wireless WPA, Security SPA, Video, VPA) this should be read as (data panel A).

<table>
<thead>
<tr>
<th>Type of room</th>
<th>Room #</th>
<th>Type of panel</th>
<th>Panel port #</th>
<th>End room #</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDF</td>
<td>105</td>
<td>Wireless panel “A”</td>
<td>Port 47</td>
<td>Room 18</td>
</tr>
</tbody>
</table>

G. The vendor will provide a sample of the labeling terminology for approval with project submittals.

2B. Racks, Jack panels & Termination Blocks

Racks located in MDF/IDF locations should be labeled using a numerical format beginning with 1 and continuing as required.

Tulsa Public Schools
Macarthur Elementary Classroom Addition 2018
Allied Engineering Group, LLC
A. Termination Blocks or Jack panels shall be labeled with an alphabetical identifier. This identifier for a rack mounted panel should begin with the letter A at the top of the rack and continue on through the alphabet as more jack panels are added to that particular rack or wall space.

B. Labeling of panels or punch blocks with letters will begin again with A as more blocks are added in a different termination zone. For example, labeling of panels should begin again with the letter A for each new rack and the labeling of panels on the wall should begin with A.

C. Individual ports on the panel should be numbered in ascending order. If not printed on the panel by the manufacturer, the vendor is responsible for making sure that each port is labeled with its own number.

2C. Horizontal Cable and Outlet Boxes

A. Each end of the horizontal cable should be labeled on the outside jacket of the cable within 12 inches of the termination points.

B. Outlet boxes shall be labeled on the appropriate area with the cable identifier.

3. Communication Room Requirements

3A. MDF Room

The telecommunications closet must have enough space to support required communications systems, including projected growth. A typical Main Distribution Frame (MDF) Room is composed of a wall mounted plywood backboard and relay racks designed for mounting termination equipment and electronics. There will be one MDF communications closet per building. It should ideally be located in a central location.

Size

A distance of 4 feet is the required clearance from all sides of a relay rack. However, if there are space constraints, vendor will need to contact TPS IT Project Manager for directions. If possible, locate sleeves, cores, slots and/or conduits together in one area to maximize usable wall space. To plan for future expansion space should be allowed for an extra rack.

Cable Length

Telecommunications closets should be situated to minimize the length and the quantity of wire runs needed for the vertical (backbone) and horizontal distribution systems. The maximum horizontal distribution cable distance must be less than 90 meters (295ft.), independent of media type. This distance represents the cable length from the mechanical termination of the media in the telecommunications closet to the outlet in the work area. Vertical (backbone) distribution system distance limitations vary, and are dependent upon media, topology and facility ITues. If the length of any cable run to a work area exceeds the 90 meter limitation, additional IDF or MDF/IDF Telecommunications Closets must be used. Note that this limitation is for actual terminated cable length, not point-to-point distance.

Door
The door should be at least thirty-six inches (36”) wide by eighty inches (80”) tall and should swing open out of the room. The door should lock from outside access. The lock core should be keyed as a TPS standard MDF key. The door shall contain no glass.

**Lighting**
All telecommunications closets require adequate light. Within ceilings, position light fixtures at least 8 feet above the finished floor. Indirect (reflected) lighting is not recommended. If possible, minimize heat and glare by using fluorescent light fixtures with protective covers instead of incandescent fixtures. Do not place light fixtures where the light may be blocked or filtered. Typically, light fixtures should not be directly above or within 12 inches of cabling, equipment cabinets, termination frames or other free standing equipment. Install light fixtures on power circuits separate from those used for communications equipment. Light switches should be the motion sensor, auto switching type.

**Environment**
Since electronic equipment is somewhat sensitive to changes in temperature and humidity, it is recommended that a stable environment be established for areas housing such equipment. HVAC should be included in the design of the room in order to maintain a room temperature of approximately 70 degrees with the full complement of equipment in the room. Relative humidity should be maintained between 30% and 55%. MDF closets should also be equipped with temperature sensing monitors.

**Electrical Requirements**
Depending upon whether the MDF is located in a “Hub” site verses a “Spur” each room shall have a minimum of two dedicated 120volt/30 amp circuits for the rack mounted equipment and one 120volt/30 amp circuit for the voice equipment. Depending upon the UPS requirements the requirements could be one 220 volt circuit and one 120volt dedicated 30 amp circuits. Each individual circuit should be provided via a four position outlet box. The 220 Volt circuit will be for the UPS with the 120volt/30 amp provided for the other equipment in the rack. The remaining 30 amp circuit will be placed in the room for the voice equipment and should be located in an area with that equipment on the plywood backboard. Larger equipment loads at Hub site locations may require additional circuits. One Chatsworth 10 outlet rack mounted power strip should be available for each
two relay racks. The feed should be run from above the racks and mounted to the frame of the rack.

**Grounding:**
Most telecommunications equipment requires bonding and grounding of equipment cabinets. Do not use plumbing or conduit (EMT) fixtures as a ground source. Grounding shall meet the NEC and EIA/ TIA requirements and practices except where other authorities or codes impose more stringent requirements or practices. Grounding should be terminated directly to the “Building Source Ground”.

**Plywood Backboard:**
Each MDF Room will contain a minimum of one flush mounted sheet of plywood (4’ X 8’) on the wall. Securely fasten the plywood to wall-framing members to ensure that it can support attached equipment. The plywood is to be 3/4”, A/C grade and fire retardant. All plywood backboards are to be mounted smooth side out and painted white fire retardant paint at time of installation and prior to installation of equipment onto the plywood.
### Rack Layout and Equipment List:

<table>
<thead>
<tr>
<th>Ref #</th>
<th>Qty</th>
<th>Part Number</th>
<th>Vendor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>55053-703</td>
<td>Chatsworth</td>
<td>Chatsworth - “Universal” rack - Black</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>30162-703</td>
<td>Chatsworth</td>
<td>Chatsworth - Cable management, 7”, 6” wide, 6.38” deep - black</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>12487-719</td>
<td>Chatsworth</td>
<td>Chatsworth - monitor shelf with single sliding keybd tray - black</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>12853-701</td>
<td>Chatsworth</td>
<td>Chatsworth -10 position vertical power strip, 10’ cord, 6.5” standoff</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td></td>
<td></td>
<td>48 Position Jack panel</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td></td>
<td></td>
<td>Fiber jack panel Qty is 1 or 2 depending upon # of IDF’s</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>10595-712</td>
<td>Chatsworth</td>
<td>Chatsworth 3” Channel Rack to Runway mounting plate</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>10250-712</td>
<td>Chatsworth</td>
<td>Chatsworth Universal Cable runway 12” Black (9” is 10250-709)</td>
</tr>
</tbody>
</table>

Horizontal wire management between each panel and switch.
3B. IDF Room

A typical Intermediate Distribution Frame (IDF) Room is composed of a wall mounted plywood backboard and relay racks designed for mounting termination equipment and electronics. The IDF rooms on each floor provide area coverage of connectivity based upon the same rules as the MDF room. IDF’s are considered extensions of the Main Distribution Frames (MDF) and the guidelines established above also pertain to the IDF rooms as well.

**Size:**
Intermediate Distribution Frame rooms should be sized to meet the requirements of the current and planned communications equipment. When requirements are not known, the EIA 569 standard recommends that there be a minimum of 0.75 square feet of space for every 100 square feet of workspace. (A minimum of 80 square feet is recommended). Always allow for the minimal stated clearance’s stated under the MDF guidelines.

**Number of IDF’s:**
Each floor in a building should have at least one IDF Telecommunications Closet. Wiring stations to IDF Telecommunications Closets on different floors is not a preferred practice but can be done if no alternative exists. If possible, IDF Telecommunication Closets should be positioned toward the center of the building (usually the core area) and stacked vertically, when possible, in multi-story buildings.

The cable distance between the IDF and any workspace must not exceed 90 meters (295 feet).

**Plywood Backboard:**
Each IDF Room will contain a minimum of one flush mounted sheet of plywood (4’ X 8’) on the wall. Securely fasten the plywood to wall-framing members to ensure that it can support attached equipment. The plywood is to be 3/4”, A/C grade and fire retardant. All plywood backboards are to be mounted smooth side out and painted white fire retardant paint at time of installation and prior to installation of equipment onto the plywood.

Environmental:
Due to the reduction of equipment which resides in our TPS IDF rooms no special environmental conditions need be met.

Electrical Requirements:
Two 20 amp circuits should be provided. These should be mounted along the wall behind the equipment rack. These should be mounted per electrical standards. One Chatsworth 10 outlet rack mounted power strip or equivalent should be available for the equipment racks. Each individual circuit should be provided via a four position outlet box.

3C. Unacceptable locations for Communication Rooms
- Anywhere water vapor exists, such as boiler rooms, washrooms, janitor's closets or where access requires traversing a restroom.

- The telecommunications closet must be free of corrosives, explosives, and combustibles, including acid, ammonia, chlorine, oxygen, and petroleum vapors.

- Spaces containing steam pipes, drains, or clean-outs.

- Areas with high traffic volumes (for security reasons, as well as to minimize the risk of Inadvertent damage) unless separately enclosed.

- Areas of high electromagnetic interference (EMI) or radio frequency interference (RFI). Some examples are:
  - Near equipment that cause’s high interference includes, but is not limited to:
    - Audio visual equipment
    - Copiers and electric bursting equipment
    - Elevators
    - Fluorescent lights
    - Motors, transformers and fans
    - Microwave and radio transmitters

3D. Classroom Requirements
In order to meet the needs of standardizing classrooms and the technology in them, the following requirements will be followed.

Each classroom will receive no less than 11 data drops. The data drops will be the proper color as specified in appendix A. In locations where the drops cannot be installed in walls, a low
voltage surface mount raceway and junction box will be used including any fittings needed for a clean and finished look. Panduit is the Tulsa Schools standard, refer to appendix B for parts.

- Two data drops will be for WiFi
- One data drop for teacher’s desk
- One data for intercom speaker
- One data for clock
- A cluster of four data drops for students.
- Data for teacher’s desk and students will be installed near an electrical outlet.

4. Deliverables

4A. Vendor

- The Vendor is required to perform this work in accordance with acknowledged industry standards and professional standards and practices, and the procedures specified herein. Furnish and install all materials, devices, components and equipment for complete operational systems.

- The Vendor will be required to provide a project lead during the entire installation. The technical lead will be required to interface with the Tulsa Public Schools Project Lead at various intervals throughout the project.

- Systems are to be installed only by certified Commscope or Uniprise personnel. All system equipment installations and tests are to be made by workmen skilled in the specific trade.

- Provide and make connections to all specified products as indicated. Install all products in accordance with manufacturer’s instructions. All installation practices and materials shall be fully TIA/EIA T568-A/B compliant. Provide test results for each drop upon completion of installation. Test results must be submitted before “completion walkthrough” can begin.

4B. Project Sign Off

- Vendor is responsible for maintaining safe working environment on job site. Upon completion of installation, job site must be free of any debris related to the cabling installation before project sign off can begin.

- A “completion walkthrough” will be conducted by TPS and Vendor leads upon completion of the installation. Punch list items will be detailed and noted by the TPS project lead. Resolution of punch list items will be the responsibility of the Vendor. The
TPS lead will request completion dates from the Vendor specific to resolution of punch list items.

- Payment will be withheld from TPS until all “Project Scope & Specifics” have been met and punch list items resolved by the Vendor.

- The TPS Project Lead and Vendor Lead will sign the “Project Sign Off” document once all scope and specifics have been met. Copies will be distributed to both parties.
SECTION 280513 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

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. UTP cabling.
   2. RS-232 cabling.
   3. RS-485 cabling.
   4. Low-voltage control cabling.
   5. Control-circuit conductors.
   6. Fire alarm wire and cable.
   7. Identification products.

1.3 ACTION SUBMITTALS
A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS
A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

1.5 QUALITY ASSURANCE
A. Testing Agency Qualifications: An NRTL.
   1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.6 DELIVERY, STORAGE, AND HANDLING
A. Test cables upon receipt at Project site. Test each pair of UTP cable for open and short circuits.
1.7 FIELD CONDITIONS

A. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.
   1. Indications that wire and cables are wet or moisture damaged include, but are not limited to, discoloration and sagging of factory packing materials.

B. Environmental Limitations: Do not deliver or install UTP cable and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 50 or less.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 UTP CABLE

A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
   1. ADC.
   2. AMP Netconnect; a brand of Tyco Electronics Corporation.
   3. Belden Inc.
   4. Berk-Tek; a Nexans company.
   5. CommScope, Inc.
   6. Mohawk; a division of Belden Networking, Inc.
   7. 3M; Communication Markets Division.

B. Description: 100-ohm, four-pair UTP, covered with a blue thermoplastic jacket.
   1. Comply with ICEA S-90-661 for mechanical properties.
   2. Comply with TIA/EIA-568-B.1 for performance specifications.
   4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
      a. Communications, General Purpose: Type CM or CMG.
      b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
      c. Communications, Riser Rated: Type CMR, complying with UL 1666.
      d. Communications, Limited Purpose: Type CMX.
2.3 UTP CABLE HARDWARE

A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

1. ADC.
3. AMP Netconnect; a brand of Tyco Electronics Corporation.
4. Belden Inc.
5. Dynacom Inc.
6. Hubbell Incorporated; Hubbell Premise Wiring.
7. Leviton Commercial Networks Division.
8. Panduit Corp.

B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

C. Connecting Blocks: 110-style for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

2.4 RS-232 CABLE

A. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.

2.5 RS-485 CABLE

A. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.

2.6 LOW-VOLTAGE CONTROL CABLE

A. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.7 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway.

B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

2.8 FIRE ALARM WIRE AND CABLE

A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
   2. Draka Cableteq USA.
   3. Genesis Cable Products; Honeywell International, Inc.
   4. Rockbestos-Suprenant Cable Corp.
   5. West Penn Wire.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair, No. 18 AWG.

   1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.


   1. Line-Voltage Circuits: No. 12 AWG, minimum.
   2. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NTRL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

2.9 IDENTIFICATION PRODUCTS

A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

   1. Brady Worldwide, Inc.
   3. Kroy LLC.
4. Panduit Corp.

B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Section 260553 "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for installation of supports for cables.

3.2 WIRING METHOD

A. Install cable, concealed in accessible ceilings, walls, and floors when possible.

B. Wiring within Enclosures:
   1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
   2. Install lacing bars and distribution spools.
   3. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer.
   4. Install conductors parallel with or at right angles to sides and back of enclosure.
   5. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks.
   6. Mark each terminal according to system's wiring diagrams.
   7. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.

C. General Requirements for Cabling:
   2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
   3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
   4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.

6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

D. UTP Cable Installation: Install using techniques, practices, and methods that are consistent with Category 6 rating of components and that ensure Category 6 performance of completed and linked signal paths, end to end.

2. Install 110-style IDC termination hardware unless otherwise indicated.
3. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
4. Separation between cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
3.4 FIRE ALARM WIRING INSTALLATION

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method: Install wiring in metal raceway according to Section 260533 "Raceways and Boxes for Electrical Systems."

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.

C. Wiring Method:

1. Fire-Rated Cables: Use of 2-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is permitted.
2. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or raceway as signaling line circuits.

D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

G. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.

H. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.
3.5 POWER AND CONTROL-CIRCUIT CONDUCTORS

A. 120-V Power Wiring: Install according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.

B. Minimum Conductor Sizes:
   1. Class 1 remote-control and signal circuits, No. 14 AWG.
   2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
   3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.6 CONNECTIONS

A. Comply with requirements in Section 281300 "Access Control" for connecting, terminating, and identifying wires and cables.

B. Comply with requirements in Section 282300 "Video Surveillance" for connecting, terminating, and identifying wires and cables.

C. Comply with requirements in Section 283112 "Zoned (DC Loop) Fire-Alarm System" for connecting, terminating, and identifying wires and cables.

3.7 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-B, "Firestopping" Annex A.

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.8 GROUNDING

A. For communications wiring, comply with J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. For low-voltage wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.9 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.10 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.

2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.

   a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 280513
SECTION 281600 – EXISTING INTRUSION DETECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:


B. Products Installed but Not Supplied Under This Section

1. Section 262726 - Wiring Devices
2. Section 280513 - Conductors and Cables for Electronics Safety and Security

1.2 REFERENCES

A. Underwriters Laboratories (UL):

1. UL 365 – Police Station Connected Burglar Alarm Units and Systems
2. UL 609 – Grade A Local Mercantile Premises and Mercantile Safe and Vault
3. UL 611 – Grades A, AA Central Station
4. UL 985 – Household Fire Warning System Units
5. UL 1023 – Household Burglar-Alarm System Units
6. UL 1076 – Proprietary Burglar Alarm Units and Systems
7. UL 1610 – Central Station Burglar-Alarm Units
8. UL 1635 – Digital Alarm Communicator System Units

B. Federal Communications Commission (FCC):

2. Code of Federal Regulations Title 47 - Part 68 – Connection of Terminal Equipment to the Telephone Network.

C. National Fire Protection Association (NFPA):


1.3 SYSTEM DESCRIPTION

A. The existing system has the following capabilities: VISTA 250BP SECURITY SYSTEM ALARM by Honeywell. The Owner has an in-house maintenance department which requires the Owner to standardize the equipment specified and installed. Items specified are not limited to a single distributor. Alternate bidders supplying another system will not be approved. Products and devices required for the new Work indicated on the drawings shall be capable to interface with the product listed with U.L. Listed components.
1. Listed for UL Commercial Burglary
2. Supports up to 250 zones.
3. Supports up to eight (8) separate partitions independently, functioning as if it had its own separate control.
4. Supports up to 250 user codes with seven authority levels.
5. Accommodates 32 keypad macro commands per system.
6. Keeps a log of up to 1,000 events.
7. Provides integrated security, Access control, and CCTV switching capability.
8. Supports up to 50 latching-type glass break detectors.
9. Supports up to 96 programmable outputs.
10. Supports long-range radio (LRR) communication.
11. Provides scheduling capability to allow for automated operations.
12. Supports up to eight (8) alphanumeric paging devices.
13. Supports panel linking up to eight panels.
15. Supports alarm reporting via Internet.
16. Interfaces with automation software.
17. Capable of being installed using existing wiring.

1.4 SUBMITTALS

A. Submittals shall include manufacturer data sheets for system components required and indicated on drawings in the new Work.

1.5 QUALITY ASSURANCE

A. The alarm manufacturer shall be certified as being compliant with ISO9001.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE – (EXISTING)

A. Control Panel - The existing control panel has eight (8)-partition, UL commercial burglary control panel that supports up to 250 zones using basic hardwired, polling loop, and wireless zones. It also provides supervision of the bell output, RF receivers, and relay modules. In addition, the ability to schedule time-driven events and allow certain operations to be automated by pressing a single button. The system is capable of interfacing with an ECP long range radio (LRR) unit that can send Contact ID messages, and alphanumeric paging devices. The control provides integrated access control and CCTV-switching capability.

1. Basic Hardwired Zones - The control provides nine (9) style-B hardwire zones with the following characteristics:

   a. EOLR supervision (optional for zones 2-8): Shall support N.O. or N.C. sensors (EOLR supervision required for UL installations).
   b. Individually assignable to one of eight (8) partitions.
   c. Support up to 16 two-wire smoke detectors on one selected zone.
   d. Support four-wire smoke or heat detectors on any zone (power to four-wire smoke detectors must be supervised with an EOL device).
   e. Support up to 50 two-wire latching glass break detectors on one selected zone.
2. Optional Expansion Zones

B. Polling Loop Expansion – The control supports up to 241 additional hardwire zones using a built-in two-wire polling (multiplex) loop interface.

C. A Common Lobby partition (1-8), which can be programmed to perform the following functions:

D. Authority level (Master, Manager, or several other Operator levels). Each User Code (other than the installer code) shall be capable of being assigned the same or a different level of authority for each partition that it will operate.

1. Peripheral Devices – The control shall support up to 30 addressable ECP devices, which can be any combination of keypads, RF receivers, relay modules, annunciator modules, and interactive phone modules. Peripheral devices have the following characteristics:

E. Each device set to an individual address according to the device's instructions.

F. Performs all system arming functions.

G. Programmed to activate in response to system events.

1. Optional Vista Interactive Phone Module – The control shall support the ADEMCO 4285/4286 VIP Modules, which permit access to the security system in order to perform the following functions:

H. Obtain system status information.

1. Optional LED Annunciator – The control shall support the ADEMCO FSA-8 and FSA-24 annunciators, which are capable of:

I. Visually identifying a zone or point that is in alarm or trouble.

J. Providing a command that activates relays to allow access doors to open (e.g., lobby door), lights to be turned on or off, etc.

1. CCTV Switching – The System shall be capable of supporting the VistaView 100 CCTV Switching System. The CCTV system shall be fully integrated and be event driven by Fire, Burglary or Access events. When cameras are not event driven, they shall be driven by an automatic preset dwell time. The system shall also be capable of:

K. Activating the CCTV system via a Form-C relay output.

   a. Operating up to 60 camera inputs and 30 video outputs.

2. Commercial Wireless Equipment – The Control shall be compatible with UL Listed Commercial Wireless Fire & Security equipment including:

L. ADEMCO 5881ENHC Commercial Fire/Burglar Receiver. - The receiver capable of receiving as many points as the control panel is rated for. Up to two (2) Receivers may be used on any system. Receivers may be remotely located anywhere on the system Keypad/Annunciator bus.

   a. ADEMCO 5808LST Wireless Photoelectric Smoke and Heat Detector - The device shall be UL 268 listed.

   b. ADEMCO 5809 Wireless 135D Fixed Temperature and Rate of Rise Heat Detector - The device shall be UL 521 listed for commercial applications.
c. ADEMCO 5817CB Wireless Universal Contact Monitoring Transmitter - This device shall be capable of making any conventional UL listed contact device a wireless device. The device shall be UL listed as follows: UL 985 for fire and UL 365, 609, 1023, 1076 and 1610 for security and nurse call.

d. ADEMCO 5869 Wireless Hold Up Switch/Transmitter - This device shall be UL 636 listed for commercial burglary applications.

2. Optional Key switch – The control shall support the ADEMCO 4146 Key switch on any one of the system's 8 partitions. If used, zone 7 is no longer available as a protection zone.

3. Voltage Triggers – The system shall provide voltage triggers, which change state for different conditions. Used with LRR (Long Range Radio) equipment or other devices such as a remote keypad sounder, key switch ARMED and READY LEDs, or a printer to print the system's event log.

4. Event Log – The System shall maintain a log of different event types (enabled in programming). The event log shall provide the following characteristics:

M. Stores up to 1,000 events.

N. Open/close schedules (for control of arming/disarming and reporting).

O. Formats

1. ADEMCO Low Speed (Standard or Expanded).
2. Sescoa/Radionics.
3. ADEMCO Express.
4. ADEMCO High Speed.
5. ADEMCO Contact ID.

7. ECP long-range radio (LRR) interface.

8. Audio Alarm Verification Option - Provides a programmable Audio Alarm Verification (AAV) option that can be used in conjunction with an output relay to permit voice dialog between an operator at the central station and a person at the premises.

9. Cross-Zoning Capability - Helps prevent false alarms by preventing a zone from going into alarm unless its cross-zone is also faulted within 5 minutes.

10. Pager Interface – The Control Panel shall be capable of sending event information to an alphanumeric pager via a VA-8201 pager interface device.

11. Exit Error False Alarm Prevention Feature – The System shall be capable of differentiating between an actual alarm and an alarm caused by leaving an entry/exit door open. If not subsequently disarmed, the control panel shall:

P. Bypass the faulted E/E zone(s) and/or interior zones and arm the system.

Q. Uploading and downloading all programming information at 300 baud.

R. Control multiple zones, partitions, and/or buildings from a central location.

S. The control panel shall be the VISTA-250BP Commercial Burglary Partitioned Security System or equivalent.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Submission of a proposal confirms that the Contract Documents and site conditions are accepted without qualifications unless exceptions are specifically noted.

B. The site shall be visited on a regular basis to appraise ongoing progress of other trades and contracts, make allowances for all ongoing work, and coordinate the requirements of this contract in a timely manner.

3.2 INSTALLATION

A. The System shall be installed and tested in accordance with the Manufacturer's Installation instructions. The following conditions are applicable:

1. In order to ensure a complete, functional System, for bidding purposes, where information is not available from the Owner upon request, the worst case condition shall be assumed.
2. Interfaces shall be coordinated with the Owner’s representative, where appropriate.
3. All necessary backboxes, pullboxes, connectors, supports, conduit, cable, and wire shall be furnished and installed to provide a complete and reliable System installation. Exact location of all boxes, conduit, and wiring runs shall be presented to the Owner for approval in advance of any installation.
4. All conduit, cable, and wire shall be installed parallel and square with building lines, including raised floor areas. Conduit fill shall not exceed forty percent (40%). All wires shall be gathered and tied up to create an orderly installation.

3.3 TESTING AND CERTIFICATION

A. The Contractor shall demonstrate the functionality of the System upon completion of installation, documenting the result of all tests and providing these results to the Owner. The System shall be tested in accordance with the following:

1. The Contractor shall conduct a complete inspection and test of all installed equipment. This includes testing and verifying connection to equipment of other Divisions.
2. The Contractor shall provide staff to test all devices and all operational features of the System for witness by the Owner’s representative and the Authority having jurisdiction. The Contractor shall provide two-way radio communications to assist in the testing. All testing must be witnessed by the owner’s representative, prior to acceptance.
3. The testing and certification shall take place as follows:

B. System shall be tested in conjunction with the manufacturer’s representative.

a. All deficiencies noted in the above test shall be corrected.
b. Test results shall be submitted to the consultant or owner’s representative.
c. System test witnessed by owner’s representative and correction of any deficiencies noted.
d. The Owner’s representative shall accept the System.
e. System test shall be witnessed by the Authority having Jurisdiction, and any deficiencies that are noted shall be corrected.
2. A letter of certification shall be provided to indicate that the tests have been performed and all devices are operational.

END OF SECTION 281600
SECTION 283111 – DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

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.

B. Section 260523 – Control-Voltage Electrical Power Cables.

1.2 SUMMARY

A. This Section includes:
   1. Fire-alarm control unit.
   3. System smoke detectors.
   6. Device guards.
   7. Magnetic door holders.
   10. Digital alarm communicator transmitter.
   11. Fire alarm wire and cable.

B. Related Sections and Work include the following:
   1. Drawings indicate new and existing doors with access controls requiring interconnection and shall be field verified prior to bid - for door closers and holders with associated smoke detectors, electric door locks, and release devices that interface with the fire alarm system. Extend and Interconnect to existing devices.

1.3 DEFINITIONS

A. FACP: Fire alarm control panel.

B. LED: Light-emitting diode.

C. NICET: National Institute for Certification in Engineering Technologies.

D. Definitions in NFPA 72 apply to fire alarm terms used in this Section.
1.4 SYSTEM DESCRIPTION

A. This section of the specification includes the furnishing, installation, connection and testing of the main control board, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators and/or digital alarm communications to central stations and wiring as shown on the drawings and specified herein.

B. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for Local Protected Premises Signaling Systems except as modified and supplemented by this specification. The system field wiring shall be supervised either electrically or by software-directed polling of field devices.

   1. The Secondary Power Source of the fire alarm control panel will be capable of providing at least 24 hours of backup power with the ability to sustain 5 minutes in alarm at the end of the backup period.

C. The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of ISO 9001:2008 standards and guidelines.

D. The FACP and peripheral devices shall be manufactured or supplied 100% by a North America manufacturer (or division thereof).

E. Underwriters Laboratories Inc. (UL) - USA:

   1. No. 38 Manually Actuated Signaling Boxes
   2. No. 50 Cabinets and Boxes
   3. No. 864 Control Units for Fire Protective Signaling Systems
   4. No. 268 Smoke Detectors for Fire Protective Signaling Systems
   5. No. 268A Smoke Detectors for Duct Applications
   6. No. 346 Waterflow Indicators for Fire Protective Signaling Systems
   7. No. 464 Audible Signaling Appliances
   8. No. 521 Heat Detectors for Fire Protective Signaling Systems

F. The installing company shall employ NICET (minimum Level II Fire Alarm Systems) technicians on site to guide the final check-out and to ensure the systems integrity.

G. The FACP shall meet requirements of UL ANSI 864 Ninth Edition.

1.5 SCOPE

A. An intelligent fire alarm detection system shall be installed in accordance to the project specifications and drawings.

B. Basic Performance:

   1. Initiation Device Circuits (IDC) shall be wired Class B (NFPA Style B) as part of an addressable device connected by the SLC Circuit.
   2. Notification Appliance Circuits (NAC) shall be wired Class B as part of an addressable device connected by the SLC Circuit.
3. All circuits shall be power-limited, per UL864 requirements.
4. A single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.

C. BASIC SYSTEM FUNCTIONAL OPERATION

1. When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

   a. The system Alarm LED on the FACP shall flash.
   b. A local sounder with the control panel shall sound.
   c. A backlit 80-character LCD display on the FACP shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
   d. In response to a fire alarm condition, the system will process all control programming and activate all system outputs (alarm notification appliances and/or relays) associated with the point(s) in alarm. Additionally, the system shall send events to a central alarm supervising station via either dial-up over PSTN or Internet or Intranet via PSDN or virtual private network.

1.6 SUBMITTALS

A. General:

1. Two copies of all submittals shall be submitted to the Architect/Engineer for review.
2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent compatible UL-listed equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.
3. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

B. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams and conduit layouts.
3. Show configurations, terminations and annunciator layout.

C. Manuals:

1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.
2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.
3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

D. Software Modifications
1. Provide the services of a qualified technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.

E. GUARANTY:
1. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance.
2. The full cost of maintenance, labor and materials required to correct any defect during this five year period shall be included in the submittal bid.

1.7 MAINTENANCE:

A. Maintenance and testing shall be on a semi-annual schedule or as required by the local AHJ. A preventive maintenance schedule shall be provided by the contractor describing the protocol for preventive maintenance. The schedule shall include:
1. Systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, waterflow switches and all accessories of the fire alarm system.
2. Each circuit in the fire alarm system shall be tested semiannually.
3. Each smoke detector shall be tested in accordance with the requirements of NFPA 72 Chapter 14.

B. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, tests, and repairs described below. Include also a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment and response travel costs for each year of the maintenance period. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

1.8 POST CONTRACT EXPANSIONS:

A. The contractor shall have the ability to provide parts and labor to expand the system specified, if so requested, for a period of five (5) years from the date of acceptance.
B. As part of the submittal, include a quotation for all parts and material, and all installation and test labor as needed to increase the number of intelligent addressable devices by ten percent (10%). This quotation shall include intelligent smoke detectors, intelligent heat detectors, addressable manual stations, addressable beam detectors, addressable monitor modules and addressable control modules equal in number to one tenth of the number required to meet this specification (list actual quantity of each type).
C. The quotation shall include installation, test labor, and labor to reprogram the system for this 10% expansion. If additional FACP hardware is required, include the material and labor necessary to install this hardware.

D. Do not include cost of conduit or wire or the cost to install conduit or wire except for labor to make final connections at the FACP and at each intelligent addressable device. Do not include the cost of conventional peripherals or the cost of initiating devices or notification appliances connected to the addressable monitor/control modules.

E. Submittals that do not include this estimate of post contract expansion cost will not be accepted.

1.9 APPLICABLE STANDARDS AND SPECIFICATIONS:

The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.

A. National Fire Protection Association (NFPA) - USA:

1. No. 12 Standard on Carbon Dioxide Extinguishing Systems
2. No. 12A Standard on Halon 1301 Fire Extinguishing Systems
3. No. 12B Standard on Halogenated Fire Extinguishing Agent Systems Halon 1211
4. No. 13 Sprinkler Systems
5. No. 15 Standard for Water Spray Fixed Systems for Fire Protection
7. No. 70 National Electric Code (NEC)
8. No. 72 National Fire Alarm Code
10. No. 38 Manually Actuated Signaling Boxes
11. No. 217 Smoke Detectors, Single and Multiple Station
12. No. 228 Door Closers–Holders for Fire Protective Signaling Systems
13. No. 268 Smoke Detectors for Fire Protective Signaling Systems
14. No. 268A Smoke Detectors for Duct Applications
15. No. 346 Waterflow Indicators for Fire Protective Signaling Systems
16. No. 464 Audible Signaling Appliances
17. No. 521 Heat Detectors for Fire Protective Signaling Systems
18. No. 864 Control Units for Fire Protective Signaling Systems
19. No. 1481 Power Supplies for Fire Protective Signaling Systems
20. No. 1610 Central Station Burglar Alarm Units
21. No. 1638 Visual Signaling Appliances
22. No. 1971 Visual Signaling Appliances
23. No. 2001 Standard on Clean Agent Fire Extinguishing Systems
24. No. 2017 General-Purpose Signaling Devices and Systems

B. The FACP shall be ANSI 864, 9th Edition Listed. Systems listed to ANSI 864, 8th edition (or previous revisions) shall not be accepted.
C. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

D. Local and State Building Codes.

E. All requirements of the Authority Having Jurisdiction (AHJ).

1.10 APPROVALS:

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:
   1. FM Factory Mutual

1.11 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Work of this Section be performed by a UL-listed company.

C. Installer Qualifications: Personnel certified by NICET as Fire Alarm Level III.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.12 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 Construction Manager no fewer than 5 days in advance of proposed interruption of fire alarm service.
   2. Do not proceed with interruption of fire alarm service without Construction Manager's written permission.

1.13 SEQUENCING AND SCHEDULING

A. Existing Fire Alarm Equipment: Maintain fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service. Remove existing fire alarm equipment and system entirely from the building.

Tulsa Public Schools
Macarthur Elementary Classroom Addition 2018
Allied Engineering Group, LLC
B. Equipment Removal: After acceptance of the new fire alarm system, remove existing disconnected fire alarm equipment.

1.14 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but not less than 1 unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but not less than 1 unit.
3. Smoke Detectors: Quantity equal to 10 percent of amount of each type installed, but not less than 1 unit of each type.
4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than 1 unit of each type.
5. Keys and Tools: One extra set for access to locked and tamper-proofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system.

1.15 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
2. Warranty Period: Five years from date of Substantial Completion.

1.16 FIELD CONDITIONS

A. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.

1. Indications that wire and cables are wet or moisture damaged include, but are not limited to, discoloration and sagging of factory packing materials.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIAL, GENERAL:

A. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a fire protective signaling system, meeting the National Fire Alarm Code.
B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.2 CONDUIT AND WIRE:

A. Conduit:

1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
2. Where required, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross-sectional area where three or more cables are contained within a single conduit.
3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-29.
4. Wiring for 24 volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
5. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
6. Conduit shall be 3/4 inch (19.1 mm) minimum.

B. Wire:

1. All fire alarm system wiring shall be new.
2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system.
3. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.
4. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
5. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NEC 760 (e.g., FPLR).
6. Wiring used for the multiplex communication circuit (SLC) shall be twisted and support a maximum wiring distance of 9,820 feet when sized at 12 AWG. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit. Shielded wire shall not be required.
8. All field wiring shall be electrically supervised for open circuit and ground fault.
9. The fire alarm control panel shall be capable of T-tapping Class B Signaling Line Circuits (SLCs). Systems which do not allow or have restrictions in, for example, the amount of T-taps, length of T-taps etc., is not acceptable.

C. Terminal Boxes, Junction Boxes and Cabinets: All boxes and cabinets shall be UL listed for their use and purpose.
D. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold copper water pipe or grounding rod.

2.3 MAIN FIRE ALARM CONTROL PANEL:

A. The FACP shall be a Mircom Model FX-3500 and shall contain a microprocessor-based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, Digital Dialer and Communicators and other system-controlled devices.

B. Operator Control

1. Acknowledge Switch:
   a. Activation of the control panel Acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the 80-character LCD display to the next alarm or trouble condition.
   b. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.

2. Alarm Silence Switch: Activation of the alarm silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silence able by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto silence timers.

3. Alarm Activate (Drill) Switch: The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

4. System Reset Switch: Activation of the System Reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.

5. Lamp Test: The Visual Indicator Test Button shall activate all system LEDs and turns the buzzer on steady.

C. System Capacity and General Operation

1. The control panel shall provide, or be capable of, expansion to 954 intelligent/addressable devices.

2. The control panel shall include Form-C Alarm, Trouble and Supervisory relays rated at 1.0 amps @ 28 VDC as well as 4 programmable Notification Appliance Circuits (NACs) capable of being wired as Class B or Class A. Total NAC power is 6.0A (1.5A max per circuit). It shall also include an on board DACT for communicating digital information between a fire alarm control panel and a
UL-Listed central station. The main power supply for the fire alarm control panel shall provide 10.0 amps of available power for the control panel and peripheral devices.

3. The fire alarm control panel shall include an operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color-coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.

4. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel. The system shall be fully programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes. The control unit will support the ability to upgrade its operating program using FLASH memory technology. The unit shall provide the user with the ability to program from either the included keypad or from a computer running upload/download software.

5. The system shall allow the programming of any input to activate any output or group of outputs. Systems which have limited programming (such as general alarm), have complicated programming (such as a diode matrix), are not considered suitable substitutes.

6. The FACP shall be capable of coding Notification Appliance Circuits in Steady, Temporal Code, California Code, or March Time. Main panel notification circuits shall also automatically synchronize any of the following manufacturer’s notification appliances connected to them: Mircom, Potter/Amseco, System Sensor, Gentex or Wheelock with no need for additional sync modules.

7. The FACP shall provide the following features:
   a. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
   b. Detector sensitivity test, meeting requirements of NFPA 72, Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
   c. The ability to display or print system reports and event logs for up to 400 Alarm events and 400 General events.
   d. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification an excessive number of times.
   e. Positive Alarm Sequence (PAS pre-signal), meeting NFPA 72 requirements.
   f. Quick response manual station reporting.
   g. Non-alarm points for general (non-fire) control.
   h. Periodic detector test conducted automatically by the software.
   i. One-Man Walk Test

D. Central Microprocessor

1. The microprocessor shall be a state-of-the-art and it shall communicate with, monitor and control all external interfaces. A "watch dog" timer circuit to detect and report microprocessor failure.
2. The microprocessor shall contain and execute all specific actions to be taken in the condition of an alarm. Control programming shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.

3. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file.

4. An auto configurator capability (self-learn) shall be provided to quickly identify devices connected on the SLC and make the system operational.

5. For flexibility and to ensure program validity, an optional Windows(TM) based configurator program utility shall be available. This configurator program shall be used to off-line program the system. This program shall also have a verification utility which scans the program files, identifying possible errors. The configurator program utility uses the on board port. This shall be in compliance with the NFPA 72 requirements for testing after system modification.

E. Display

1. The display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.

2. The display shall include status information and custom alphanumeric labels for all intelligent Advanced Protocol detectors, addressable modules, internal panel circuits, and software zones.

3. The display shall contain an alphanumeric, text-type display and dedicated LEDs for the annunciation of AC POWER, FIRE ALARM, SUPERVISORY, TROUBLE, ALARM SILENCED, DISABLED, CPU FAULT INDICATOR, BATTERY and GROUND conditions.

4. The display keypad shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Three different password levels shall be provided to prevent unauthorized system control or programming.

5. The display shall include the following operator control switches: ACKNOWLEDGE, ALARM SILENCE, DRILL (alarm activate), and SYSTEM RESET.

F. Signaling Line Circuit (SLC)

1. The SLC interface shall provide power to and communicate with up to 159 intelligent Advanced Protocol detectors (photoelectric or thermal) addressable Beam Detectors, and 159 addressable pull stations, intelligent modules (monitor or control) for a system capacity of 954 devices (3 SLC). All three SLC can support Advanced Protocol (AP) and CLIP compatible devices. Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.

2. The CPU shall receive information from all intelligent Advanced Protocol detectors to be processed to determine whether normal, alarm, pre-alarm, or trouble conditions exist for each detector. The software shall automatically compensate for the accumulation of dust in each detector up to allowable limits. The information shall also be used for automatic detector testing and for the determination of detector maintenance conditions.
3. The detector software shall meet NFPA 72, Chapter 14 requirements and be certified by UL as a calibrated sensitivity test instrument.

G. Serial Interfaces

1. The system shall provide a means of interfacing to UL Listed Electronic Data Processing (EDP) peripherals using the RS-232 communications standard.

2. One RS-232 port shall be used to connect an UL-Listed printer. The printer shall communicate with the control panel using an interface complying with Electrical Industries Association standard EIA-232D. Power to the printer shall be 120 VAC @ 60 Hz.

H. The control panel will have the capability of Reverse Polarity Transmission or connection to a Municipal Box for compliance with applicable NFPA standards.

I. Digital Alarm Communicator Transmitter (DACT). The On board DACT is an interface for communicating digital information between a fire alarm control panel and a UL-Listed central station.

1. Communication shall include vital system status such as:
   - Independent Zone (Alarm, trouble, non-alarm, supervisory)
   - Independent Addressable Device Status
   - AC (Mains) Power Loss
   - Low Battery and Earth Fault
   - System Off Normal
   - 12 and 24 Hour Test Signal
   - Abnormal Test Signal (per UL requirements)
   - EIA-485 Communications Failure

2. The On board DACT communicator shall support independent zone/point reporting via the Contact ID format. In this format, the DACT shall support the transmission of addressable points within the system. This format shall enable the central station to have exact details concerning the location of the fire for emergency response.

J. Stand Alone Emergency and Fire Alarm Audio System

1. A standalone Emergency and Fire Alarm Audio System shall be available from the same manufacturer of the main fire alarm system.

2. This Emergency and Fire Alarm Audio System shall be a Mircom Model QX-Mini and work stand alone or as a slave to the Main Fire Alarm Control Panel.

3. Shall have as minimum requirements:
   a. Integral 30 Watt, 25 Vrms audio amplifier with a software option for 70.7 volt systems. The system shall be capable of expansion to 60 watts total via the insertion of an additional 30 watt audio amplifier module into the same cabinet and expandable to 360 Watts.
   b. Speaker circuit shall be capable of either Class A or B wiring.
c. Digital Message with a memory capacity for up to 12 minutes of audio messages in total. The Digital Message shall be capable of producing twelve distinct messages. The software configurator can be used to select default messages; import custom message, record custom message and Text To Speech (Type in message produces a voice message).

d. Designed to meet the NFPA 72 sleeping space requirement to produce a fundamental frequency of 520 Hz +/- 10% with a square wave or its equivalent.

e. Built in alert tone patterns with March Code, California, Steady, Alert Tone, Temporal, 520HZ, Continuous Whoop, or No Tone is field programmable. Tone Prior to transmitting a message, the Emergency and Fire Alarm Audio System can be programmed to produce a pre-announce and post-announce tone.

f. The Emergency and Fire Alarm Audio System will be capable of detecting and announcing the following conditions: Loss of Power (AC and DC), System Trouble, Ground Fault, Alarm, Microphone Trouble, Message Generator Trouble, Tone Generator Trouble, and Amplifier Fault.

g. Emergency and Fire Alarm Audio System will provide 2 Notification Appliance Circuit (NAC) output (2.5 Amps per NAC circuit total of 5.0 Amps) with sync generator or follower for Mircom, Potter/Amseco, System Sensor, Gentex or Wheelock protocols. Each NAC shall be capable of One (1) Style Y (Class B) or Style Z (Class A) circuit.

h. On-board battery charger which supports charging up to 75 AH batteries (cabinet holds up to 18AH batteries).

4. The Emergency and Fire Alarm Audio System shall be fully supervised including microphone, amplifier output, message generator, speaker wiring, and tone generation.

5. Speaker outputs shall be fully power-limited.

6. Amplifiers shall be independently powered and protected to eliminate a short on one circuit from affecting other circuits.

7. The Emergency and Fire Alarm Audio System shall provide full supervision on both active alarm and standby conditions.

K. Speakers:

1. All speakers shall operate on 25 VRMS, with field selectable output taps from 0.25 to 2.0 Watts.

2. Speakers in corridors and public spaces shall produce a nominal sound output of 84 dBA at 10 feet (3m).

3. Frequency response shall be a minimum of 400 HZ to 4000 HZ.

4. The back of each speaker shall be sealed to protect the speaker cone from damage and dust.

L. Enclosures:

1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected and painted red.
2. The back box and door shall be constructed of steel with provisions for electrical conduit connections into the sides and top.
3. The door shall provide a key lock and shall provide for the viewing of all indicators.

M. **INX-10A** is an Intelligent Booster Power Supply that extends the power capabilities of existing notification appliance circuits as well as provide power for other ancillary devices.

1. The INX-10A shall offer up to 10.0 amps of regulated 24 volt power. It shall include an integral charger designed to charge 40.0 amp hour batteries.
2. The Intelligent Booster Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a control relay. Five NAC outputs, wired Class A or Class B, shall be available for connection to the Notification devices.
3. The INX-10A shall optionally provide synchronization of all connected strobes or horn strobe combinations when either Mircom, Potter/Amseco, System Sensor, Gentex or Wheelock devices are installed.
4. The INX-10A shall function as a sync follower as well as a sync generator.
5. The INX-10A shall include a surface or flush-mountable backbox.
6. The Intelligent Booster Power Supply shall include the ability to delay the reporting of an AC fail condition per NFPA requirements.
7. The INX-10A shall provide 24 VDC regulated and power-limited circuitry per UL standards.

N. **Power Supply:**

1. The main power supply for the fire alarm control panel shall provide 10.0 amps of available power for the control panel and peripheral devices.
2. Positive-Temperature-Coefficient (PTC) thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs. The power supply shall provide an integral battery charger up to 42Ah.
3. The main power supply shall continuously monitor all field wires for earth ground conditions.
4. The main power supply shall operate on 120 VAC, 60 Hz, or 240VAC 50 Hz and shall provide all necessary power for the FACP.

O. **Programmable Electronic Sounders:**

1. Electronic sounders shall operate on 24 VDC nominal.
2. Electronic sounders shall be field programmable without the use of special tools, to provide slow whoop, continuous, or interrupted tones with an output sound level of at least 90 dBA measured at 10 feet from the device.
3. Electronic sounders shall be flush or surface mounted as shown on plans.

P. **Strobe lights** shall meet the requirements of the ADA, UL Standard 1971 and shall meet the following criteria:

1. The maximum pulse duration shall be 2/10 of one second.
2. Strobe intensity shall meet the requirements of UL 1971.
3. The flash rate shall meet the requirements of UL 1971.

Q. **Audible/Visual Combination Devices:**
1. Shall meet the applicable requirements of Section A listed above for audibility.
2. Shall meet the requirements of Section B listed above for visibility.
R. System Operations

1. Alarm Verification: Each of the intelligent Advanced Protocol addressable smoke detectors in the system may be independently programmed for verification of alarm signals. The alarm verification time period shall not exceed 2 minutes.

2. Point Disable: Any Advanced Protocol addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.

3. Point Read: The system shall be able to display the following point status diagnostic functions:
   a. Device status
   b. Device type
   c. Custom device label
   d. Device zone assignments

4. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.

5. System History Recording and Reporting: The fire alarm control panel shall contain two event history logs comprised of a 400 event alarm log for alarm related events and a 400 event general log for all other events. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history log may be manually reviewed, one event at a time, or printed in its entirety. The history log shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.

6. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent Advanced Protocol detector and shall analyze the detector responses over a period of time. If any intelligent Advanced Protocol detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

7. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.

8. The fire alarm control panel shall include Silent and Audible Walk Test functions. It shall include the ability to test initiating device circuits and Notification Appliance Circuits from the field without returning to the panel to reset the system. The operation shall be as follows:
   a. The Silent Walk Test will not sound NACs but will store the Walk Test information in History for later viewing.
   b. Alarming an initiating device shall activate programmed outputs, which are selected to participate in Walk Test.
   c. Introducing a trouble into the initiating device shall activate the programmed outputs.
   d. Walk Test shall be selectable on a per device/circuit basis. All devices and circuits which are not selected for Walk Test shall continue to provide fire protection and if an alarm is detected, will exit Walk Test and activate all programmed alarm functions.
   e. All devices tested in walk test shall be recorded in the history buffer.
   f. All devices not tested in walk test shall be recorded in the history buffer.
9. Waterflow Operation: An alarm from a waterflow detection device shall activate the appropriate alarm message on the control panel display; turn on all programmed Notification Appliance Circuits and shall not be affected by the Signal Silence switch.

10. Supervisory Operation: An alarm from a supervisory device shall cause the appropriate indication on the control panel display, light a common supervisory LED, but will not cause the system to enter the trouble mode.

11. Signal Silence Operation: The FACP shall have the ability to program each output circuit (notification circuit or relay) to deactivate upon depression of the Signal Silence switch.

12. Non-Alarm Input Operation: Any addressable initiating device in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.

2.4 SYSTEM COMPONENTS:

A. Addressable Advanced Protocol manual station:
   1. Addressable Advanced Protocol manual station shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
   2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.

B. Intelligent Advanced Protocol Multi-Sensing Detector
   1. The intelligent Advanced Protocol detector shall be an addressable device this is capable of detecting multiple threats by employing photoelectric and thermal technologies in a single unit. This detector shall utilize advanced electronics which react to slow smoldering fires (photoelectric and heat thermal) all within a single sensing device.
   2. The multi-detector shall include two bicolor LEDs for 360-degree viewing.
   3. Automatically adjusts sensitivity levels without the need for operator intervention or programming. Sensitivity increases with heat.

C. Intelligent Advanced Protocol Photoelectric Smoke Detector
   1. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
   2. The detectors shall be ceiling-mounted and available in an alternate model with an integral fixed 135-degree heat-sensing element.
   3. Each detector shall contain a remote LED output and a built-in test switch.
   4. Detector shall be provided on a twist-lock base.
   5. It shall be possible to perform a calibrated sensitivity and performance test on the detector without the need for the generation of smoke. The test method shall test all detector circuits.
   6. A visual indication of an alarm shall be provided by dual latching Light Emitting Diodes (LEDs), on the detector, which may be seen from ground level over 360 degrees? These LEDs shall periodically flash to indicate that the detector is in communication with the control panel.
7. The detector shall not go into alarm when exposed to air velocities of up to 1500 feet per minute (fpm).
8. The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber.
9. All field wire connections shall be made to the base through the use of a clamping plate and screw.

D. Projected Addressable Beam Detector

1. The projected beam type shall be a 4-wire 24 VDC intelligent, addressable projected beam smoke detector device.
2. The detector shall be listed to UL 268 and shall consist of a single transmitter-receiver and corresponding non powered reflector.
3. The detector shall operate in either a short range (16' – 230') or long range (16'–328') when used with an extender module.
4. The temperature range of the device shall be -22 degrees F to 131 degrees F.
5. The detector shall feature an optical sight and 2-digit signal strength meter to ensure proper alignment of unit without need of special tools.
6. The unit shall be both ceiling and wall mountable.
7. The detector shall have the ability to be tested using calibrated test filters or magnet-activated remote test station.
8. The detector shall have four standard sensitivity selections along with two automatic self-adjusting settings. When either of the two automatic settings is selected the detector will automatically adjust its sensitivity using advanced software algorithms to select the optimum sensitivity for the specific environment.

E. Intelligent Advanced Protocol Thermal Detectors

1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

F. Intelligent Advanced Protocol Duct Smoke Detector

1. The smoke detector housing shall accommodate an intelligent Advanced Protocol photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.
2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

G. Addressable Advanced Protocol Monitor Module

1. Addressable Advanced Protocol monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any normally open dry contact device) to one of the fire alarm control panel SLCs.
2. The monitor module shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box.
3. The IDC zone shall be suitable for Class A or Class B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.

H. Addressable Advanced Protocol Conventional Zone Module

1. Means shall be provided for the monitoring of conventional Initiating Device Circuits populated with 2-wire smoke detectors as well as normally-open contact alarm initiating devices (pull stations, heat detectors, etc.).
2. Each IDC of conventional devices will be monitored as a distinct address on the polling circuit by an addressable module. The module will supervise the IDC for alarms and circuit integrity (opens).
3. The Conventional Zone module will be compatible, and listed as such, with all devices on the supervised circuit.
4. The IDC zone may be wired for Class A or B operation. An LED shall be provided that shall flash under normal conditions, indicating that the Zone module is operational and in regular communication with the control panel.
5. The Conventional Zone module shall be capable of mounting in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box or in a surface mount backbox.

I. Addressable Advanced Protocol Control Relay Module

1. Addressable Advanced Protocol control relay modules shall be provided to control the operation of fan shutdown and other auxiliary control functions.
2. The Advanced Protocol control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.
3. The Advanced Protocol control relay module will provide a dry contact, Form-C relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relays may be energized at the same time on the same pair of wires.
4. The Advanced Protocol control relay module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

J. Addressable Control Relay Module SixOutput

1. Up to 6 Addressable intelligent control relay modules combined on one circuit board shall be provided to control the operation of fan shutdown and other auxiliary control functions.
2. Using rotary address switches, the first module shall be addressed from 01 to 94 while the remaining modules shall be automatically assigned to the next five higher addresses. Note, binary dip switches for setting address are not acceptable.
3. A single isolated set of dry relay form C contacts shall be provided for each of the 6 module addresses, which shall be capable of being wired for either a normally-open or normally-closed operation.
4. The module shall allow an addressable control panel to switch these contacts on command.
5. The module shall contain removable plug in terminal blocks capable of supporting 12 AWG to 18 AWG wire.
6. The control relays mounted on the module shall be suitable for pilot duty applications and rated for a maximum of 3.0 amps at 30 VDC, resistive, non-coded and 2.0 amps at 30 VDC maximum, resistive, coded.
K. Six-Zone Interface Module

1. A six zone interface module shall be provided as an interface between the addressable panel and two-wire conventional detection zones.
2. A common SLC input shall be used for all modules, and the initiating device circuits shall share a common external supervisory supply and ground.
3. The first address on the interface module shall be addressed from 01 to 94 while the remaining modules are automatically assigned to the next five higher addresses.
4. Address shall be set using decimal encoded rotary address switches. Binary address switches are not acceptable.
5. Provision shall be included for disabling a maximum of two unused addresses of the six available.
6. All two-wire detectors being monitored shall be two-wire compatibility listed with the six zone input module.
7. The six zone input module shall transmit the status of a zone of two-wire detectors to the fire alarm control panel. Status shall be reported as normal, open or alarm.
8. Removable plug-in terminals shall be provided capable of accepting from 18 AWG up to 12 AWG wire.

L. Ten Input Monitor Module

1. A single multi input module shall be provided for the monitoring of up to 10 conventional Initiating Device Circuits populated with 2-wire smoke detectors as well as normally-open contact alarm initiating devices (pull stations, heat detectors, etc.).
2. Each IDC of conventional devices will be monitored as a distinct address on the polling circuit by an addressable point. The module will supervise the IDC for alarms and circuit integrity (opens).
3. The first address on the 10 input boards shall be set from 01 to 90 and the remaining module addresses shall be automatically assigned to the next nine higher addresses.
4. Provision shall be included for disabling a maximum of two unused addresses.
5. The supervised state (normal, open, or short) of the monitored device shall be sent back to the panel. A common SLC input shall be used for all modules, and the initiating device loops shall share a common supervisory supply and ground.
6. The IDC zone may be wired for Class A or B operation. A green LED for each circuit shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel. LEDs shall latch on when a circuit is in alarm.

M. Fault Isolator Module

1. Fault Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B. The Fault isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one Fault isolator module shall be provided for each floor or protected zone of the building.
2. If a wire-to-wire short occurs, the Fault isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the Fault isolator module shall automatically reconnect the isolated section.
3. The Fault isolator module shall not require any address- setting and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
4. The Fault isolator module shall mount in a standard 4-inch (101.6 mm) deep electrical box or in a surface mounted backbox. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

N. Annunciator

1. The annunciator shall communicate with the fire alarm control panel via a two-wire RS 485 communications circuit.
2. The annunciator shall require no more than four wires for operation. Annunciation shall include: intelligent addressable points, system software zones, control relays, and notification appliance circuits. The following operations shall also be provided:
   a. Up to 7 annunciators be installed on the system.
   b. The annunciator shall provide alarm and trouble resound, with flash for new conditions.
   c. This unit shall provide for each zone: alarm indications, using a red alarm and yellow trouble LEDs, and switches for the control of fire alarm control panel functions. The annunciator will also have local piezo electric signal, local acknowledge/lamp test switch, and custom slide-in zone/function identification labels.
   d. Switches shall be available for remote annunciation and control of output points in the system, system acknowledge, telephone zone select, speaker select, global signal silence, and global system reset within the confines of all applicable standards.
3. This system shall provide a means of interfacing to a graphic style annunciator.
4. The graphic annunciator interface will possess the capability of individually annunciation each individual addressable device in the system.

O. Alphanumeric LCD Type Annunciator:

1. The alphanumeric display annunciator shall be a supervised, remotely located back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text.
2. The LCD annunciator shall display all alarm and trouble conditions in the system.
3. An audible indication of alarm shall be integral to the alphanumeric display.
4. The display shall be UL listed for fire alarm application.
5. It shall be possible to connect up to 7 LCD displays and be capable of wiring distances up to 6,000 feet from the control panel.
6. The annunciator shall connect to RS-485 serial link. This is a two-wire loop connection and shall be capable of distances to 8,000 feet. Each annunciator LCD display shall mimic the main control panel.

2.5 SYSTEM COMPONENTS - ADDRESSABLE DEVICES

A. Addressable Devices - General

1. Addressable devices shall employ the simple-to-set decade addressing scheme. Addressable devices which use a binary-coded address setting method, such as a DIP switch, are not an allowable substitute.
2. Detectors shall be addressable and intelligent, and shall connect with two wires to the fire alarm control panel signaling line circuits.
3. Addressable smoke and thermal (heat) detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED.

4. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 14.

5. Detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a base with a built-in local) sounder rated for a minimum of 85 DBA, a relay base and an isolator base designed for Style 7 applications.

6. Detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel.

7. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (PHOTO, THERMAL).

8. Detectors shall provide address-setting means using decimal switches.

2.6 BATTERIES:

A. Upon loss of Primary (AC) power to the control panel, the batteries shall have sufficient capacity to power the fire alarm system for required standby time (24 or 60 hours) followed by 5 minutes of alarm.

B. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.

C. If necessary to meet standby requirements, external battery/charger systems may be used.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Connecting to Existing Equipment: Verify that existing fire alarm system is operational before making changes or connections.

1. Connect new equipment to the existing control panel in the existing part of the building.
2. Connect new equipment to the existing monitoring equipment at the Supervising Station.

B. Smoke or Heat Detector Spacing:

1. Smooth ceiling spacing shall not exceed 30 feet and the rating of the detector.
2. Spacing of heat detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas, shall be determined according to Appendix A in NFPA 72.
3. Spacing of heat detectors shall be determined based on guidelines and recommendations in NFPA 72.

C. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of the duct.

E. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

F. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

G. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

H. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.

I. Device Location-Indicating Lights: Locate in public space near the device they monitor.

J. FACP: Surface mount with tops of cabinets not more than 72 inches above the finished floor.

K. Annunciator: Install with top of panel not more than 72 inches above the finished floor.

L. Exterior Visible Alarm Indicating Devices: Install adjacent to Fire Department Connection at 6" above Fire Riser exterior door and coordinated with exterior lighting.

3.2 WIRING INSTALLATION

A. Install wiring according to the following:

1. NECA 1.
2. TIA/EIA 568-A.

B. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceways and Boxes for Electrical Systems."

1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.

C. Wiring Method:

1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
2. Fire-Rated Cables: Use of 2-hour fire-rated fire alarm cables, NFPA 70 Types MI and CI, is not permitted.
3. Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as signaling line circuits. Verify with manufacturers recommendation.
D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Exposed Ceiling Structures: Route cables in EMT raceways.

F. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

G. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

H. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum 1-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.

I. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Identification of Electrical Systems."

B. Install instructions frame in a location visible from the FACP.

C. Paint power-supply disconnect switch red and label "FIRE ALARM."

3.4 GROUNDING

A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

3.5 QUALITY ASSURANCE AND TESTING

A. The service of a competent, NICET level II technician shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72, Chapter 14.

B. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

C. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
D. Verify activation of all水流开关.
E. Open initiating device circuits and verify that the trouble signal actuates.
F. Open and short signaling line circuits and verify that the trouble signal actuates.
G. Open and short notification appliance circuits and verify that trouble signal actuates.
H. Ground all circuits and verify response of trouble signals.
I. Check presence and audibility of tone at all alarm notification devices.
J. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.
K. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
L. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.6 FINAL INSPECTION:
A. At the final inspection, a minimum NICET Level II technician shall demonstrate that the system functions properly in every respect.

3.7 INSTRUCTION:
A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.
B. The contractor or installing dealer shall provide a user manual indicating "Sequence of Operation."

3.8 ADJUSTING
A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.
B. Annual Test and Inspection: One year after date of Substantial Completion, test the fire alarm system complying with the testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for annual period. Use forms developed for initial tests and inspections.
3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 283111
287300

Valcom IP Solution For Classrooms-Intercom and Clock System
SECTION 287300
VALCOM IP SOLUTION FOR CLASSROOMS-INTERCOM AND CLOCK SYSTEM

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.

B. Contract documents are detailed only to the extent required to show design intent. It shall be understood and agreed upon by the Contractor that all work described herein shall be complete in every detail.

C. Furnish additional items not mentioned herein to meet requirements as specified without claim for additional payments. Items may include hardware, rack panels, 66 Blocks etc., and other devices that are required for installation.

1.2 SUMMARY

A. Related Requirements:
   1. Section 260529 “Hangers and Supports for Electrical systems”.
   2. Section 260553 “Electrical identification”.
   3. Section 260533 "Raceways and Boxes".
   4. Section 270528 “Pathways for Communications Systems”.
   5. Section 271500 “Communications Horizontal Cabling”.

B. The Contractor shall furnish and install all equipment including, but not limited to, outlet boxes, wiring, speakers, and all other necessary equipment to provide a complete operating system as indicated with the contract documents. Provide all necessary wall plates, specialty boxes, etc., not provided by others.

C. Class Connection™ IP6000 Communication System shall be considered as meeting all specifications and as the base bid. The Owner has an in-house maintenance department which requires the Owner to standardize on the equipment specified. Items specified are not limited to a single distributor. Alternate bidders supplying another system will not be approved.

D. The intent of this specification is to maximize communications between the classroom and administrative areas while enhancing school safety and reducing maintenance and operational cost.

E. Under this specification, the system shall provide a complete Communication System for the entire school including the outdoor recreational areas.
F. The Communication System shall provide distribution of intercom, overhead paging, emergency paging, class change time tones, emergency tones, program material and on board emergency messaging.

G. The Class Connection™ IP6000 Communication System shall replace any existing intercom system and shall distribute intercom, overhead paging, emergency paging, class change time tones, emergency tones and program material over the existing speakers in all buildings, including portable buildings, not being remodeled. Provide required IP gateways at the removed equipment location to integrate the existing speakers into the new Class Connection™ IP6000 Communication System.

H. The Class Connection™ IP6000 Communication System shall be interfaced with the School’s telephone system to ensure full access to the Class Connection™ IP6000 Communication System speakers. Coordinate all work with the District’s IT Department.

I. The Class Connection™ IP6000 Communication System shall be programmed to meet the School District requirements. The Contractor shall meet with the School District maintenance department and obtain programming criteria prior to programming the system. The system shall be tested in the presence of the School District maintenance department staff prior to completion to ensure compliance with the School District criteria and the Contractor shall make required modifications to the system as required to satisfy the School District’s requirements.

J. At no time during the construction phase when school is in session and when teachers are on campus shall it be acceptable for the intercom-paging-class pass and clock system to be inoperative or not serving the buildings connected to the existing intercom-paging-class change tone and clock system. The contractor shall provide temporary intercommunications between all buildings and rooms within the buildings whenever the system is inoperative or shut-down for any reason. A temporary school wide intercommunications plan to be implemented during system shut-downs or inoperative periods shall be submitted to the School District for approval prior to start of the demolition phase. Temporary school wide intercommunications shall at a minimum consist of walky-talkies for all staff members and battery operated self-correcting atomic clocks for all rooms currently provided with system clocks.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Products include:

1. IP6000 School Application Server-Model VE6021 connection is provided by the Owner for each school. Coordinate with Owner personnel.
2. SIP Compliant Quad Networked Page Zone Expander-Model VE8004AR-Common areas.
3. Quad Networked Station–FXS-Port- Model VE8014AR-Phone system
4. 26 Port/24 PoE+ Gigabit Managed Switch-Model XMX-2624P
5. Power Supply, 6 amp, Positive 24 VDC – Model V-C6124P
6. Administrative Telephone – Model VEADP2
7. 2x2 lay-In Ceiling Speaker – Model VE9022A-2-Corridors, Classrooms and Common areas.
8. 5-Watt Horn (Beige) – Model V-1030C-Outside
9. Wall mount Volume Control – V-1092-for Common areas speakers
10. Push Button Call Switch – V-2972PK-Cafeteria and Gyms
11. IP Analog Clock with 2x2 Lay-in Talk-Back Speaker- Model VE-4122-A for K thru 5 Classrooms.
12. IP 4-inch Digital Clock with 2x2 Lay-in Talk-Back Speaker - Model VE-4122-D for 6 thru 12 Classrooms.
13. IP PoE 2x2 Lay-in Talk-Back Speaker- Model VIP-422A.
14. IP PoE 12 Inch Analog Clock (Wall Mount) – VIP-A12A for K thru 5 Classrooms.
15. IP PoE 4 Digit 4 Inch Clock (Wall/Ceiling Mount) – VIP-D440A for 6 thru 12 Classrooms.

B. Submit layout drawings of the communication system and all components.

C. Submit all communication system devices, and all components.

D. Submit drawings of control equipment showing all major components and positions in the rack.

E. Provide block diagrams showing components and relative connections.

F. Submit a certificate showing a completion of installation, programming, and service training from the system manufacturer.

G. Submit data sheets on equipment provided.

H. Shop Drawings: Signed and sealed by an RCDD.
   1. Equipment Details: Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location of each field connection.
   2. Station-Arrangement Details
   3. Wiring Diagrams: Signal, and control wiring. Include the following:
      a. Single-line diagram showing interconnection of components.
      b. Cabling diagram showing cable routing.

I. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved.
   1. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

J. Installer Qualifications:
   1. The equipment must be purchased and installed by a Valcom Factory Authorized Integrator with full warranty privileges.
   2. The design shall be performed by a Valcom Factory Authorized Integrator.
   3. The Valcom Factory Authorized Integrator must have installed a minimum of 3 (three) projects of this size and application or shall arrange for onsite factory assistance during system commissioning.
   4. The Valcom Factory Authorized Integrator shall possess, or coordinate with entities that possess, technical knowledge of the network to which the IP6000 system will connect. Full compliance with Valcom’s latest published IP6000 network requirements is mandatory.
K. Qualification Data: For Installer and testing agency.
   1. The contractor shall be from an established and local company providing solutions to the school market for a minimum of 3 (three) years with Telecom/Data/Sound Experience.
   2. The contractor shall maintain an adequate parts inventory to perform necessary service and upgrades.

1.4 INFORMATIONAL SUBMITTALS

   A. Base bids must be submitted on the basis of specified BASE BID System. Alternate equipment proposals shall not be allowed as Valcom IP Solutions is the intercom standard by TPS.

   B. The Contractor shall be from an established and local company providing solutions to the school market for a minimum of 3 (three) years with Telecom/Data/Sound Experience.

   C. The Contractor shall maintain an adequate parts inventory to perform necessary service and upgrades.

1.5 QUALITY ASSURANCE

   A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

   B. Maintenance Proximity: Not more than 4 hours normal travel time from installer’s place of business to project site.

   C. The Contractor shall be an authorized dealer of the supplied equipment with full warranty privilege

   D. The Contractor must have attended the Manufacturers’ Training Program and be an authorized Class Connection Distributor.

   E. The Contractor shall inventory the necessary parts in order to maintain and service the equipment being supplied. This equipment inventory level shall be in direct proportion to total systems installed as recommended by the manufacture.

   F. The Contractor shall provide complete drawings detailing all interconnections, panel wiring diagrams, and specification sheets.

   G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

   H. Comply with NFPA 70.
1.6 COORDINATION

A. Coordinate layout and installation of Communication System Devices and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

B. Coordinate final device location with Owner’s representative prior to rough-in.

1.7 MAINTENANCE.

A. The Contractor shall provide a 12 (twelve)-month guarantee of the installed system against defects in material and workmanship. All warranty material shall be provided at no expense to the Owner. Guarantee period shall begin on the date of acceptance by the Owner or Engineers.

1.8 RESPONSIBILITY

A. Contract documents are detailed only to the extent required to show design intent. It shall be understood and agreed upon by the Contractor that all work described herein shall be complete in every detail.

B. Furnish additional items not mentioned herein to meet requirements as specified without claim for additional payments. Items, may include hardware, rack panels, 66Blocks etc., and other devices that are required for installation.

C. Labor furnished shall be trained and experienced in telecommunication systems.

D. All equipment unless otherwise specified, shall be new, free from defects, and the best craftsmanship in its class.

E. All manufactured equipment shall be installed as recommended by the manufacturers, or as indicated in their published installation manual.

F. Furnish and install necessary equipment, back boxes, supports and enclosures.

G. Furnish and install all necessary wire.

H. Furnish shop drawings.

I. Perform initial programming of system and audio level adjustments.

J. Perform final programming of system and audio level adjustments.

K. Provide system documentation including equipment manuals and drawings.

L. Guarantee all equipment and components for their specified period from date of acceptance.

M. Provide information on system requirements to any Contractor responsible for supplying related materials for this system.
N. System must be U.L. 813 and FCC Part 15 listed for safety reasons. Systems not listed as above shall not be acceptable.

1.9 IN-SERVICE TRAINING
A. The Contractor shall furnish in-service training with the system. The sessions shall facilitate the training of personnel in operating classroom equipment, administrative equipment, program distribution, and user programming functions. System specific customized user manuals shall be provided at the time of training.

1.10 WARRANTY
A. Manufacturer's standard form in which manufacturer of unit agrees to repair or replace components of device that fails in materials or workmanship within specified warranty period.
B. Warranty Period for each system as defined on basis of design equipment. 1 year from date of Substantial Completion. Full warranty shall apply for first year.

1.11 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data: For each type of Communication system equipment and devices to include in emergency, operation, and maintenance manuals.
   1. Provide a list of all device types used on Project.

1.12 COMMUNICATION SYSTEM FUNCTION AND FEATURES
A. The Communication System shall provide at least the following functions and features:
   1. Direct dialed, hands-free, two-way communication from all administrative telephones to any location equipped with a talkback speaker.
   2. Call button initiated hands-free, two-way communication from all classroom locations equipped with a talkback speaker to an administrative telephone.
   3. Microprocessor based PoE system capable of handling unlimited end-points. An endpoint is defined as a device with an IP address. The system IP speakers must be SIP compliant.
   4. System shall be a VoIP system compatible with 45 ohm 2-way speakers, 25v 2-way speakers, self-amplified one-way speakers and VoIP speakers. The system should also have 1, 2 and 4 zone one-way gateways for common area announcements.
   5. System shall interface with any SIP capable VoIP telephone system, analog telephone system, or single line telephone, thus allowing the school(s) to upgrade or replace their telephone system without suffering a requirement to replace, or lose any feature of, their internal communications (intercom) system. Any system that limits system features based
upon any selected telephone system, and/or is proprietary to one or only a few telephone systems shall not be acceptable.

6. System shall be capable of converting and loading WAV files used for bells, announcements or music.

7. System shall be capable of initiating emergency notifications by internet browser from anywhere on the network.

8. System shall be capable of increasing volume by event. An event is defined as any WAV file or tone.

9. System shall be capable of downloading a graph (site, building, etc.) and arranging icons on it to play emergency announcements, back to school announcements, message from the Superintendent, etc.; any WAV file.

10. System shall automatically sound a tone over any loudspeaker connected for two-way communication to alert the classroom teacher that this two-way call has been established. This is intended to prevent unauthorized monitoring. The privacy tone must repeat every 15 (fifteen) seconds.

11. System shall be capable of distribution of emergency or general announcement(s) by Administration functions or from any authorized telephone to all areas furnished with a loudspeaker. Emergency announcements shall have the highest system priority.

12. Classroom speakers shall be software assignable to an unlimited number of audio groups.

13. Provide the ability to define and archive unlimited time tone schedules with unlimited events per schedule. Each scheduled event shall be capable of controlling any internal tone; user selected custom WAV files, audio from any auxiliary source or up to 40 relays for building control. Each scheduled audio event shall be distributable to any of the audio groups. The system shall feature the ability to automatically initiate unlimited schedules per day, based upon the day of the week or calendar dates up to one year in advance. The system shall feature the ability to operate 25 or more schedules simultaneously. Schedule administration, modification and creation functions must be available through an Internet browser. Systems that do not allow the school to manage their own schedules with an Internet browser do not offer calendar based scheduling up to one year in advance or require separate page and time groups shall not be acceptable.

14. Distribution of emergency announcement(s) from any authorized telephone to all areas furnished with a loudspeaker. Emergency announcements shall have the highest system priority.

15. Distribution of general announcements from any administrative telephone, staff telephone, or classroom telephone. The system shall be capable of providing all-call, group call, multiple group call, or dial-on-the-fly page groups.

16. Classroom speakers shall be software assignable to any or all of 72 (seventy-two) audio groups.
17. Provide the ability to define and archive unlimited time tone schedules with up to 255 events per schedule. Each scheduled event shall be capable of controlling any one of 6 (six) internal tones; user selected custom audio/voice phrases, audio from any of 3 auxiliary sources or up to 40 relays for building control. Each scheduled audio event shall be distributable to up to 72 audio groups. The system shall feature the ability to automatically initiate up to 8 schedules per day, based upon the day of the week or calendar dates up to one year in advance. Up to 8 daily schedules shall operate simultaneously. Schedule administration, modification and creation functions must be available through administration PC software. Systems that do not allow the school to manage their own schedules with PC software do not offer calendar based scheduling up to one year in advance or require separate page and time groups shall not be acceptable.

18. Provide 1 to 11 digits numbering plan, thus allowing the classroom speaker and the classroom telephone to be the same architectural number.

19. Programmable features shall be stored in non-volatile memory and shall not be lost due to power failures.

20. Classroom initiated intercom calls must be able to be assigned to ring at specific administrative ports. These administrative 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.

21. System functionality must include the capability to manually activate an unlimited amount of chained events via browser based device, pushbuttons, contact closure, or dial up tones from any administrative telephone. These events shall be customizable with respect to volume levels, cadence, priority, type and duration. Browser access must only be accessible by authorized users.

22. The system must be capable of providing an unlimited amount of ports to be connected to the telephone system via SIP or FXS Port integration from the intercom system. These ports shall provide built-in Enhanced Caller Line Identification which will visually announce the name of the teacher or location, the architectural classroom number. Systems that require integration to a specific telephone system or systems in order to offer this feature, or any system feature, shall not be acceptable.

23. The system shall have the ability to control all system relays. Relays shall be controlled through the browser, DTMF controlled, automatically cycle at a programmed time of day, or follow time schedule events. All relays must be software programmable with the flexibility to change as required.

24. The system shall provide at least three simultaneously operating, non-restrictive program distribution channels. The system administration shall be browser based allowing simple and easy changes.

25. The system shall have the ability to store up to 25000 seconds of WAV files directly onto the Application Server and shall not be lost due to power outage.

26. The WAV files shall be capable of being activated via any computer on the LAN/Wan, Telephone and/or Telephone system, and push buttons.
27. The WAV files shall be programmable as to what level of priority they can be broadcast. They shall be programmable as to override any class change tones, normal all call, music, and intercom in the event of an emergency.

28. The WAV files shall also have the ability to be broadcast into any and all of the audio groups.

29. The WAV files shall be have the ability to be broadcast via a schedule for any day of the week or time of the day. They shall also have the ability to be broadcast for any duration of time and repeat number of plays with the ability to select how long the duration is between each repeated broadcast.

30. The WAV files shall be able to be broadcast via a pushbutton. When this pushbutton is activated it shall be programmable to select which WAV file is broadcast, the priority level, where it is broadcast, and how many times it shall play.

31. The WAV files shall also have the ability to be a part of the class change tones within the system. These files shall be able to replace any tone within the class change schedules as to offer the flexibility of customizable tones and or phrases in this class change mode.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

**Basis-of-Design:** Subject to compliance with requirements, provide product by Valcom, Inc as noted.

2.2 GENERAL REQUIREMENTS FOR INTERCOM CONTROL UNIT

A. IP6000 COMMUNICATION SYSTEM (BY OWNER)

1. The Applications Server, Model VE6021, when used in a Class Connection IP6000 IP School Communications System shall provide scheduling, clock control and on demand distribution of WAV formatted audio to simultaneous groups of speakers per event. The server shall feature simple browser-based interface to facilitate easy manipulation of custom audio files for use as class change tones or emergency notification. Schedules shall be capable of automated initiation based upon day of the week, calendar date up to one year in advance and shall feature manual control capability. The 1U server shall utilize web browser access for setup of schedules, and real-time control. The server shall be capable of simultaneously operating multiple schedules, events per schedule and simultaneously occurring events. The schedules shall feature one-second event resolution. Events shall be capable of controlling paging, relays, and/or streaming audio. The server shall allow cascading events from a single time trigger. Schedules shall be presented to the user in a calendar view showing school year and months with tabs for other options. The server shall provide for default screen view after login and permissions per user. The Application Server shall provide on demand access of pre-loaded audio files via web browser or contact closure. Additionally, the Applications Server shall provide for “Quick Page” on demand triggers for easy origination of unscheduled events and shall import and convert audio files from many .wav formats with both an option to
enhance audio files during import and an option to record page audio to a file. Events shall feature programmable pre/post page delays and volume control per event. The server shall control VE8001AR/VE8002AR/VE8004ARs to provide streaming audio to page group(s) and shall use VE8048 inputs to execute events from the Playlist. Controlling VE8048 relays from events shall be inherent. The server shall communicate with VIP-102B setup tool for setup and dial code and group information. Users shall have the ability to enter names for displaying dial codes, page groups, inputs, events, and schedules.

B. Shall seamlessly integrate to any VoIP/SIP or legacy phone system via SIP, FXO or Loop Start Trunk.

C. Contractor shall provide one or more VE8014AR at the MDF and connect (1) port to the existing telephone systems trunk port. System shall be able to add analog access talk paths in increments of 4 (four) ports.
   1. FXS station port access shall be via CC Model # VE8014AR (four ports)
   2. Enhanced Network Station Port Model VE8014XAR will provide a single 10/100 Ethernet port and four FXS station ports. The Enhanced Network Station Port Model VE8014XAR will provide all circuitry and software to convert network data to audio output and analog telephone control signals. The Enhanced Network Station Port Model VE8014 will provide all circuitry and software to convert input audio and analog telephone events to zone page audio and control information suitable for transmission to other Class Connection IP Solutions products. The Enhanced Network Station Model VE8014XAR shall be powered an 802.3af PoE Ethernet switch port.

D. Contractor shall provide a one or more Networked Page Zone Extenders at the MDF and each IDF. The purpose of this Networked Page Zone Extender is to provide streaming audio out to common area speakers (analog speakers). Connect the building’s common area speakers to the Networked Page Zone Extender channels are required.
   1. Low level audio connection shall be via CC Model # VE8004AR (four ports)
   2. The Networked Page Zone Extenders shall provide a single 10/100 Ethernet port, audio input/output circuits and N.O. relay contact outputs. The unit shall be SIP compatible. The Networked Page Zone Extender shall provide all circuitry and software to convert network data to zone page audio output. The Networked Page Zone Extender shall also provide all circuitry and software to convert input audio to zone page audio and control information suitable for transmission to other Class Connection IP Solutions products over a data network. The Networked Page Zone Extender shall be powered via an 802.3af PoE Ethernet switch port.

E. The system shall seamlessly control relay contacts for building system control.

F. The low voltage control shall be via CC Model # VE8048 (8 each input)

G. The VE8048/VE8048R IP Input/output Module allows operation of eight (8) contact closures which are software programmable as either form A or form B. Eight (8) contact closure activated inputs provide for various programmable relay functions. The VE8048/VE8048R allows initiation of VE6021 server events over an IP-based LAN/WAN. Multiple VE8048/VE8048R may be deployed on the same network. The VE8048R is designed for 19" mounting (1U). The VE8048R shall be powered via an 802.3af PoE Ethernet switch port.
2.3 IP SCHOOL APPLICATION SERVER-VE6021

ALL NEW SYSTEMS SHALL BE INSTALLED TO WORK WITH IP6000 SYSTEMS INSTALLED AT TULSA PUBLIC SCHOOLS EDUCATION SERVICE CENTER AND BACKUP SITE, YET TO BE DETERMINED. CONTRACTOR SHALL NOT PRICE THE VE6021 OR VE6025 SERVER EQUIPMENT WITH THEIR BIDS.

General Requirements for Application server when used in a Class Connection IP6000 Communications System:
1. Shall provide automated emergency messaging, event scheduling, and clock control and on demand distribution of WAV formatted audio to up to 25 simultaneous groups of speakers.
2. The server shall feature a simple browser-based interface. Schedule control shall be via automatic initiation (based upon day of the week, calendar date up to one year in advance) or manual control.
3. The server shall provide multiple simultaneous schedules, multiple events per schedule and up to 12 simultaneously occurring events.
4. The schedules shall feature one-second resolution. Events shall be capable of controlling paging, relays, and/or streaming audio.
5. The server shall allow cascading events from a single time trigger. Schedules shall be presented to the user in a calendar view showing year and months.
6. The server shall provide for default screen view and permissions per user.

B. The VE6021 Applications Server:
1. Shall provide for manually initiated origination of unscheduled events and shall import and convert audio files from many .wav formats with an option to enhance audio files during import and an option to record page audio to a file.
2. Events shall feature programmable pre/post page delays and volume control per event. A master volume control (system-wide) shall also be available.
3. The server shall control VE8001/8002/8004s to provide streaming audio to page group(s) and shall use VE8048 inputs to execute events from the Playlist. Controlling VE8048 relays from events shall be inherent.
4. The server shall communicate with VIP-102B setup tool for setup and dial code information. The ability to control receipt of messages based upon priority shall be inherent. Audio storage capacity shall be 25,000 seconds.

2.4 GENERAL REQUIREMENTS FOR VOICE OVER IP TELEPHONE INTERGRATION

A. All admin access path ports shall be integrated via SIP, or FXO Port type protocol. This integration shall be seamless and easy to meet all standards as set forth in SIP, or FXO Port type interfacing. The VoIP Phone System Call Manager shall be used to manage these ports for control and management thus reducing adds, moves and change cost.

B. It shall be possible without the cost of additional hardware/software to incorporate a WAN/LAN district wide paging system by means of the built in VoIP district Paging Adapter. This adapter shall give the district the ability to page each school independently, as a group of schools, or all schools where a Class Connection IP system is installed.
2.5 SIP COMPLIANT QUAD NETWORK AUDIO PORT (RACK MOUNTED)-VE8004AR

A. Description: The Quad Networked Page Zone Extender Model VE8004R will provide a single 10/100 Ethernet port, 4 audio input/output circuits, 4 Digital contact closure inputs and 4 N.O. relay contact outputs.

1. The unit shall be SIP compatible. The Quad Networked Page Zone Extender Model VE8004R will provide all circuitry and software to convert network data to zone page audio output.

2. The Quad Networked Page Zone Extender Model VE8004AR will provide all circuitry and software to convert input audio to zone page audio and control information suitable for transmission to other Class Connection IP Solutions products over a data network.

3. The Quad Networked Page Zone Extender Model VE8004AR shall form one part of a server less Network based communications system.

4. The Quad Networked Page Zone Extender Model VE8004AR shall be powered via either an external 24 Vdc power supply or via an 802.3af PoE Ethernet switches port.

5. All setup and configuration of the Quad Networked Page Zone Extender Model VE8004AR will be via the Valcom VIP-102B IP Solutions Setup Tool.

6. The Quad Networked Page Zone Extender Model VE8004AR shall be constructed of steel and be wall, table or rack mountable.

7. The maximum dimensions shall be: Dimensions: 16.50" x 1.75" x 9.50" (41.91 cm x 4.45 cm x 24.13 cm). Shipping Weight shall be approximately: 7.80 lbs. (3.54 kg)

2.6 QUAD NETWORK STATION (FXS PORT (RACK MOUNT))-VE8014AR

A. Description: Quad Enhanced Network Station Port Model VE8014AR will provide a single 10/100 Ethernet port, 4 FXS station ports and 4 form C relay contact outputs.

1. The Quad Enhanced Network Station Port Model VE8014AR will provide all circuitry and software to convert network data to audio output and analog telephone control signals.

2. The Quad Enhanced Network Station Port Model VE8014AR will provide all circuitry and software to convert input audio and analog telephone events to zone page audio and control information suitable for transmission to other Class Connection IP Solutions products.

3. The Quad Enhanced Network Station Port Model VE8014AR shall form one part of a server less Network based communications system.

4. The Quad Enhanced Network Station Port Model VE8014AR shall provide caller ID signaling.

5. The Quad Enhanced Network Station Port Model VE8014AR shall be powered via either an external 24 Vdc power supply or via an 802.3af PoE Ethernet switches port.

6. All setup and configuration of the Quad Enhanced Network Station Port Model VE8014AR will be via the Valcom VIP-102B IP Solutions Setup Tool.

7. The Quad Enhanced Network Station Port Model VE8014AR shall be constructed of steel and be wall, table or rack mountable.

8. The maximum dimensions shall be: 16.50" x 1.75" x 9.50" (41.91 cm x 4.45 cm x 24.13 cm). Shipping Weight shall be approximately: 7.80 lbs. (3.54 kg).
2.7 26 PORT/24 PoE PORT SWITCH-XMS-2624P

A. General Requirements for Switch: Comply with IEEE Protocols and Standards listed on the Basis of design Switch- LUXUL 24 Port/24PoE+Gigabit Managed Switch. Provide required amount for fully operable integration.

B. The switch shall be capable of:
   1. Connecting up to 24 IP Devices or other PoE enabled devices(Max output of 370Watts)

C. Features:
   a. 24 Gigabit RJ45 802.3af/at PoE+ Ports.
   b. 2 Gigabit RJ-45 uplink ports with 2 shared SFP ports (Combo ports).
   c. 370 Watt Power budget.
   d. 52Gbps Switching Capacity.
   e. Layer 3 Static Routing
   f. 802.1Q VLAN (with Trunking) and QoS Support.
   g. Plug-and Play installation with intuitive Management.
   h. Simple Power Management of PoE-Enabled devices.
   i. Variable Speed Fans for Quite Operation.
   j. Standard 19” Rack-Mount
   k. Three year limited Warranty.
   l. One Power cord.

2.8 POWER SUPPLY-VC-6124P

A. General Requirements for Power Supply Model-VC-6124P

1. The wall or rack mountable switching power supply, model number VC-6124P, shall be - 24 VDC power supply capable of providing 6 amperes of current.

2. 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.

3. The supply’s design shall incorporate EMI filtering, a minimum 88.5% efficiency, a 3 second power up delay, a working input frequency range of 47 to 63 Hertz and an LED status indicator. The supply shall also feature +/- 2 % voltage regulation and over voltage protection.

4. 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.

5. An optional battery backup system, models number VP-6124-UPS and VBB-1424, shall be available to integrate with the power supply.

6. Maximum dimensions of the supply shall not exceed 10.3”H x 5.92”W x 2.5”D (26.16cm x 15.04cm x 6.35cm).
2.9 ADMINISTRATIVE TELEPHONE-VEDP2

A. Description: With its large display screen, customizable soft keys and improved headset options, the enhanced VEADP2 provides advanced features and flexibility for Valcom Engineered Solutions applications.

B. Functionality can be customized to allow the user to set up all soft keys for one touch access to features such as All Call, Paging Groups, Emergency Tones, WAV file distribution, Test Rooms, Crisis Mode, Schedules, and much more.

C. Multiple VEADP2s may be added to any Valcom Communication System. The VEADP2 also provides excellent back up access to the Valcom Communication system in the event the phone system fails.

D. Dial: Tone

E. Power: 16 VAC, 250 mA transformer

2.10 IP TALKBACK SPEAKER CLOCK ASSEMBLY-VIP-429A-A (Elementary Classrooms) or IP TALKBACK SPEAKER CLOCK ASSEMBLY-VIP-429A-D (7th to 12th Grade Classrooms)

A. Features:
   1. SIP and Multicast Enabled.
   2. Easy to Install
   3. Power over Ethernet (802.3af)
   4. Integral Back box Meets or Exceeds ASTM E84 Flame & Smoke Test with 3 Hour Burn Rating (UL 181)
      a. Recessed Mount Box: VB-R22
      b. Surface Mount Box: VB-A24
   5. Live, Recorded or Scheduled Messages
   6. Easily Connect Loudspeaker System to Existing Computer Networks
   7. Compatible with Cisco, Avaya/Nortel, and Most IP Telephone Systems
   8. Talkback Paging
   9. Software Interface for Control and Setup
   10. Can Operate Over Secure Networks
   11. Paging Prioritization
   12. Line Out Supports Amplified Speakers
   13. Full Supervision
   14. DHCP Addressable
   15. Integrated LED Flasher

B. General Description:
   1. Accessible as specific SIP End Point and accessible as a Multicast Group Member. Valcom multicast group paging features robust grouping and priority controls. This makes it easy to distribute low priority announcements yet allow high priority paging to override ongoing announcements.
   2. An absolute priority can be assigned to allow for emergency override in any circumstance. Group paging priorities work locally or across the network in the same fashion allowing facility wide emergency paging.
3. If a fault is detected in speakers it can be reported to an external device or syslog facility.
4. Power over Ethernet: 802.3af Compatible
5. Networking: 10/100 Mbps Ethernet port
6. Manual or Dynamic Host Configuration Protocol (DHCP) IP address setup
7. Protocols:
   a. IETF SIP (RFC3261)
   b. IETF IGMP version 3 (RFC3376)
   c. IETF RTP (RFC1889)
   d. IEF RFC28323
8. Power sourcing equipment to be compliant to IEEE802.af
10. Dimensions and Weight:
    a. Dimensions: 14.50" H x 13.00" W x 3.40" D
    b. Weight: 4.8 lbs. (2.17 kg)

2.11 2X2 LAY-IN CEILING SPEAKER

A. Descriptions:
1. 8" speaker assembly with speaker, amplifier and volume control mounted in 2’X2’ grille with integral back box
2. Output:
   a. Rating > 96dB @ 4’
   b. Signal/noise ratio: -70dB
3. Frequency Response: 80Hz to 10kHz
4. Power Requirement: 50Ma @ 24 Vdc
5. Housing and Finish:
   a. Steel housing with a white baked on acrylic enamel finish
6. Dimensions and Weight:
   a. 23.75"L x 23.75"W x 3.75"D
   b. Weight: 5.5iibl

B. The VE9022A-2 Lay-in Ceiling Speakers shall consist of a white two foot by two-foot perforated grille, a speaker and integral back box. The volume control is accessible through the perforated grille.

C. The speaker for the VE9022A-2 shall be 8" (20.32 cm) in diameter and have a 5 oz. (142 g) 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 0.75" (1.91 cm) diameter. Operating temperature shall be +32 to +122 °F (0 to +50 °C).

D. The One-Way, Model VE9022A-2, 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 -24 Vdc.

E. The baffle shall be constructed with a single piece of perforated steel with a white baked on acrylic enamel finish.
F. The back box meets or exceeds A.S.T.M. E84 flame and smoke test and has a three hour burn rating (UL181). Four seismic tabs provided for additional mounting integrity.

G. Maximum dimensions of the grill shall be: Baffle 2' x 2' (60.96 cm x 60.96 cm). Weight shall be approximately 5.5 lbs. (2.49 kg).

2.12 5-WATT HORN(BEIGE)-V-1030C (Beige)

A. Description: Self-contained 5 Watt paging system with 5 Watt amplifier. High efficiency horn with volume control

B. Requirement:
1. Input Impedance: 1000 Ohms nominal
2. Input level: -15dBm to + 10dBm
3. Current at -24 VDC (900mA)

2.13 WALL MOUNT VOLUME CONTROL-V-1092

A. Description:
1. Wall Mount Volume control unit mounted into s single gang electrical box.
2. Compatible with all Valcom one-way and two-way speakers
3. Comes with its own surface mount box with ½ conduit access.

2.14 PUSH BUTTON CALL SWITCH-V-2972PK

A. Description:
1. Designed to be used with Talkback Page Control units with remote calling feature.
2. Provides momentary spring return rocker switch for connection to customer provided signaling equipment.
3. Designed to fit in standard single-gang box
4. No external power source required
5. White “call” button for normal call

2.15 IP PoE 12 INCH ANALOG CLOCK (WALL MOUNT)-VIP-A12A

A. Description:
1. VIP-A12, 12-inch round analog clock.
2. Enable time indication, synchronization, and correction over IP-bases LAN/WAN

B. Features:
1. Power over Ethernet(PoE) switch meeting the 802.3af specification (4.5W via PoE)
2. RJ-45 network connection
3. Low-profile/semi-flush smooth surface metal case
2.16  **IP PoE 4 DIGIT 4 INCH DOUBLE SIDED CLOCK (WALL/CEILING MOUNT)-VIP-D440ADS**

A. **Description:**
   1. VIP-D440 4-inch, 4 digits Clock Display.
   2. Enable time indication, synchronization, and correction over IP-bases LAN/WAN

B. **Features:**
   1. Power over Ethernet(PoE) switch meeting the 802.3af specification (5.4W via PoE)
   2. RJ-45 network connection
   3. Easy to read, high visibility Red 2.5” to 4.0”
   4. Selectable 12 or 24 hour format

2.17  **CONDUCTORS AND CABLES**

A. Use Division 27 Section "Communications Horizontal Cabling" for specifying conductors and cables.

B. Provide a minimum length of 5 feet for network patch cords. Black Cat.6 cable for clocks and gray Cat.6 cables for speakers.

C. Conductors: Jacketed, twisted pair and twisted multipair, untinned solid copper (West Penn # AQC 439 or equal). Sizes as recommended by system manufacturer, but not smaller than No. 22 AWG. – Us when cabling a 25/70V speaker.

D. Insulation: Thermoplastic, not less than 1/32 inch thick.

E. Shielding: For speaker-microphone leads and elsewhere where recommended by manufacturer; No. 34 AWG tinned, soft-copper strands formed into a braid or equivalent foil.

F. Minimum Shielding Coverage on Conductors: 60 percent.

G. Plenum Cable: Listed and labeled for plenum use.

H. Category 6 UTP – Use when connecting an IP device. Follow TPS color codes DEFAULT IS GRAY.

2.18

**PART 3 - EXECUTION**

3.1  **INSTALLATION**

A. Complete system shall be installed in accordance with Manufacturer’s recommendations.

C. Wiring Method: Install wiring in raceways except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum-board partitions where cable wiring method may be used. Use plenum cable in environmental air spaces, including plenum ceilings. Conceal cables and raceways except in unfinished spaces.

D. Install exposed cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps, staples, or similar fittings designed and installed to avoid damage to cables. Secure cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, or fittings.

E. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess. Use lacing bars in cabinets. All wiring shall be listed for the intended purpose. The intercom shall use 6 UTP U.L. listed cable. All classrooms shall be homerun.

F. Control-Circuit Wiring: Install number and size of conductors as recommended by system manufacturer for control functions indicated.

G. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs as specified by BICSI TDMM 12 Edition.

H. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

I. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.

J. Remove and Reinstall New: Remove exiting clock system being replaced and coordinate location and backbox provisions with Owner’s Representative for the capability to accept the new Clock(s). Provide metal covers with edge trims over removed old clock backboxes and match adjacent surface. Where acceptable, mount new clocks over new metal covers.

3.2 SYSTEM PROGRAMMING

A. Programming: Fully brief Owner on available programming options. Record Owner's decisions and set up initial system program. Prepare a written record of decisions, implementation methodology, and final results.

3.3 DISTRIBUTION

A. For a shared network the requirements shall be a VLAN capable 10/100 Ethernet switched with Gig fiber backbone. The recommended installation shall be to create a port based, fully enabled multicasting, VLAN on the network and install the VCRCA Network Intercom Extender on that VLAN.

3.4 MDF/IDF WIRING

A. All wiring shall be listed for the intended purpose. The cabling shall Cat 6 for all connections from the MDF or IDF to the classroom and or zone origination point. All classrooms shall be
homerun to each local MDF/IDF that serves that area. There shall be no cabling required from the IDF to the MDF as this is accomplished through the shared or dedicated network devices and infrastructure. All interior wiring shall be in accordance with new construction guidelines suggested by the Manufacturer; including the speaker and the call-in switch.

3.5 PROTECTION

A. The contractor shall provide all necessary protection on the AC power feed and on all station lines leaving/entering the building.

B. The contractor shall note in his system drawings, the type of protection devices and all relative information.

3.6 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 16075 “Electrical Identification.”

3.7 FIELD QUALITY CONTROL

A. Test complete Communication system to demonstrate proper operation.

B. Perform the following field tests and inspections:
   1. Schedule tests with at least seven days' advance notice of test performance.
   2. After installing school intercom and program equipment and after electrical circuitry has been energized, test for compliance with requirements.
      a. Operational Test: Test originating station-to-station, all-call, and page messages at each intercom station. Verify proper routing and volume levels and that system is free of noise and distortion. Test each available message path from each station on system.

C. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.

D. Verify the server and devices are running the latest software revisions.

E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to Communication system, retest to demonstrate compliance with standards.

3.8 STARTUP SERVICE

A. Delete first paragraph below if factory-authorized service representative is not required. Retain option for microprocessor-switched system.

B. Engage a factory-authorized service representative to perform startup service and initial system programming.
C. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.

3.9 ADJUSTING

A. On-Site Assistance: Engage a factory authorized service representative to provide on-site assistance in adjusting sound levels and for any initial troubleshooting.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting Communication system (intercom and clocks) to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.

1. Adjust Communication system devices (Intercom, and Clocks) in the presence of Owner’s Representative.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain school intercom and program equipment.

END OF SECTION 16730
PART 1  GENERAL

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

1.02  SUMMARY
A. This Section includes the following:
   1. Protecting existing trees, vegetation to remain.
   2. Removing existing trees, vegetation.
   3. Clearing and grubbing.
   4. Stripping and stockpiling topsoil.
   5. Removing above- and below-grade site improvements.
   6. Disconnecting, capping or sealing, and removing site utilities.
   7. Temporary erosion and sedimentation control measures.
B. Related Sections include the following:
   1. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.

1.03  DEFINITIONS
A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.04  MATERIAL OWNERSHIP
A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.
1.05 SUBMITTALS
A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
B. Record drawings, according to Division 01 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.06 QUALITY ASSURANCE
A. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.07 PROJECT CONDITIONS
A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
B. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
C. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 PRODUCTS
2.1 SOIL MATERIALS
A. Approved Engineerd Fill Materials: Requirements for engineered fill soil materials are specified in Division 31 Section "Earth Moving."
   1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 EXECUTION
3.01 PREPARATION
A. Protect and maintain benchmarks and survey control points from disturbance during construction.
B. Locate and clearly flag trees and vegetation to remain or to be relocated.
C. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.
3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways. Refer to Stormwater Pollution Prevention Plan.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.03 TREE PROTECTION

A. Do not excavate within tree protection zones, unless otherwise indicated.

B. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

3.04 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.

2. Owner will arrange to shut off indicated utilities when requested by Contractor.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Architect's written permission.

3.05 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.

2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.

3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 12 inches below exposed subgrade.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.
3.06 **TOPSOIL STRIPPING**

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Limit height of topsoil stockpiles to 72 inches.
   2. Do not stockpile topsoil within tree protection zones.
   3. Stockpile surplus topsoil to allow for resprading deeper topsoil.

3.07 **SITE IMPROVEMENTS**

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
   2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.08 **DISPOSAL**

A. Disposal: Remove unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

**END OF SECTION**
SECTION 311100
STORMWATER POLLUTION PREVENTION PLAN

PART 1  GENERAL

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

1.02  SUMMARY
A. This Section includes the following:
   1. Stormwater Pollution Prevention Plan.
B. Related Sections include the following:
   1. Division 02 Section "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
   2. Division 02 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.

1.03  QUALITY ASSURANCE
A. Preform Work in accordance with Oklahoma Department of Transportation Standard Specifications for Highway Construction and Oklahoma Department of environmental Quality. Maintain one copy on site.

PART 2  PRODUCTS – Not applicable.

PART 3  EXECUTION

3.01  EXECUTION
A. Contractor shall review and familiarize himself with all aspects of the Stormwater Pollution Prevention Plan and perform work accordingly.
B. Contractor shall submit Notice of Intent (NOI) to the Oklahoma Department of Environmental Quality (ODEQ) prior to starting work.
C. Upon completion of the project and establishment of permanent erosion control measure, the contractor shall submit the Notice of Termination (NOT) to ODEQ.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Preparing subgrades for areas outside the building perimeter.
   2. Subbase and base course for paving.
   3. Subsurface drainage backfill for walls and trenches.
   4. Excavating and backfilling for utility trenches.

B. Related Sections include the following:
   1. Division 01 Section "Unit Prices" for unit-price rock excavation and authorized additional excavation provisions.
   2. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
   3. Division 03 Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
   4. Division 31 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
   5. Division 32 Section "Turf and Grasses" for finish grading, including preparing and placing topsoil and planting soil for lawns.

1.03 UNIT PRICES

A. Unit prices for earthwork are included in Division 01 Section "Unit Prices."

1.04 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subgrade and hot-mix asphalt or concrete paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Soil imported from off-site for use as fill or backfill.

E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.

2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Initial Backfill: Fill free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit and as defined by utility trench detail on the plans.

I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, or ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch-wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,090 lbf and stick-crowd force of not less than 18,650 lbf; measured according to SAE J-1179.

2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 48,510-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.

J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface. Refer to structural earthwork specifications for earth moving for structures.

K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base course, drainage fill, or topsoil materials.

L. Utilities: Underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.05 SUBMITTALS

A. Product Data: For the following:

1. Each type of plastic warning tape.
2. Controlled low-strength material, including design mixture.

B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D 2487 of each soil material proposed for fill and backfill.
2. Laboratory compaction curve according to ASTM D 698 for each soil material proposed for fill and backfill.

C. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.06 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.
B. Preexcavation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient on site materials do not match the Geotech report for engineered fill.

B. Base Course: Naturally graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; conforming to ODOT Type “A” aggregate base.

C. Engineered Fill (Structural Fill):
   1. Approved Low Volume Change Cohesive Soils:
      a. Plasticity Index (PI) 8 to 18
      b. Containing at least 15 percent fines (material passing the No.200, based on dry weight)
      c. Shall not contain rock fragments greater than 1.5 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
      d. Prior to any filling operations, samples will need to be tested by and approved by Geotech Engineer.

D. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve. Or as defined by the utility trench details.

E. Drainage Course: Narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

F. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

G. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

H. Fly Ash: ASTM C618, Class C

2.02 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
   1. Survivability: Class 2; AASHTO M 288.
   2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
   3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
   4. Tear Strength: 56 lbf; ASTM D 4533.
   5. Puncture Strength: 56 lbf; ASTM D 4833.
   6. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
4. Tear Strength: 90 lbf; ASTM D 4533.
5. Puncture Strength: 90 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.03 CONTROLLED LOW-STRENGTH MATERIAL
A. Controlled Low-Strength Material: Low-density, self-compacting, flowable concrete material as follows:
   1. Portland Cement: ASTM C 150, Type I, II or III.
   2. Fly Ash: ASTM C 618, Class C or F.
   5. Water: ASTM C 94/C 94M.
B. Produce conventional-weight, controlled low-strength material with 80-psi compressive strength when tested according to ASTM C 495.

2.04 ACCESSORIES
A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
   2. Yellow: Gas, oil, steam, and dangerous materials.
   3. Orange: Telephone and other communications.
   4. Blue: Water systems.
   5. Green: Sewer systems.

PART 3 - EXECUTION
3.01 PREPARATION
A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."
C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing," during earthwork operations.
D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

E. After stripping and completing all cuts, proof-roll the exposed subgrade with a fully-loaded, pneumatic-tired, 10-wheeled tandem-axle dump truck weighing not less than 25 tons. Overexcavate and replace soft, unstable or unsuitable materials with approved engineered fill if they cannot be stabilized in place.

F. After completing proof-rolling and before placing any fill, scarify the exposed subgrade to a minimum depth of 8 inches, moisture condition to a level within 2 percent above the material's optimum moisture content, and compact to at least 95 percent of its maximum standard Proctor dry density.

3.02 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
   2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.03 EXPLOSIVES

A. Explosives: No explosives are allowed.

3.04 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
   1. If excavated materials intended for fill and backfill include unsuitable soil materials and rock, replace with approved engineered fill materials.
   2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
      a. 24 inches outside of concrete forms other than at footings.
      b. 12 inches outside of concrete forms at footings.
      c. 6 inches outside of minimum required dimensions of concrete cast against grade.
      d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
      e. 6 inches beneath bottom of concrete slabs on grade.
      f. 6 inches beneath pipe in trenches.

3.05 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
1. Excavations for Footings and Foundations: Over excavate 12” below shallow footings and backfill with engineered fill or ODOT Type “A” Aggregate. The over excavation should also extend laterally a minimum of 2/3 of the total depth of over excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Construct a 12-inch layer of low volume change engineered fill below floor slab. The thickness of the low volume change fill zone does not include the thickness of any granular leveling material below the floor slab. This layer of fill shall extend at least 5 feet beyond the building perimeter.

3.06 EXCAVATION FOR WALKS AND PAVEMENTS
A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.07 EXCAVATION FOR UTILITY TRENCHES
A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

3.08 SUBGRADE INSPECTION
A. Notify Engineer when excavations have reached required subgrade.

B. After stripping and completing any cuts, the subgrade shall be proofrolled. Proof-roll subgrade under the observation of the geotechnical engineer, with a loaded, tandem-axle dump truck weighing at least 25 tons, to locate any zones that are soft or unstable. The Proofrolling should involve overlapping passes in mutually perpendicular directions. Where rutting or pumping is observed during proof-rolling, the unstable soils shall be over-excavated and replaced with engineered fill.

C. After completing the proof-rolling and required over-excavations and before placing any fill, the exposed subgrade shall be scarified to a depth of at least eight (8) inches and moisture conditioned to within 2 percent of the soils material’s optimum moisture content. The scarified zone shall be compacted to at least 95 percent of the material’s standard Proctor maximum dry density, per ASTM D-698.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.09 UNAUTHORIZED EXCAVATION
A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Engineer.
1. Fill unauthorized excavations under other construction or utility pipe as directed by Engineer.

3.10 STORAGE OF SOIL MATERIALS
A. Stockpile borrow soil materials and excavated on-site suitable soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL
A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including, where applicable, sub-drainage, damp-proofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.
   6. Removing temporary shoring and bracing, and sheeting.
   7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL
A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Place and compact initial backfill of, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

D. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the utility pipe or conduit.

E. Backfill voids while installing and removing shoring and bracing.

F. Place and compact final backfill to final subgrade elevation.

G. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

H. Construct clay “trench plug” that extends at least 5 feet out from the face of the building exterior. The plug material shall consist of clay compacted at a water content at or above the soils optimum water content. The clay fill shall be placed to completely surround the utility line and be compacted to at least 95% standard proctor density.

3.13 SOIL FILL
A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:
1. Under grass and planted areas, use on-site soils.
2. Under walks and pavements, use engineered fill.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

D. Prior to placing fill, the exposed subgrade shall be scarified to a depth of at least 8 inches, moisture conditioned to within 2 percent of the material’s optimum moisture content and recompacted to at least 95 percent of the material’s standard proctor maximum dry density, determined in accordance with ASTM D-698, the standard proctor procedure.

3.14 SOIL MOISTURE CONTROL
A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of the material’s optimum moisture content, determined in accordance with ASTM D-698, (standard Proctor procedure).

3.15 COMPACtion OF SOIL BACKFILLS AND FILLS
A. Place backfill and fill soil materials in layers not more than 9 inches in depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers. Backfill and fill soil materials shall be moisture conditioned to within 2 percent of the optimum moisture content.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
   1. Under pavements and walkways, scarify and recompact top 8 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
   2. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
   3. For utility trenches in unpaved areas, compact each layer of initial and final backfill soil material at 85 percent. In paved areas, compact utility trench backfill at 95 percent.

3.16 SUBGRADE STABILIZATION
A. Pavement Subgrade Stabilization:
   1. Existing soils in pavement subgrade areas shall be stabilized with hydrated lime as described below:
      a. Lime treatment: 4 to 7 percent required to reduce the PI to 18 or less for areas exhibiting a PI of 18 or greater.
      b. Hydrated lime stabilization shall be performed according to ODOT specifications.
      c. Hydrated lime stabilized subgrade shall be compacted within 2 hours after the addition of water to the mix.
      d. Actual amount shall be determined in the field to reduce the plasticity of the subgrade soils to 18 or less.

3.17 GRADING
A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Lawn or Unpaved Areas: Plus or minus 1 inch.
   2. Walks and Pavements: minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.18 SUBSURFACE DRAINAGE
A. Subdrainage Pipe: Specified in Division 33 Section “Subdrainage.”

3.19 BASE COURSES
A. Place base course on subgrade free of mud, frost, snow, or ice.
B. On prepared subgrade, place base course under pavements and walks as follows:
   1. Where indicated, install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
   2. Shape base course to required crown elevations and cross-slope grades.
   3. Place base course in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   4. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D-698.

3.20 DRAINAGE COURSE
A. Place drainage course on subgrades free of mud, frost, snow, or ice.

3.21 FIELD QUALITY CONTROL
A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
C. Contact Engineer for subgrade proofrolling.
D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
E. Perform Atterberg limits tests on fly ash and cement kiln dust treated fill/backfill materials placed in the building area for the low volume change fill layer at frequency of at least 1 test per 5,000 SF of area with at least 2 test per lift. Intent or Atterberg limits testing is to determine if the soil has been effectively treated.
F. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.

2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.

3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.

G. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.22 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion prior to placement of subsequent base course, paving, or foundations above. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.23 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove waste material, including unsuitable soil, trash, and debris, and legally dispose of it off Owner's property. Retain paragraph above or paragraph and subparagraph below.

B. Transport surplus engineered fill to designated storage areas on Owner's property.

END OF SECTION
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. Drilling and cleaning pier holes.
   2. Under-reaming pier holes.
   4. Casing pier holes when required.
   5. Products installed, not furnished under this Section:
      a. Concrete and reinforcing steel.
      b. Anchor rods, templates and dowels.

B. Related Sections:
   1. Section 033000 – Cast-In-Place Concrete
   2. Section 311000 – Site Clearing

1.3 UNIT PRICES

A. Basis for Bids
   1. Base Contract Price on indicated number of drilled piers and, for each pier, the design length from top elevation to bottom of shaft and the diameter of shaft. For bidding purposes only, assume piers are founded at the depth shown on the Contract Drawings.
   2. Do not include temporary casing in Base Contract Sum for drilled piers.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Shop Drawings: For concrete reinforcement detailing fabricating, bending, supporting, and placing.
   1. Submit three bond sets of shop drawings for review by the Structural Engineer-of-Record. The Structural Engineer-of-Record will mark three sets with red and will return one set to the contractor through the Architect. The contractor shall make the number of photocopies required of the approved shop drawings for distribution to other parties, and the contractor shall be responsible for transmitting the original red-marked set to the fabricator for corrections.
   2. Only complete shop drawing submittals will be reviewed. Shop drawings not in compliance with the Submittal portion of this document will be rejected. Time
required by structural engineer to review shop drawing submittals a second or third time will be billed to the Contractor at structural engineer’s hourly rates.

D. Qualification Data: For qualified Installer.

E. Welding certificates.

F. Material Certificates: For the following, from manufacturer:
   1. Cementitious materials.
   2. Admixtures.
   3. Steel reinforcement and accessories.

G. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
   1. Aggregates.

H. Field quality-control reports.

I. Other Informational Submittals:
   1. Record drawings.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer with at least 5 years of experience that has specialized in drilled-pier work in similar applications.
   1. Experience shall be relevant to anticipated subsurface materials, water conditions, shaft sizes and special techniques required.
   2. Demonstrate to Architect and Structural Engineer-of-Record dependability of equipment and techniques to be used, when requested.

B. Testing Agency Qualifications: Qualified according to ASTM C 1077, ASTM D 3740, and ASTM E 329 for testing indicated.

C. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code - Steel."
   2. AWS D1.4, "Structural Welding Code - Reinforcing Steel."

D. Drilled-Pier Standard: Comply with ACI 336.1 unless modified in this Section.

E. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to drilled piers including, but not limited to, the following:  
      a. Review geotechnical report.
      b. Discuss existing utilities and subsurface conditions.
      c. Review coordination with temporary controls and protections.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Locate existing underground utilities before excavating drilled piers. If utilities are to remain in place, provide protection from damage during drilled-pier operations.
   1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, adapt drilling procedure if necessary to prevent damage to utilities. Cooperate with Owner and utility companies in keeping services and
facilities in operation without interruption. Repair damaged utilities to satisfaction of utility owner.

B. Interruption of Existing Utilities: Do not interrupt any utility to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
1. Notify Architect and Owner no fewer than seven days in advance of proposed interruption of utility.
2. Do not proceed with interruption of utility without Owner's written permission.

C. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.
1. Make additional test borings and conduct other exploratory operations necessary for drilled piers.
2. The geotechnical report is included elsewhere in the Project Manual.

D. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled piers. Before excavating, lay out each drilled pier to lines and levels required. Record actual measurements required in the Contractor's drilled pier log.
1. Record and maintain information required in the Contractor's drilled pier log for each drilled pier and cooperate with Owner's testing and inspecting agency to provide data for required reports.

PART 2 PRODUCTS

2.1 SPACERS
A. Provide steel band spacers or precast concrete spacers to maintain position of cages within pier holes.

2.2 END BLOCKS
A. Provide precast concrete end blocks to maintain required clearance at bases of cages.

PART 3 EXECUTION

3.1 PREPARATION
A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, vibration, and other hazards created by drilled-pier operations.

B. Contractor shall maintain a separate independent Pier Log. For each pier record the following information.
1. Identification mark
2. Shaft diameter
3. Bell diameter
4. Bottom of pier elevation
5. Steel reinforcing cage length, number and size of vertical bars and tie size and spacing
6. Depth and diameter of casing, where casing is required
7. Top of pier elevation  
8. Date and time drilling is completed  
9. Date and time concrete placement is begun and is completed  
10. Plumbness variation  
11. Condition of drilled hole before placement of concrete  
12. Elevation of proper bearing stratum  
13. Embedment into bearing stratum  
14. Water depth from bottom of pier at time of concrete placement  

3.2 EXCAVATION  

A. Unclassified Excavation: Excavate to bearing elevations regardless of character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.  
   1. Obstructions: Unclassified excavation may include removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions. No changes in the Contract Sum or the Contract Time will be authorized for removal of obstructions.  

B. Prevent surface water from entering excavated shafts. Conduct water to site drainage facilities.  

C. Excavate shafts for drilled piers to indicated elevations. Remove loose material from bottom of excavation.  
   1. Excavate bottom of drilled piers to level plane within 1:12 tolerance.  
   2. Remove water from excavated shafts before concreting.  
   3. Excavate rock sockets of dimensions indicated.  
   4. Excavate and complete concreting of drilled pier on same day if possible, or redrill, clean and test slurry in excavation before concreting.  

D. Notify and allow testing and inspecting agency to test and inspect bottom of excavation. If unsuitable bearing stratum is encountered, make adjustments to drilled piers as determined by Architect.  
   1. Do not excavate shafts deeper than elevations indicated unless approved by Architect.  
   2. Payment for additional authorized excavation will be according to Contract provisions for changes in the Work.  

E. Excavate shafts for closely spaced drilled piers and for drilled piers occurring in fragile or sand strata only after adjacent drilled piers are filled with concrete and allowed to set.  

F. Temporary Casings: Install watertight steel casings of sufficient length and thickness to prevent water seepage into shaft; to withstand compressive, displacement, and withdrawal stresses; and to maintain stability of shaft walls.  
   1. Remove temporary casings, maintained in plumb position, during concrete placement and before initial set of concrete, or leave temporary casings in place.  

G. Bells: Excavate bells for drilled piers to shape, base thickness, and slope angle indicated. Excavate bottom of bells to level plane and remove loose material before placing concrete.  
   1. Shore bells in unstable soil conditions to prevent cave-in during excavation, inspection, and concreting.  

H. Tolerances: Construct drilled piers to remain within ACI 336.1 tolerances and those listed below, whichever are most stringent.
1. Location of drilled pier shall be within 2 inches of planned position.
2. Plumbness of drilled pier shall be within 1.5% of vertical.
3. Shaft diameter shall be within plus 2 inches and minus 0 of diameter specified on contract documents.
4. Top of pier elevation shall be within plus 1 inch and minus 3 inches or elevation specified on contract documents.
5. Diameter of underream shall be within plus 2 inches and minus 0 of that specified on contract documents.
6. Bearing elevation shall be within plus 1 foot (deeper than specified) and minus 0 of the bearing elevation required per the contract documents.
7. Placement of vertical dowels at tops of piers shall be within plus or minus 1 inch lateral and plus or minus 2 inches vertical of position specified on the contract documents.
8. Placement of anchor bolts shall be within plus or minus 1/8" lateral from position specified on contract documents.
9. Excavate bottom of drilled piers to level plane within 1:12 tolerance.
10. If location or out-of-plumb tolerances are exceeded, provide corrective construction. Submit design and construction proposals to Architect for review before proceeding.

3.3 STEEL REINFORCEMENT

A. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
B. Fabricate reinforcing cages in continuous stock lengths before drilling pier holes. Cut reinforcing cages to required lengths after final length of each drilled pier has been measured.
C. Do not splice vertical reinforcing.
D. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.
E. Fabricate and install reinforcing cages symmetrically about axis of shafts in a single unit.
F. Accurately position, support, and secure reinforcement against displacement during concreting. Maintain minimum cover over reinforcement.
G. Use templates to set anchor bolts, leveling plates, and other accessories furnished in work of other Sections. Provide blocking and holding devices to maintain required position during final concrete placement.
H. Protect exposed ends of extended reinforcement, dowels, or anchor bolts from mechanical damage and exposure to weather.

3.4 CONCRETE PLACEMENT

A. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by Owner's independent testing and inspecting agency.

1. Construct a construction joint if concrete placement is delayed more than one hour. Level top surface of concrete. Before placing remainder of concrete, clean surface laitance, roughen, and slush concrete with commercial bonding agent or with sand-cement grout mixed at ratio of 1:1.
B. Dry Method: Place concrete to fall vertically down the center of drilled pier without striking sides of shaft or steel reinforcement.
   1. Where concrete cannot be directed down shaft without striking reinforcement, place concrete with chutes, tremies, or pumps.
   2. Use tremies to within 10 feet of bottom of shaft for a maximum 10 foot fall.
   3. Consolidate top 60 inches of each pier with a mechanical vibrator.

C. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60 inch head of concrete above bottom of casing.
   1. Consolidate top 60 inches of each pier with a mechanical vibrator after withdrawal of temporary casing.
   2. Do not rotate casing during removal.

D. Screed concrete at cutoff elevation level and apply scoured, rough finish. Where cutoff elevation is above the ground elevation, form top section above grade and extend shaft to required elevation.

E. Where water rises to top of pier during placement, remove over-wetted concrete and replace with sound, dense material.

F. Remove and replace portions of concrete that become contaminated with mud or spoil during placement.

G. Protect concrete work, according to ACI 301, from frost, freezing, or low temperatures that could cause physical damage or reduced strength.
   1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   2. Do not use calcium chloride, salt, or other mineral-containing antifreeze agents or chemical accelerators.

H. If hot-weather conditions exist that would impair quality and strength of concrete, place concrete according to ACI 301 to maintain delivered temperature of concrete at no more than 90 deg F.
   1. Place concrete immediately on delivery. Keep exposed concrete surfaces and formed shaft extensions moist by fog sprays, wet burlap, or other effective means for a minimum of seven days.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Drilled piers.
   2. Excavation.
   3. Concrete.
   4. Steel reinforcement welding.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. The Testing Agency Inspector shall be present during all work in this section and shall inspect the drilling of each pier hole.

C. Drilled-Pier Tests and Inspections: For each drilled pier, before concrete placement.
   1. Soil Testing: Bottom elevations, bearing capacities, and lengths of drilled piers indicated have been estimated from available soil data. Actual elevations and drilled-pier lengths and bearing capacities will be determined by testing and
inspecting agency. Final evaluations and approval of data will be determined by Architect.

D. Concrete Tests and Inspections: refer to section 033000 “Cast-in-Place Concrete” for required concrete tests and inspections.

E. An excavation, concrete, or a drilled pier will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports for each drilled pier as follows:
   1. Actual top and bottom elevations.
   2. Actual drilled-pier diameter at top, bottom, and bell.
   3. Top of rock elevation.
   4. Description of soil materials.
   5. Description, location, and dimensions of obstructions.
   6. Final top centerline location and deviations from requirements.
   7. Variation of shaft from plumb.
   8. Shaft excavating method.
   9. Design and tested bearing capacity of bottom.
  10. Depth of rock socket.
  11. Levelness of bottom and adequacy of cleanout.
  12. Ground-water conditions and water-infiltration rate, depth, and pumping.
  13. Description, purpose, length, wall thickness, diameter, tip, and top and bottom elevations of temporary or permanent casings. Include anchorage and sealing methods used and condition and weather tightness of splices if any.
  14. Description of soil or water movement, sidewall stability, loss of ground, and means of control.
  15. Bell dimensions and variations from original design.
  16. Date and time of starting and completing excavation.
  17. Inspection report.
  18. Condition of reinforcing steel and splices.
  20. Concrete placing method, including elevation of consolidation and delays.
  22. Locations of construction joints.
  23. Concrete volume.
  24. Concrete testing results.
  25. Remarks, unusual conditions encountered, and deviations from requirements.

3.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION
PART 1    GENERAL

1.01    RELATED DOCUMENTS

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

1.02    SUMMARY

A. This Section includes the following:
   1. Hot-mix asphalt paving.
   2. Pavement-marking paint.

B. Related Sections include the following:
   1. Division 02 Section "Earthwork" for aggregate subbase and base courses and for aggregate pavement shoulders.
   2. Division 02 Section "Pavement Joint Sealants" for joint sealants and fillers at paving terminations.

1.03    DEFINITIONS

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

B. DOT: Department of Transportation.

1.04    SYSTEM DESCRIPTION

A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of standard specifications of state DOT.
   1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.05    SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

C. Qualification Data: For manufacturer.

D. Material Test Reports: For each paving material.

E. Material Certificates: For each paving material, signed by manufacturers.
1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer.
   1. Manufacturer shall be a paving-mix manufacturer registered with and approved by
      ODOT of the state in which Project is located.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated,
   as documented according to ASTM E 548.

C. Regulatory Requirements: Comply with ODOT standard specifications for highway
   construction.

D. Asphalt-Paving Publication: Comply with AIMS-22, "Construction of Hot Mix Asphalt
   Pavements," unless more stringent requirements are indicated.

E. Preinstallation Conference: Conduct conference at Project site to comply with
   requirements in Division 01 Section "Project Management and Coordination." Review
   methods and procedures related to hot-mix asphalt paving including, but not limited to, the
   following:
   1. Review proposed sources of paving materials, including capabilities and location of
      plant that will manufacture hot-mix asphalt.
   2. Review condition of subgrade and preparatory work.
   3. Review requirements for protecting paving work, including restriction of traffic during
      installation period and for remainder of construction period.
   4. Review and finalize construction schedule and verify availability of materials, Installer's
      personnel, equipment, and facilities needed to make progress and avoid delays.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals
   unbroken and bearing manufacturer's labels containing brand name and type of material,
   date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature
   range required by manufacturer. Protect stored materials from direct sunlight.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively
   damp or if the following conditions are not met:
   1. Prime and Tack Coats: Minimum surface temperature of 60 deg F.
   2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of
      placement.
   3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of
      placement.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and
   at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F
   for water-based materials, and not exceeding 95 deg F.
PART 2    PRODUCTS

2.01    AGGREGATES

A. Coarse Aggregate:  ASTM D 692, sound; angular crushed stone, crushed gravel, or properly cured, crushed blast-furnace slag.

B. Fine Aggregate:  ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, properly cured blast-furnace slag, or combinations thereof.
   1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

C. Mineral Filler:  ASTM D 242, rock or slag dust, hydraulic cement, or other inert material.

2.02    ASPHALT MATERIALS

A. Asphalt Binder, Asphalt Cement and Tack Coat in accordance with ODOT standard specifications for highway construction.

B. Water:  Potable.

2.03    AUXILIARY MATERIALS

A. Herbicide:  Commercial chemical for weed control, registered by the EPA.  Provide in granular, liquid, or wettable powder form.

B. Sand:  ASTM D 1073, Grade Nos. 2 or 3.

C. Joint Sealant:  ASTM D 3405, hot-applied, single-component, polymer-modified bituminous sealant.

D. Pavement-Marking Paint:  Alkyd-resin type, lead and chromate free, ready mixed, complying with FS TT-P-115, Type I.
   1. Color:  As indicated.

PART 3    EXECUTION

3.01    SURFACE PREPARATION

A. General:  Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces.  Ensure that prepared subgrade is ready to receive paving.
   1. Sweep loose granular particles from surface of unbound-aggregate base course.  Do not dislodge or disturb aggregate embedded in compacted surface of base course.

B. Herbicide Treatment:  Apply herbicide according to manufacturer’s recommended rates and written application instructions.  Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
   1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C. Tack Coat:  Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.02 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
   1. Place hot-mix asphalt base course in lifts of 3” or less.
   2. Place hot-mix asphalt surface course in single lift.
   3. Spread mix at minimum temperature of 250 deg F, or higher temperature as required by the grade of asphalt cement used.
   4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
   5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
   1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.03 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
   1. Clean contact surfaces and apply tack coat to joints.
   2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
   3. Offset transverse joints, in successive courses, a minimum of 24 inches.
   4. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."
   5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.

3.04 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
   1. Complete compaction before mix temperature cools to 185 deg F, or higher temperature as required by the grade of asphalt cement used.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated
crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
1. Average Density: 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent nor greater than 100 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.05 INSTALLATION TOLERANCES

A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
   1. Base Course: Plus or minus 1/2 inch.
   2. Surface Course: Plus 1/4 inch, no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
   1. Base Course: 1/4 inch.
   2. Surface Course: 1/8 inch.
   3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.06 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 30 mils. To be applied in two 15 mil coats.
   1. Broadcast glass spheres uniformly into wet pavement markings at a rate of 6 lb/gal.
3.07 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
   1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to AASHTO T 168.
   1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
   2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
      a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
      b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.08 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
   1. Do not allow excavated materials to accumulate on-site.

END OF SECTION
SECTION 321313
CONCRETE PAVING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:
   1. Driveways and roadways.
   2. Parking lots.
   3. Curbs and gutters.
   4. Walkways.

B. Related Sections include the following:
   1. Division 02 Section "Earthwork" for subgrade preparation, grading, and subbase course.
   2. Division 02 Section "Pavement Joint Sealants" for joint sealants of joints in concrete pavement and at isolation joints of concrete pavement with adjacent construction.
   3. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.04 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Qualification Data: For manufacturer.

D. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
   1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.
E. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

F. Minutes of preinstallation conference.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.


D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.06 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 PRODUCTS

2.01 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
1. Use flexible or curved forms for curves with a radius 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.02 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
D. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
E. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 deformed bars.
F. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 deformed bars.
G. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.
H. Plain Steel Wire: ASTM A 82.
I. Deformed-Steel Wire: ASTM A 496.
J. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, deformed.
K. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.
L. Epoxy-Coated Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain steel bars.
M. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.
N. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:
   1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
   2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
O. Epoxy Repair Coating: Liquid two-part epoxy repair coating, compatible with epoxy coating on reinforcement.
P. Zinc Repair Material: ASTM A 780.

2.03 CONCRETE MATERIALS

A. Cementitious Material: Use one of cementitious materials, of the same type, brand, and source throughout the Project:
   1. Portland Cement
C. Water: ASTM C 94/C 94M.


E. Chemical Admixtures: Provide admixtures as allowed by ODOT specifications for highway construction.

2.04 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

   1. Products: Conform to ODOT.

E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

   1. Products: Conform to ODOT.

F. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.

   1. Products: Conform to ODOT.

2.05 RELATED MATERIALS


   1. Color: As indicated by manufacturer's designation Match Architect's sample As selected by Architect from manufacturer's full range.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to requirements, and as follows:

   1. Types I and II, non-load bearing IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Chemical Surface Retarder: Water-soluble, liquid-set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

   1. Products: Conform to ODOT.
2.06 PAVEMENT MARKINGS

A. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 45 minutes.
   1. Color: As indicated.

2.07 WHEEL STOPS

A. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.
   1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

2.08 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
   1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

B. Proportion mixtures to provide normal-weight concrete with the following properties:
   1. Compressive Strength (28 Days): 4000 psi
   2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.25-0.44.
   3. Slump Limit: 2 inches plus or minus 1 inch.
      a. Slump Limit for Concrete Containing High-Range Water-Reducing Admixture: Not more than 9 inches after adding admixture to plant- or site-verified, 2- to 3-inch slump.
   4. Air Content: 6.5 percent plus or minus 1.5 percent for 3/4-inch (19-mm) nominal maximum aggregate size.

C. Calcium Chloride shall not be permitted in concrete mixtures.

D. Chemical Admixtures: Conform to ODOT specifications for highway construction.
   1. Use water-reducing admixture high-range, water-reducing admixture high-range, water-reducing and retarding admixture plasticizing and retarding admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

E. Cementitious Materials: Conform to the ODOT specifications for highway construction Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements.
   1. Fly Ash or Pozzolan: 15 percent.
   2. Ground Granulated Blast-Furnace Slag: 25 percent.
   3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 40 percent, with fly ash or pozzolan not exceeding 15 percent.
   4. Fly Ash or Pozzolan: not allowed in City of Tulsa Right of Way pavements.

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.
1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in an appropriate drum-type batch machine mixer.
   1. For concrete mixes of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
   2. For concrete mixes larger than 1 cu. yd, increase mixing time by 15 seconds for each additional 1 cu. yd.
   3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
   B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
      1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
      2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 50 tons.
      3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/4 inch require correction according to requirements in Division 02 Section "Earthwork."
   C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.02 PREPARATION
   A. Remove loose material from compacted subbase surface immediately before placing concrete.
   B. Precautions to protect fresh concrete from developing plastic shrinkage cracks must be taken in advance of concrete placement when evaporation rate due to any combination of temperature, humidity, and wind velocity is expected to approach 0.2 lb./sq. ft./hr. as determined by Figure 2.1.5 of ACI 305. Acceptable precautions to reduce the rate of evaporation include use of wind breaks, monomolecular film evaporation retarders, fog spray, covering with polyethylene sheeting, or wet cover.

3.03 EDGE FORMS AND SCREED CONSTRUCTION
   A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous
progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.04 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

F. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.05 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
   1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
   1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
   2. Provide tie bars at sides of pavement strips where indicated.
   3. Dowelled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
   1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated.
   2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/4-inch- wide joints into concrete when cutting action will not tear, abrade (within 12 hours of concrete pour), or otherwise damage surface and before developing random contraction cracks.
3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated and at construction joints. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 3/8-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.06 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side
forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

H. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
1. Remove and replace concrete that has been placed for more than 15 minutes without being covered by top layer, or use bonding agent if approved by Architect.

I. Screed pavement surfaces with a straightedge and strike off.

J. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

K. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.

L. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.
1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.

M. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.

N. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.

O. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

P. Wind:
1. Take precautions to prevent development of plastic shrinkage cracks.
3.07 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.

2. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.08 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recolat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.09 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:

1. Elevation: 1/4 inch.
3. Surface: Gap below 10-foot-long, unleveled straightedge not to exceed 1/4 inch.
4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
8. Joint Spacing: 3 inches.

3.10 **PAVEMENT MARKING**

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow concrete pavement to cure for 21 days and be dry before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

  1. Spread glass beads uniformly into wet pavement markings at a rate of 6 lb/gal.

3.11 **WHEEL STOPS**

A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes drilled or cast into wheel stops at one-quarter to one-third points. Firmly bond each dowel to wheel stop and to pavement. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.12 **FIELD QUALITY CONTROL**

A. Testing Agency: a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

C. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

  1. Testing Frequency: Obtain at least 1 composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

  2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.

  3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.
   a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

G. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

H. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

I. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

J. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

K. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

L. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.14 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement back to nearest control joint that is broken, damaged, or defective or that does not comply with requirements in this Section.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION
SECTION 321373
PAVEMENT JOINT SEALANTS

PART 1 GENERAL

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

1.02 SUMMARY
A. This Section includes the following:
   1. Expansion and contraction joints within cement concrete pavement.
   2. Joints between cement concrete and asphalt pavement.
B. Related Sections include the following:
   1. Division 02 Section "Asphalt Paving" for constructing joints between concrete and asphalt pavement.
   2. Division 02 Section "Cement Concrete Pavement" for constructing joints in concrete pavement.
   3. Division 07 Section "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

1.03 SUBMITTALS
A. Product Data: For each joint-sealant product indicated.
B. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
C. Qualification Data: For Installer.
D. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
   1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
   2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.04 QUALITY ASSURANCE
A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
   1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
   2. Submit not fewer than four pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
   3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   4. For materials failing tests, obtain joint-sealant manufacturer’s written instructions for corrective measures including use of specially formulated primers.
   5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing of current sealant products within a 36-month period preceding the commencement of the Work.
   1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 for testing indicated, as documented according to ASTM E 548.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.06 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
   2. When joint substrates are wet or covered with frost.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.
PART 2  PRODUCTS

2.01 MANUFACTURERS
A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.02 MATERIALS, GENERAL
A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

2.03 COLD-APPLIED JOINT SEALANTS
A. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.
   1. Products:
      a. Crafco Inc.; RoadSaver Silicone SL.
      b. Dow Corning Corporation; 890-SL.

2.04 JOINT-SEALANT BACKER MATERIALS
A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.
D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.05 PRIMERS
A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
PART 3 EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of backer materials.
   2. Do not stretch, twist, puncture, or tear backer materials.
   3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses provided for each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealants from surfaces adjacent to joint.
   2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.04 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION
SECTION 323113
CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 SECTION INCLUDES
   B. Excavation for post bases.
   C. Concrete anchorage for posts and center drop for gates.

1.2 RELATED SECTIONS
   A. Section 033000 – Cast In Place Concrete

1.3 REFERENCES
   A. ASTM A123 – Zinc (Hot Galvanized) Coatings of Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strips.
   B. ASTM B429 – Aluminum-Alloy Extruded Structural Pipe and Tube.
   C. ASTM F567 – Installation of Chain Link Fence
   D. ASTM F668 – PVC-Coated Steel Chain Link Fence Fabric.

1.4 SUBMITTALS
   A. Submit shop drawings and product data in accordance with Section 016000.
   B. Include plan layout, grid, spacing of components, accessories, fittings, hardware, anchorages, schedule of components, finish and installation instructions.
   C. Submit samples of fence fabric finish.

PART 2 PRODUCTS

2.1 GALVANIZED STEEL FENCE MATERIALS
   A. Fabric: ASTM F668, Class 1, with the following requirements:
      1. Nine gauge Standard Industrial, 2 inch mesh (before PVC coating).
      2. PVC Coating extruded over zinc-coated steel wire before weaving.
      3. Top selvage knuckled finish; bottom selvage twisted and barbed finish.
      4. All framework, posts and rails; gates and accessories which follow shall receive 15 mil. PVC coating.
   B. Posts and Pipes: Steel, hot-dipped galvanized, ASTM A120, Table 1
   C. Post Sizes: Fences 4'-0" high and over.
      1. Line Posts: 2.375 inch O.D.
      2. Terminal and Corner Posts: 2.875 inch O.D.
      3. Gate Posts:
a. 2.375 inch O.D. for gates to 3 feet wide or double to 6 feet wide.
b. 2.875 inch O.D. for gates to 6 feet wide or double to 12 feet wide.
c. 4 inch O.D. for gates to 13 feet wide or double to 26 feet wide.
d. 6.625 inch O.D. for gates to 18 feet wide or double to 36 feet wide.

D. Top Rail: 1.660 inch O.D.

E. Braces: 1.660 inch O.D. space midway between top rail and ground, and extend from terminal and / or corner posts to first adjacent line post. Fasten to posts with pressed steel connection; then truss from line post back to terminal post with 3/8 inch galvanized rod complete with truss tightener.

F. Fittings: Hot-dip galvanized or malleable iron, cast iron or pressed steel.

G. Fabric Ties: 9 gauge galvanized or aluminum. Space minimum at 24 inch on top rail and 14 inch on posts. Connect fabric to terminal posts with galvanized bars, 3/4 inch by 3/16 inch and approved type galvanized tension bands fabricated for bolts or lock pins.

H. Tension Wire: 7 gauge galvanized coilwires; tie to fence fabric with 11 gauge galvanized hog rings on 12 inch centers or by other approved method; tie to posts separate from fabric with 9 gauge galvanized wire ties.

I. Post Tops: Galvanized.

J. Gates: Design for no-sag operation.
   1. Frames: Hot-dip galvanized pipe, ASTM A120, Table 1; 1.660 inch O.D.
   2. Corner Ells: Pressed steel, malleable iron or welded corners all hot-dipped galvanized after fabrication.
   3. Internal Bracing: 1.660 inch O.D. hot-dip galvanized pipe, ASTM A120, Table 1 with 3/8 inch galvanized adjustable truss rods.
   4. Fabric: Same as fence.
   5. Sizes: Match the size and style of gates indicated on Construction Drawings.
   6. Hardware: Furnish gates complete with the following approved galvanized hardware:
      a. Malleable iron ball and socket hinges of type to allow 105 degree swing.
      b. Locking pintle and latch to secure gate in closed position.
      c. Stops and catches, set in concrete, to secure drive gates in open position.
      d. Self-draining stops and rests for double gates.

2.2 CONCRETE

A. Concrete shall be 3,500 psi, air entrained.

PART 3 EXECUTION

3.1 POSTS

A. Space line posts a maximum of 10 feet on center. Set plumb, centered in holes and to lines shown on drawings. Place in concrete with bottom 6 inch above bottom of hole; thoroughly puddle and support plumb until concrete is set. Crown top of concrete in an approved manner.

B. Fasten top rail with couplings at approximately 20 feet centers. Pass rail through line post tops to form a continuous brace.

C. Minimum sizes of footings for fences 60 inches in height and above.
   1. Line Posts: 12 inch diameter, 42 inch deep.
   2. Terminal, Brace and Corner Posts: 14 inch diameter, 42 inch deep.
3.2 FABRIC

A. Do not stretch until concrete is 5 days old. Stretch slightly above tension recommended by fence manufacturer, for season or year applied, and allow to slack away slightly when pullers are released. Attached pullers to fabric full width and tie in at least 7 places on each post before releasing. If desired, pulls may be made from two ways and jointed by inserting on picket. Set post braces before placing fabric. Fasten fabric to line posts with fabric bands spaced 14 inch apart and to top rail with tie wires spaced 24 inch apart. Place tension wires after plan size of fabric is installed.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY
   A. Deciduous and Evergreen Trees
   B. Topsoil backfill
   C. Mulch
   D. Maintenance service

1.02 QUALITY ASSURANCE
   A. All materials shall be labeled with name tags.
   B. All plants and planting material not meeting these specifications shall be rejected.
   C. Submit letter from topsoil supplier stating that topsoil provided meets specified requirements.
   D. All planting work shall be done under the direction and supervision of personnel with at least 5 years of horticultural and planting experience and conform to best Horticultural Practices.

1.03 SUBMITTALS
   A. Samples of mulch, topsoil and tree accessories must be submitted in accordance with Section 013000.

1.04 DELIVERY, STORAGE AND HANDLING
   A. Lift trees by ball or container only.
   B. Do not accept trees whose surrounding earth is cracked or has been frozen.
   C. Do not deliver trees and groundcover until immediately prior to planting.

1.05 WARRANTY AND MAINTENANCE
   A. All planting material shall be warranted for a period of one year from date project is deemed Substantially Complete.
   B. All planting material shall be in a vigorous condition at end of warranty period.
   C. A new one year warranty period shall be provided for each specimen that must be replaced starting on the date that it is planted. Replanting shall not be performed until weather conditions allow.
   D. Replacement planting material shall meet the original specifications.
   E. Provide watering and maintenance of trees during the entire warranty period.
PART 2 PRODUCTS

2.01 TREES
A. Trees shall be of quantity, size and species as scheduled.
B. All trees shall be free of disease and insects.
C. All trees shall be nursery grown.

2.02 TOPSOIL
A. Topsoil shall be free of rocks, sticks and other debris.
B. Provide topsoil with an acidity range of 6.0 to 7.0. Verify acidity level requirements with planting materials.
C. Topsoil shall contain a minimum of 2% of humus.

2.03 MULCH
A. Mulch shall be shredded cypress.
B. Mulch shall be provided free of insects.

2.04 PLANTING SCHEDULE
A. Trees shall have a caliper of 2" to 3" and be 6' to 8' in height.
B. Tree species and locations shall be as specified on Construction Drawings.

PART 3 EXECUTION

3.01 INSTALLATION
A. Do not proceed with installation of planting materials until weather conditions permit.
B. Review locations of tree species with Architect prior to planting.
C. Prune trees as required to improve form and remove any dead or broken branches.
D. Provide fertilizer to trees and groundcover after planting as recommended by nursery.
E. Install staking and guying as indicated on drawings.

END OF SECTION
SECTION 332000
WATER DISTRIBUTION

PART 1 GENERAL

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

1.02 SUMMARY
   A. This Section includes water-distribution piping and related components outside the building for water service and fire-service mains.
   B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.03 DEFINITIONS
   A. EPDM: Ethylene propylene diene terpolymer rubber.
   B. LLDPE: Linear, low-density polyethylene plastic.
   C. PE: Polyethylene plastic.
   D. PVC: Polyvinyl chloride plastic.

1.04 SUBMITTALS
   A. Product Data: For each type of product indicated.
   B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
   C. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.
   D. Field quality-control test reports.
   E. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE
   A. Regulatory Requirements:
1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

E. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

F. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

G. NSF Compliance:
   1. Comply with NSF 14 for plastic potable-water-service piping.
   2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
   1. Ensure that valves are dry and internally protected against rust and corrosion.
   2. Protect valves against damage to threaded ends and flange faces.
   3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
   1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
   2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.07 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 PRODUCTS

2.01 PVC PIPE AND FITTINGS

A. PVC, Schedule 40 Pipe: ASTM D 1785.
   1. PVC, Schedule 40 Socket Fittings: ASTM D 2466.

B. PVC, Schedule 80 Pipe: ASTM D 1785.
   1. PVC, Schedule 80 Socket Fittings: ASTM D 2467.
   2. PVC, Schedule 80 Threaded Fittings: ASTM D 2464.

C. PVC, AWWA Pipe: AWWA C900, Class 200 (DR14), with bell end with gasket, and with spigot end.
   1. Comply with UL 1285 for fire-service mains if indicated.
   2. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
      a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.02 JOINING MATERIALS

A. Brazing Filler Metals: AWS A5.8, BCuP Series.

B. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

C. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.03 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:
   1. Manufacturers: Subject to compliance with requirements of City of Tulsa.
   2. Nonrising-Stem, Resilient-Seated Gate Valves:
      a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
      1) Standard: AWWA C509.
      2) Minimum Pressure Rating: 200 psig.
      3) End Connections: Mechanical joint.
      4) Interior Coating: Complying with AWWA C550.

2.04 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:
1. Manufacturers: Subject to compliance with requirements of City of Tulsa.
2. Description: Sleeve and valve compatible with drilling machine.
   a. Standard: MSS SP-60.
   b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
   c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.
1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.05 CHECK VALVES

A. AWWA Check Valves:
   1. Manufacturers: Subject to compliance with requirements of City of Tulsa.
   2. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.
      b. Pressure Rating: 175 psig.

2.06 DETECTOR CHECK VALVES
1. Detector check valves will be subject to compliance with requirements of City of Tulsa

2.07 CORPORATION VALVES AND CURB VALVES

A. Manufacturers:
   1. Manufacturers: Subject to compliance with requirements of City of Tulsa.

B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.
   1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
   2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
   3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

C. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

D. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.
1. **Shutoff Rods**: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.08 **WATER METERS**
1. Water meters will be subject to compliance with requirements of City of Tulsa

2.09 **WATER METER BOXES**
1. Description: Cast-iron body and cover for disc-type water meter, with lettering "WATER METER" in cover, and with slotted, open-bottom base section of length to fit over service piping. Subject to compliance with requirements of City of Tulsa.

2.10 **PROTECTIVE ENCLOSURES**
A. Freeze-Protection Enclosures:
1. Description: Insulated enclosure designed to protect aboveground water piping, equipment, or specialties from freezing and damage, with heat source to maintain minimum internal temperature of 40 deg F when external temperatures reach as low as minus 34 deg F.
   b. Class I: For equipment or devices other than pressure or atmospheric vacuum breakers.
   c. Class I-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.
      1) Housing: Reinforced-aluminum or-fiberglass construction.
         a) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
         b) Drain opening for units with drain connection.
         c) Access doors with locking devices.
         d) Insulation inside housing.
         e) Anchoring devices for attaching housing to concrete base.
      2) Electric heating cable or heater with self-limiting temperature control.

2.11 **FIRE HYDRANTS**
A. Dry-Barrel Fire Hydrants:
1. Manufacturers: Subject to compliance with requirements of City of Tulsa.

PART 3 **EXECUTION**

3.01 **EARTHWORK**
A. Refer to Division 02 Section "Earthwork" for excavating, trenching, and backfilling.

3.02 **PIPING APPLICATIONS**
A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
C. Do not use flanges or unions for underground piping.
D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

3.03 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.
   3. Use the following for valves in vaults and aboveground:
      a. Gate Valves, NPS 2 and Smaller: Bronze, nonrising stem.
      b. Gate Valves, NPS 3 and Larger: AWWA, cast iron, OS&Y rising stem, resilient seated.
      c. Check Valves: AWWA C508, swing type.
   4. Pressure-Reducing Valves: Use for water-service piping in vaults and aboveground to control water pressure.
   5. Relief Valves: Use for water-service piping in vaults and aboveground.
      a. Air-Release Valves: To release accumulated air.
      b. Air/Vacuum Valves: To release or admit large volume of air during filling of piping.
      c. Combination Air Valves: To release or admit air.

3.04 PIPING INSTALLATION

A. Water-Main Connection: Tap water main according to requirements of City of Tulsa water utility company and of size and in location indicated.

B. Make connections larger than NPS 2 with tapping machine according to the following:
   1. Install tapping sleeve and tapping valve according to MSS SP-60.
   2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
   3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
   4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

C. Make connections NPS 2 and smaller with drilling machine according to the following:
   1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
   2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
   3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
   4. Install corporation valves into service-saddle assemblies.
   5. Install manifold for multiple taps in water main.
   6. Install curb valve in water-service piping with head pointing up and with service box.

D. Comply with NFPA 24 for fire-service-main piping materials and installation.
E. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

G. Bury piping with depth of cover over top at least 36 inches, with top at least 12 inches below level of maximum frost penetration, and according to the following:

H. Install piping by tunneling by boring, under streets and other obstructions that cannot be disturbed.

I. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
   1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

J. Sleeves are specified in Division 15 Section "Common Work Results for Plumbing."

K. Mechanical sleeve seals are specified in Division 15 Section "Common Work Results for Plumbing."

L. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping.

M. See Division 13 Section "Fire-Suppression Piping" for fire-suppression-water piping inside the building.

N. See Division 15 Section "Domestic Water Piping" for potable-water piping inside the building.

3.05 JOINT CONSTRUCTION

A. Make pipe joints according to the following:
   1. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
   2. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure. Refer to Division 15 Section "Common Work Results for Plumbing" for joining piping of dissimilar metals.

3.06 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
   1. Locking mechanical joints.
   2. Set-screw mechanical retainer glands.
   3. Bolted flanged joints.
   5. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
   2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.07 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.08 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according requirements of City of Tulsa.

3.09 ROUGHING-IN FOR WATER METERS

A. Rough-in piping and specialties for water meter installation according to utility company's written instructions.

3.10 WATER METER BOX INSTALLATION

A. Install water meter boxes in paved areas flush with surface.

B. Install water meter boxes in grass or earth areas with top 2 inches above surface.

3.11 PROTECTIVE ENCLOSURE INSTALLATION

A. Install concrete base level and with top approximately 2 inches above grade.

B. Install protective enclosure over valves and equipment.

C. Anchor protective enclosure to concrete base.

3.12 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. AWWA Fire Hydrants: Comply with AWWA M17.

3.13 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
B. See Division 15 Section "Common Work Results for Plumbing" for piping connections to valves and equipment.

C. Connect water-distribution piping to utility water main. Use tapping sleeve and tapping valve.

D. Connect water-distribution piping to interior domestic water piping.

E. Ground equipment according to Division 16 Section "Grounding and Bonding."

F. Connect wiring according to Division 16 Section "Conductors and Cables."

3.14 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
   1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.15 IDENTIFICATION

A. Install continuous underground warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 02 Section "Earthwork."

B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Division 15 Section "Common Work Results for Plumbing" for identifying devices.

3.16 CLEANING

A. Clean and disinfect water-distribution piping as follows:
   1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
   2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
   3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
      a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

D. Prepare reports of purging and disinfecting activities.

END OF SECTION
PART 1 GENERAL

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

1.02 SUMMARY
A. This Section includes gravity-flow, nonpressure and force-main, sanitary sewerage outside the building, with the following components:
   1. Pipe and fittings.
   2. Nonpressure and pressure couplings.
   3. Cleanouts.

1.03 DEFINITIONS
A. EPDM: Ethylene-propylene-diene-monomer rubber.
B. LLDPE: Linear low-density, polyethylene plastic.
C. PE: Polyethylene plastic.
D. PVC: Polyvinyl chloride plastic.
E. TPE: Thermoplastic elastomer.

1.04 PERFORMANCE REQUIREMENTS
A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water.

1.05 SUBMITTALS
A. Product Data: For the following:
   1. Special pipe fittings.
   2. Pipe materials

B. Shop Drawings: For the following:
   1. Manholes: Include plans, elevations, sections, details, and frames and covers. Include design calculations, and concrete design-mix report for cast-in-place manholes.

C. Field quality-control test reports.
1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic pipe and fittings in direct sunlight.
B. Protect pipe, pipe fittings, and seals from dirt and damage.
C. Handle manholes according to manufacturer's written rigging instructions.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.02 DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS

A. Pipe: ASTM C151, for push-on joints.
B. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.
C. Compact Fittings: AWWA C153, for push-on joints.
D. Gaskets: AWWA C111, rubber.

2.03 PVC PIPE AND FITTINGS

A. PVC, Schedule 40 Pipe: ASTM D 1785.
   1. PVC, Schedule 40 Socket Fittings: ASTM D 2466.

2.04 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
   1. Top-Loading Classification: Heavy and Extra-heavy duty.
   2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

PART 3 EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 02 Section "Earthwork."

3.02 PIPING APPLICATIONS

A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
   a. Shielded flexible couplings for same or minor difference OD pipes.
   b. Shielded, increaser/reducer-pattern, flexible or rigid couplings for pipes with different OD.
   c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
2. Use pressure-type pipe couplings for force-main joints.

B. Special Pipe Fittings: Use for pipe expansion and deflection. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

3.03 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install cleanouts for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Install gravity-flow, nonpressure, drainage piping according to the following:
   1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
   2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
   3. Install piping with 36-inch minimum cover.
   4. Install piping below frost line.
   5. Install ductile-iron special fittings according to AWWA C600.

F. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.04 PIPE JOINT CONSTRUCTION

A. Basic piping joint construction is specified in Division 15 Section "Common Work Results for Plumbing" Where specific joint construction is not indicated, follow piping manufacturer's written instructions.
B. Join gravity-flow, nonpressure, drainage piping according to the following:
   1. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.

3.05 CONCRETE PLACEMENT
   A. Place cast-in-place concrete according to ACI 318/318R.

3.06 CLEANOUT INSTALLATION
   A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
      1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
      2. Use medium-duty, top-loading classification cleanouts in paved foot-traffic areas.
      3. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.
      4. Use extra-heavy-duty, top-loading classification cleanouts in roads.
   B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.
   C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.07 CONNECTIONS
   A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 15 Section "Sanitary Waste and Vent Piping."
   B. Make connections to existing piping.
      1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
      2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
      3. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.08 IDENTIFICATION
   A. Materials and their installation are specified in Division 02 Section "Earthwork." Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
      1. Use warning tape or detectable warning tape over ferrous piping.
      2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.
3.09 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
   1. Submit separate report for each system inspection.
   2. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 95 percent of piping diameter.
      c. Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leakage into piping.
      e. Exfiltration: Water leakage from or around piping.
   3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
   4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
   1. Do not enclose, cover, or put into service before inspection and approval.
   2. Test completed piping systems according to requirements of authorities having jurisdiction.
   3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
   4. Submit separate report for each test.
   5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
      a. Allowable leakage is maximum of 10 gal./inch of nominal pipe size per mile of pipe, during 24-hour period.
      b. Close openings in system and fill with water.
      c. Purge air and refill with water.
      d. Disconnect water supply.
      e. Test and inspect joints for leaks.
      f. Option: Test ductile-iron piping according to AWWA C600, "Hydrostatic Testing" Section. Use test pressure of at least 10 psig.
   6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
      a. Option: Test plastic gravity sewer piping according to ASTM F 1417.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.10 CLEANING

A. Clean interior of piping of dirt and superfluous material. Flush with potable water.

END OF SECTION
PART 1        GENERAL

1.01        RELATED DOCUMENTS

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

1.02        SUMMARY

A. This Section includes gravity-flow, nonpressure storm drainage outside the building, with the following components:
   1. Drains and pipes.
   2. Inlets

1.03        DEFINITIONS

A. EPDM: Ethylene-propylene-diene-monomer rubber.

B. LLPE: Linear low-density, polyethylene plastic.

C. PE: Polyethylene plastic.

D. PVC: Polyvinyl chloride plastic.

E. TPE: Thermoplastic elastomer.

1.04        PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water. Pipe joints shall be at least silttight, unless otherwise indicated.

1.05        SUBMITTALS

A. Product Data: For the following:
   1. Catch Basins
   2. Pipe and fittings
   3. Stormwater Inlets
   4. Manholes

B. Shop Drawings: For the following:
   1. Manholes: Include plans, elevations, sections, details, and frames and covers
   2. Catch Basins and Stormwater Inlets: Include plans, elevations, sections, details, and frames, covers, and grates.
C. Field quality-control test reports.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes, catch basins, and stormwater inlets according to manufacturer's written rigging instructions.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.02 PE PIPE AND FITTINGS

A. Corrugated PE Drainage Pipe and Fittings NPS 10 and Smaller: AASHTO M 252M, Type S, with smooth waterway for coupling joints.
   1. Silt tight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.

B. Corrugated PE Pipe and Fittings NPS 12 to NPS 48: AASHTO M 294M, Type S, with smooth waterway for coupling joints.
   1. Silt tight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.

C. Corrugated PE Pipe and Fittings NPS 56 and NPS 60: AASHTO MP7, Type S, with smooth waterway for coupling joints.
   1. Silt tight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.

2.03 PVC PIPE AND FITTINGS

A. PVC Water-Service Pipe and Fittings: ASTM D 1785, Schedule 40 pipe, with plain ends for solvent-cemented joints with ASTM D 2466, Schedule 40, socket-type fittings.

B. PVC Sewer Pipe and Fittings, NPS 15 (DN 375) and Smaller: ASTM D 3034, SDR 35 with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.


D. PVC Profile Gravity Sewer Pipe and Fittings: ASTM F 794 pipe, with bell-and-spigot ends; ASTM D 3034 fittings, with bell ends; and ASTM F 477, elastomeric seals.
2.04 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76, with bell-and-spigot or groove and tongue ends.
   1. Gasketed joints with ASTM C 443, rubber gaskets, “omni-flex” or equal
   2. Class III, Wall A.

2.05 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

2.06 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
   1. Top-Loading Classification(s): Extra-heavy duty.
   2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.07 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:
   1. Cement: ASTM C 150, Type II.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water-cementitious materials ratio.
   2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

2.08 MANHOLES

A. Standard Precast Concrete Manholes: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
   1. Diameter: 48 inches minimum, unless otherwise indicated.
   2. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
   3. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
   4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
   5. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
6. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.

7. Steps: Individual FRP steps, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.

8. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.

9. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.

10. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch-minimum width flange and 26-inch-diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

2.08 CATCH BASINS

A. Standard Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
   1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
   2. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
   3. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
   5. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
   6. Grade Rings: Include 2 or 3 reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and grate.
   7. Steps: Individual FRP steps, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches.
   8. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

2.09 PIPE OUTLETS

A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.

2.10 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 02 Section "Earthwork."
2.11 PIPING INSTALLATION
A. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

2.12 PIPE JOINT CONSTRUCTION
A. Basic pipe joint construction is specified in Division 02 Section "Piped Utilities – Basic Materials and Methods." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

2.13 CATCH BASIN INSTALLATION
A. Construct catch basins to sizes and shapes indicated.
B. Set frames and grates to elevations indicated.

2.14 CONCRETE PLACEMENT
A. Place cast-in-place concrete according to ACI 318/318R.

2.15 FIELD QUALITY CONTROL
A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
   a. Alignment: Less than full diameter of inside of pipe is visible between structures.
   b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
   c. Crushed, broken, cracked, or otherwise damaged piping.
   d. Infiltration: Water leakage into piping.
   e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

2.16 CLEANING
A. Clean interior of piping of dirt and superfluous materials.
PART 3 EXECUTION

3.01 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 02 Section "Earthwork."

3.02 PIPING APPLICATIONS

A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
   1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
      a. Shielded flexible couplings for same or minor difference OD pipes.
      b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
      c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping’s OD and larger piping's ID permits installation.
   2. Use pressure-type pipe couplings for force-main joints.

B. Special Pipe Fittings: Use for pipe expansion and deflection. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

3.03 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

F. Install gravity-flow, nonpressure drainage piping according to the following:
   1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
   2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
   3. Install piping with 36-inch minimum cover.
   4. Install piping below frost line.
5. Install PE corrugated sewer piping according to CPPA's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."
6. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
7. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.04 PIPE JOINT CONSTRUCTION

A. Basic pipe joint construction is specified in Division 02 Section "Piped Utilities – Basic Materials and Methods." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, nonpressure drainage piping according to the following:
   1. Join corrugated PE piping according to CPPA 100 and the following:
      a. Use silttight couplings for Type 1, silttight joints.
      b. Use soiltight couplings for Type 2, soiltight joints.
   2. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric gasket joints.
   3. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
   5. Join dissimilar pipe materials with nonpressure-type flexible couplings.

C. Join dissimilar pipe materials with pressure-type couplings.

3.05 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
   1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
   2. Use medium-duty, top-loading classification cleanouts in paved foot-traffic areas.
   3. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.
   4. Use extra-heavy-duty, top-loading classification cleanouts in roads areas.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.06 DRAIN INSTALLATION

A. Install type of drains in locations indicated.
   1. Use light-duty, top-loading classification drains in earth or unpaved foot-traffic areas.
   2. Use medium-duty, top-loading classification drains in paved foot-traffic areas.
   3. Use heavy-duty, top-loading classification drains in vehicle-traffic service areas.
   4. Use extra-heavy-duty, top-loading classification drains in roads areas.

B. Embed drains in 4-inch minimum depth of concrete around bottom and sides.

C. Fasten grates to drains if indicated.
D. Set drain frames and covers with tops flush with pavement surface.

3.07 MANHOLE INSTALLATION
A. General: Install manholes, complete with appurtenances and accessories indicated.
B. Install precast concrete manhole sections according to ASTM C 891.
C. Construct cast-in-place manholes as indicated.
D. Install PE sheeting on earth where cast-in-place-concrete manholes are to be built.
E. Install FRP manholes according to manufacturer's written instructions.
F. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere, unless otherwise indicated.

3.08 CATCH BASIN INSTALLATION
A. Construct catch basins to sizes and shapes indicated.
B. Set frames and grates to elevations indicated.

3.09 STORMWATER INLET AND OUTLET INSTALLATION
A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.
B. Construct riprap of broken stone, as indicated.
C. Install outlets that spill onto grade, anchored with concrete, where indicated.
D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
E. Construct energy dissipaters at outlets, as indicated.

3.10 CONCRETE PLACEMENT
A. Place cast-in-place concrete according to ACI 318/318R.

3.11 STORMWATER DISPOSAL SYSTEM INSTALLATION
A. Piping Systems: Excavate trenches of width and depth, and install piping system, filter fabric, and backfill according to piping manufacturer's written instructions.
3.12 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 15 Section "Storm Drainage Piping."
   1. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

B. Connect to sediment interceptors specified in Division 02 Section "Interceptors."

3.13 IDENTIFICATION

A. Materials and their installation are specified in Division 02 Section "Earthwork." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
   1. Use warning tape over piping and over edges of underground structures.

3.14 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
   1. Submit separate reports for each system inspection.
   2. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
      c. Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leakage into piping.
      e. Exfiltration: Water leakage from or around piping.
   3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
   4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
   1. Do not enclose, cover, or put into service before inspection and approval.
   2. Test completed piping systems according to authorities having jurisdiction.
   3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
   4. Submit separate report for each test.
   5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
      a. Exception: Piping with soiltite joints unless required by authorities having jurisdiction.
      b. Option: Test plastic piping according to ASTM F 1417.
      c. Option: Test concrete piping according to ASTM C 924.
      d. Ductile-Iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.
      e. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.

C. Leaks and loss in test pressure constitute defects that must be repaired.
D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.15 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water as required.

END OF SECTION
GENERAL NOTES

1. SHOP DRAWINGS SHALL BE ORIGINAL DRAWINGS, PREPARED BY CONTRACTOR, SUBCONTRACTOR, SUPPLIER OR DISTRIBUTOR.

2. CONTRACTOR SHALL SUPPLY ALL ITEMS FOR ATTACHING MECHANICAL AND ELECTRICAL EQUIPMENT TO THE BUILDING STRUCTURE TO RESIST ALL LOADS INCLUDING SEISMIC FORCES. ATTACHMENT SHALL BE MADE SO AS NOT TO OVERSTRESS STRUCTURAL MEMBERS.

3. CONCRETE REINFORCING SHALL MEET THE FOLLOWING:
   A. REINFORCING BARS SHALL CONFORM TO THE REQUIREMENTS OF ASTM A615 GRADE 60. REINFORCING BARS REQUIRED TO BE WELDED ALONG LENGTH.
   B. VERIFICATION OF ALL DIMENSIONS AND MEMBER SIZES RELATING TO EXISTING BUILDING.
   C. VERIFICATION OF ALL FLOOR DEPRESSIONS AND OFFSETS WITH ARCHITECTURAL DRAWINGS.
   D. REMOVE ALL ABANDONED FOUNDATIONS, UTILITIES, PIPELINES, ETC. THAT INTERFERE WITH NEW CONSTRUCTION.
   E. MISCELLANEOUS:
      1. ALL STRUCTURAL CONCRETE HAS BEEN DESIGNED IN ACCORDANCE WITH ACI 318-02 AND THE BUILDING CODE.
      2. STEEL CONSTRUCTION IN ACCORDANCE WITH 2015 IBC SECTION 1705
      3. ALL ROOF OPENINGS GREATER THAN 6" WIDE MEASURED PARALLEL TO THE SUPPORTING MEMBERS SHALL BE FRAMED WITH SPECIAL INSPECTIONS
      4. INSULATION IS REQUIRED FOR ROOFS WITH A COPING HEIGHT LESS THAN 12".
      5. INTERNAL AND EXTERNAL ROOF/SIDING JOINTS ARE TO BE COVERED WITH SLOW CURING ADHESIVES.
      6. PROVIDE TEMPORARY BRACING AND SHORING AS REQUIRED FOR STABILITY DURING CONSTRUCTION.

4. MATERIALS TESTING:
   A. DURING THE PREPARATION OF TEST PRISMS.
   B. DURING PLACEMENT OF REINFORCING STEEL AND GROUT.
   C. UPON COMPLETION OF THE ASSIGNED WORK THE ENGINEER OR ARCHITECT SHALL COMPLETE AND SIGN THE APPROPRIATE FORMS CERTIFYING THAT TO THE BEST OF HIS KNOWLEDGE THE WORK IS IN CONFORMANCE WITH THE REQUIREMENTS OF THE DRAWINGS, SPECIFICATIONS, BUILDING CODE, AND ELECTRICAL DRAWINGS FOR ADDITIONAL REQUIREMENTS.

5. SPECIAL INSPECTIONS:
   A. SPECIAL INSPECTOR SHALL OBSERVE THE WORK ASSIGNED TO VERIFY THAT IT IS IN ACCORDANCE WITH THE DRAWINGS, SPECIFICATIONS, AND TO THE ENGINEER OR ARCHITECT OF RECORD. ALL DISCREPANCIES SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE CONTRACTOR AND PROJECT SUPERVISOR.
   B. THE AGENCY IN CHARGE OF SPECIAL INSPECTION SHALL PROVIDE INSPECTION REPORTS TO THE BUILDING OFFICIAL.
   C. SPECIAL INSPECTIONS ARE REQUIRED FOR THE FOLLOWING:
      1. FOUNDATIONS
      2. FOUNDATION COMPONENTS
      3. CAST CONCRETE PIER CAPS/PEDESTALS AND GRADE BEAMS
      4. CAST IN PLACE CONCRETE PIER CAPS/PEDESTALS AND GRADE BEAMS
   D. BID DEPTH FOR BOTTOM OF PIERS SHALL BE AT ELEVATION 18'-6" BELOW GRADE. BOTTOM OF PIER ELEVATION IS APPROXIMATE AND SHALL BE CAST AGAINST EARTH.
   E. REINFORCING FOR ALL PIERS SHALL BE SUPPORTED FROM ABOVE OR WITH BOTTOM BOLSTERS WHILE DEPOSITING CONCRETE IN FORMS. SIDE CAST SLABS ON GRADE (COVER FROM TOP OF SLAB) 1 1/2" MINIMUM.
   F. ALL PIER CAPS/PEDESTALS AND GRADE BEAMS ARE DESIGNED WITH FORMED SIDES. IF THE CONTRACTOR ELECTS TO USE EARTH FORMED SIDES, THIS MUST BE APPROVED BY THE ENGINEER OR ARCHITECT.
   G. PIPE A53B TYPE 35 STRUCTURAL SHAPES AND PLATES A572 50 STRUCTURAL SHAPES AND PLATES.
## Standard Structural Details

### Classroom Addition

**Address:** 2182 South 73rd East Ave., Tulsa OK

**Classroom Addition**

**Issue Date:** 06.20.18

**Tulsa Public Schools Consultant:**

**Architect:**

**Project No.:** 17-03900

**Seals:**

**Construction Documents:**

---

**Column Base Plate**

**Elevation**

**Holes in Base Plate**

**Non-Shrink Grout**

**Column Size**

**Base Plate Dimensions (Inches)**

**Column, Base Plate and Anchor Bolt Schedule**

**Elevation Control Shall Be**

**Leveling and**

**Means of**

**Anchor Bolts and**

**HSS 4x4x3/8**

**Schedule for**

**Column Size**

**Base Plate Dimensions (Inches)**

**Column, Base Plate and Anchor Bolt Schedule**

**Not to Scale**

---

**Framed Roof Opening Detail**

**Typical Lintel Schedule**

**Typical Cont. Chord**

**Splice Detail**

**Typical Light Gauge Framing Details**

**Typical Steel Stud Wall - Screw Connection**

---

**Steel Stud Notch Repair Detail**

---

**Steel Stud Schedule**

---

**Anchor Bolt Ties**

---

**Frame Door Opening Detail**

---

**Header Schedule**

---

**Header Schedule - Exterior Walls**

---

**Notes:**

1. Refer to the specifications for interior metal stud gages and spacing, unless noted otherwise on foundation and framing plans and details.

2. Each header shall include (3)-6"x16 gage track sections as minimum at header top and bottom.

3. Double stud where shown on plan.

4. #10-16 teks 3 screws each side.

5. (3) #10-16 x 6" x 1 5/8" 16 gage.

6. (4) #10-16 teks 3 screws. 7. #10-16 teks 3 screws at 12" O.C. at each side ((2) per each track top and bottom.

8. Intermediate steel stud blocking.

9. Powder Actuated Fasteners (see note 2).

---

**Column Base Plate**

---

**Schedule for Column Size**

**Base Plate Dimensions (Inches)**

**Column, Base Plate and Anchor Bolt Schedule**

**Elevation**

**Holes in Base Plate**

---

**Typical Steel Stud Wall - Screw Connection**

---

**Steel Stud Notch Repair Detail**

---

**Steel Stud Schedule**

---

**Anchor Bolt Ties**

---

**Frame Door Opening Detail**

---

**Header Schedule**

---

**Header Schedule - Exterior Walls**

---

**Notes:**

1. Refer to the specifications for interior metal stud gages and spacing, unless noted otherwise on foundation and framing plans and details.

2. Each header shall include (3)-6"x16 gage track sections as minimum at header top and bottom.

3. Double stud where shown on plan.

4. #10-16 teks 3 screws each side.

5. (3) #10-16 x 6" x 1 5/8" 16 gage.

6. (4) #10-16 teks 3 screws. 7. #10-16 teks 3 screws at 12" O.C. at each side ((2) per each track top and bottom.

8. Intermediate steel stud blocking.

9. Powder Actuated Fasteners (see note 2).

---

**Column Base Plate**

---

**Schedule for Column Size**

**Base Plate Dimensions (Inches)**

**Column, Base Plate and Anchor Bolt Schedule**

**Elevation**

**Holes in Base Plate**

---

**Typical Steel Stud Wall - Screw Connection**

---

**Steel Stud Notch Repair Detail**

---

**Steel Stud Schedule**

---

**Anchor Bolt Ties**

---

**Frame Door Opening Detail**

---

**Header Schedule**

---

**Header Schedule - Exterior Walls**

---

**Notes:**

1. Refer to the specifications for interior metal stud gages and spacing, unless noted otherwise on foundation and framing plans and details.

2. Each header shall include (3)-6"x16 gage track sections as minimum at header top and bottom.

3. Double stud where shown on plan.

4. #10-16 teks 3 screws each side.

5. (3) #10-16 x 6" x 1 5/8" 16 gage.

6. (4) #10-16 teks 3 screws. 7. #10-16 teks 3 screws at 12" O.C. at each side ((2) per each track top and bottom.

8. Intermediate steel stud blocking.

9. Powder Actuated Fasteners (see note 2).

---

**Column Base Plate**

---

**Schedule for Column Size**

**Base Plate Dimensions (Inches)**

**Column, Base Plate and Anchor Bolt Schedule**

**Elevation**

**Holes in Base Plate**

---

**Typical Steel Stud Wall - Screw Connection**

---

**Steel Stud Notch Repair Detail**

---

**Steel Stud Schedule**

---

**Anchor Bolt Ties**

---

**Frame Door Opening Detail**

---

**Header Schedule**

---

**Header Schedule - Exterior Walls**

---

**Notes:**

1. Refer to the specifications for interior metal stud gages and spacing, unless noted otherwise on foundation and framing plans and details.

2. Each header shall include (3)-6"x16 gage track sections as minimum at header top and bottom.

3. Double stud where shown on plan.

4. #10-16 teks 3 screws each side.

5. (3) #10-16 x 6" x 1 5/8" 16 gage.

6. (4) #10-16 teks 3 screws. 7. #10-16 teks 3 screws at 12" O.C. at each side ((2) per each track top and bottom.

8. Intermediate steel stud blocking.

9. Powder Actuated Fasteners (see note 2).

---

**Column Base Plate**

---

**Schedule for Column Size**

**Base Plate Dimensions (Inches)**

**Column, Base Plate and Anchor Bolt Schedule**

**Elevation**

**Holes in Base Plate**

---

**Typical Steel Stud Wall - Screw Connection**

---

**Steel Stud Notch Repair Detail**

---

**Steel Stud Schedule**

---

**Anchor Bolt Ties**

---

**Frame Door Opening Detail**

---

**Header Schedule**

---

**Header Schedule - Exterior Walls**

---

**Notes:**

1. Refer to the specifications for interior metal stud gages and spacing, unless noted otherwise on foundation and framing plans and details.

2. Each header shall include (3)-6"x16 gage track sections as minimum at header top and bottom.

3. Double stud where shown on plan.

4. #10-16 teks 3 screws each side.

5. (3) #10-16 x 6" x 1 5/8" 16 gage.

6. (4) #10-16 teks 3 screws. 7. #10-16 teks 3 screws at 12" O.C. at each side ((2) per each track top and bottom.

8. Intermediate steel stud blocking.

9. Powder Actuated Fasteners (see note 2).

---

**Column Base Plate**

---

**Schedule for Column Size**

**Base Plate Dimensions (Inches)**

**Column, Base Plate and Anchor Bolt Schedule**

**Elevation**

**Holes in Base Plate**

---

**Typical Steel Stud Wall - Screw Connection**

---

**Steel Stud Notch Repair Detail**

---

**Steel Stud Schedule**

---

**Anchor Bolt Ties**

---

**Frame Door Opening Detail**

---

**Header Schedule**

---

**Header Schedule - Exterior Walls**

---

**Notes:**

1. Refer to the specifications for interior metal stud gages and spacing, unless noted otherwise on foundation and framing plans and details.

2. Each header shall include (3)-6"x16 gage track sections as minimum at header top and bottom.

3. Double stud where shown on plan.

4. #10-16 teks 3 screws each side.

5. (3) #10-16 x 6" x 1 5/8" 16 gage.

6. (4) #10-16 teks 3 screws. 7. #10-16 teks 3 screws at 12" O.C. at each side ((2) per each track top and bottom.

8. Intermediate steel stud blocking.

9. Powder Actuated Fasteners (see note 2).
**BEAM CONNECTION SCHEDULE**

<table>
<thead>
<tr>
<th>BEAM SIZE</th>
<th>PLATE &quot;T&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>W8, W10</td>
<td>3/8&quot;, 3/8&quot;</td>
</tr>
<tr>
<td>W12, W14</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>W16</td>
<td>3/8&quot;, 3/8&quot;</td>
</tr>
<tr>
<td>W18</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>W21</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>W24</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>W30</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>W33</td>
<td>1/2&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PLATE &quot;W&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/16&quot;, 5/16&quot;, 5/16&quot;, 5/16&quot;</td>
</tr>
<tr>
<td>1/4&quot;, 1/4&quot;, 1/4&quot;, 1/4&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BOLT QTY.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2, 3, 4, 5, 6, 7, 9, 10</td>
</tr>
</tbody>
</table>

*"T" SHEAR PLATE WITH 3 DIA A325 BOLTS (U.N.O.)*

*BOLT QTY. PER SCHEDULE*

| 3/16 |
| 3/16 |
| 3/8" |

**PLATE "T" EACH SIDE OF WEB** 1/2" CAP PLATE W/ 4-3 DIA BOLTS

**1/4" STIFFENER PLATE EACH SIDE OF BEAM WEB**

**COLUMN TYP.**

| 1/4 |
| 1/4 |

**GRID**

| 6" MIN. |
| 6" MIN. |

**HSS COLUMN TYP.**

| 1/4 |
| 1/4 |

**5/8" THICK CAP PLATE AS REQ'D**

**HSS BRACE, SLOTTED AT ENDS**

| 4" MIN. |
| 1/4 |

**4" MIN.**

**GRID**

| 6" MIN. |
| 6" MIN. |

**TYP.**

| 1/4 |
| 1/4 |

**5/8" THICK CAP PLATE AS REQ'D**

**HSS BRACE, SLOTTED AT ENDS**

**TYP.**

| 1 1/2" NON-SHRINK GROUT |

**BRACE, SLOTTED AT ENDS**

**COLUMN**

| 1/4 |
| 1/4 |

**1/2" THICK PLATE AS REQ'D**

**NOTE:** WHERE NECESSARY INCREASE BASE PLATE DIMENSIONS TO ACCOMMODATE BRACING CONNECTION PLATE

**WORK POINT**

| 8" |
| 10" |

**TOP OF SLAB**

**TYP.**

| HSS 5x5x3/8 |
| HSS 5x5x1/4 |

| T=C=23.7K |
| T=C=19.2K |

**NOTE:** WHERE NECESSARY INCREASE BASE PLATE DIMENSIONS TO ACCOMMODATE BRACING CONNECTION PLATE

**WORK POINT**

| 5/S2.3 |
| 5/S2.3 |

**TYP.**

| HSS 5x5x1/4 |
| HSS 5x5x1/4 |

| T=19.2K |
| T=23.7K |

**COLUMN**

| 1/4 |
| 1/4 |

**1/2" THICK PLATE AS REQ'D**

**TOP OF SLAB**

**NOTE:** WHERE NECESSARY INCREASE BASE PLATE DIMENSIONS TO ACCOMMODATE BRACING CONNECTION PLATE

**WORK POINT**

| 8" |
| 10" |

**TOP OF SLAB**

**TYP.**

| HSS 5x5x1/4 |
| HSS 5x5x1/4 |

| T=19.2K |
| T=23.7K |

**NOTE:** WHERE NECESSARY INCREASE BASE PLATE DIMENSIONS TO ACCOMMODATE BRACING CONNECTION PLATE

**WORK POINT**

| 8" |
| 10" |

**TOP OF SLAB**

**TYP.**

| HSS 5x5x1/4 |
| HSS 5x5x1/4 |

| T=19.2K |
| T=23.7K |