855 Abutment Road
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Dalton, GA 30721
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Additions & Renovations to:

EMS STATION #30

2017 E. CHEROKEE DRIVE, WOODSTOCK GA 30188

CHEROKEE COUNTY BOARD OF COMMISSIONERS

JOB NO.: 23-017

DATE ISSUED: 03/13/24

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SECTION 000215 - CLIMATALOGICAL DATA

PART ONE - GENERAL

1.01 DESCRIPTION:

A. The Contractor agrees that said Work shall be executed regularly, diligently and uninterruptedly at such rate of progress as shall ensure full completion of the entire project and its many and separate components and subcontractors, vendors and suppliers, thereof within the time specified.

B. It is expressly understood and agreed that the Contractor has visited the site where the work of the Project is to be performed, has considered all contingencies and factors affecting the Contractor's ability to perform all the Work within the time specified, including among others, delays caused by inclement weather (temperature and all forms of precipitation) and other possible delays caused by the climitalogical conditions prevailing in the general localities and recording stations of Cherokee County, Georgia.

C. After consideration of these factors, the Contractor has made allowances for such factors before determining and submitting his Bid and executing the Construction Agreement agreeing to the completion times and durations specified in the Contract Documents, and does, further, agree that all things considered, such completion durations are a reasonable time for completion of all Work to be performed hereunder, without the need for any extension of time or any other reasons than those specified below.

D. The Project's completion time shall not be extended for normal inclement weather for the named locale. Inclement weather days (for temperature and all forms of precipitation) per month have been anticipated and included in the contractual time period given for project completion. The Contractor's written and documented request to Cherokee County, through the Project Architect Engineer, for additional time may only be granted for actual days beyond those normally anticipated for the locale, per the schedule below, and only for which work was actually, significantly impeded or precluded by the documented inclement weather.

January	22 Calendar Days
February	16 Calendar Days
March	11 Calendar Days
April	7 Calendar Days
May	4 Calendar Days
June	6 Calendar Days
July	8 Calendar Days
August	6 Calendar Days
September	4 Calendar Days
October	5 Calendar Days
November	9 Calendar Days
December	15 Calendar Days

E. The burden of proof and documentation for such request for additional time beyond the days indicated shall rest solely with the Contractor. Documentation must clearly show the additional weather days (for above normal inclement temperature and all forms of precipitation) are historically unique to the Cherokee County, Georgia, area in general, and

the Project's site in particular.

F. In the granting and approving of any additional time for completion of the Project, by a mutually agreed upon and properly executed Change Order, in no instance shall a change in Contract Sum be granted to the Contractor by Cherokee County for any adjustments to the Contract Time due to weather.

G. Requests for time extensions for delays due to inclement weather shall be reported by the Contractor, and considered and evaluated on a quarterly basis, as determined by the Project Architect or Engineer, in consultation with Cherokee County. Only those actual days lost in excess of the cumulative allowable number of inclement weather calendar days, according to the schedule and data provided, will be considered. Time extensions for time losses due to weather conditions will be considered only for full complete calendar days.

H. No deduction or reduction in the contract time shall be made due to weather conditions of temperature and precipitation below or less than the anticipated or historical forecast.

I. Bidders shall review the climitalogical information as they solely deem necessary, and draw their own individual conclusions for bidding and contracting purposes.

END OF SECTION

SECTION 000233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section includes administrative and procedural requirements for the following:
   1. Preconstruction photographs.
   2. Periodic construction photographs.

B. Related Sections:
   1. Division 01 Section "Contract Closeout" for submitting photographic documentation as Project Record Documents at Project closeout.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Contractor, Architect or Engineer and County shall mutually determine location for each photograph to be taken each time. Once established, Contractor shall endeavor to take all future photographs from same vantage point as the Work progresses to the established Date of Substantial Completion. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within 2 days of taking photographs.
   1. Digital Camera: Minimum sensor resolution of 8 megapixels County shall establish and confirm digital photographic requirements at start of Project before first photographs are to be taken by the Contractor.
   2. Identification: Provide the following information with each image description in file metadata tag:
      a. Name of Project.
      b. Name and contact information for photographer.
      c. Date photograph was taken.
      d. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

C. Construction Photographs: Submit two prints of each photographic view with each monthly application and certificate for payment. Applications will not be processed without photographic information submitted as required and as acceptable to the County.

   1. Format: 8 x 10-inch smooth-surface matte prints on single-weight commercial-grade photographic paper, mounted on linen or card stock to allow a 1-inch- (25-mm-) wide margin and enclosed back to back in clear plastic sleeves that are punched for standard three-ring binder.

   2. Identification: On back of each print, provide an applied label or rubber-stamped impression with the following information:
      a. Cherokee County
      b. Name of Project.
      c. Name and contact information for photographer.
      d. Name of Architect or Engineer.

e. Name of Contractor.
f. Date photograph was taken if not date stamped by camera.
g. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
h. Unique sequential identifier keyed to accompanying key plan.

1.3 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years; or as may be otherwise approved by the County.

1.4 COORDINATION

A. Auxiliary Services: Cooperate with photographer and provide auxiliary services requested, including access to Project site and use of temporary facilities, including temporary lighting required to produce clear, well-lit photographs.

1.5 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to County for unlimited reproduction and display of photographic documentation.

B. Contractor may retain or obtain copies of all photographs taken for his own records, and may take additional photographs for his own purposes.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, with minimum size of 8 megapixels.

B. All photographs taken for the County shall be color.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified photographer to take construction photographs.

B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Date and Time: Include date and time in file name for each image.
2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect, Engineer and County.

D. Preconstruction Photographs: Before commencement of excavation or starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.

1. Flag construction limits before taking construction photographs.
2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
3. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction; including where necessary all underground or covered existing conditions that are to be disturbed or might be disturbed by the Work of the Project.

E. Periodic Construction Photographs: Take as required photographs with the cutoff date associated with each Application and Certificate for Payment. Select vantage points to show status of construction and progress since last photographs were taken for each established point of photography.

F. Final Completion Construction Photographs: Take as necessary color photographs after date of Substantial Completion for submission as Project Record Documents. Architect or Engineer will inform photographer of desired vantage points.

G. Additional Photographs: Architect or County may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum or in the allowance for construction photographs.

1. Three days' notice will be given, where feasible.
2. In emergency situations, take such photographs as are needed or necessary to document and record such emergency condition, and take additional photographs within 24 hours of request.
3. Circumstances that could require additional photographs include, but are not limited to, the following. These photographs are not subject to unit prices or unit-cost allowances or additional compensation to the Contractor by the County:
    a. Special events planned or that occur at Project site.
    b. Immediate follow-up when on-site events result in construction damage or losses.
    c. Photographs to be taken at fabrication locations away from Project site.
    d. Substantial Completion of a major phase or component of the Work.
    e. Extra record photographs at time of final acceptance.
    f. Special publicity photographs.

END OF SECTION

Cherokee County
Board of Commissioners

Capital Projects Office
1130 Bluffs Parkway
Canton, Georgia 30114

GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

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END OF THE INDEX

GENERAL CONDITIONS
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SECTION 01
DEFINITIONS OF TERMS

Wherever used in the Contract Documents, the following terms shall have the meanings indicated which shall be applicable to both the singular and plural thereof:

"Addenda" shall mean written or graphic instruments issued to Bidders prior to the receipt of Bids by the County and the execution of this Construction Agreement which modify or interpret the Contract Documents by additions, deletions, clarifications, or corrections.

"Architect" "Engineer" or Engineer/Engineer" shall mean an individual, partnership, or corporation performing professional Architectural and/or Engineering services for and contracted to the County as an independent contractor or consultant.

"Balanced Bid" shall mean a Bid in which each of the unit prices and total amount bid for each of the listed items reasonably reflects the value of that item with regard to the entire job considering the prevailing cost of labor, material and equipment in the relevant market. An "Unbalanced Bid" is when, in the opinion of the County, any unit prices or total amounts bid on any of the listed items do not reasonably reflect such values. A Bid determined by the County to an unbalanced bid may determine the Bid to non-responsive and cause for rejection of the Bid in whole.

"Bid" shall mean the offer or Proposal of the Bidder submitted on the prescribed form setting forth the price(s) for the Work to be performed.

"Bidder" shall mean any person, firm, or corporation submitting a Bid for the Work.

"Bonds" shall mean Bid, Performance, and Labor & Material Payment Bonds and other instruments of security, furnished by the Contractor and his surety in accordance with the Contract Documents.

"Capital Projects Office Program Manager" shall mean Cherokee County's Capital Projects Office, Cherokee County Board of Commissioners' authorized representative. The term "Capital Projects Office Program Manager" means the Program Manager or the Program Manager's authorized representative.

"Change Order" shall mean a written order to the Contractor authorizing an addition, deletion, or revision in the Work within the general scope of the Contract Documents, or authorizing an adjustment in the Contract Scope of Work, Contract Price or Contract Time, as approved by the Board of Commissioners of Cherokee County, or exempted from Board approval for Contract Price changes up to the amount of Twenty-Five Thousand Dollars ($25,000.00.)

"Contract Documents" shall consist of all Sections of Division 00 of the Bidding Requirements and Conditions of the Contract, including, but not limited to the following: Advertisement and Invitation for Bids, Instructions to Bidders, Bid Proposal, Bid Bond, Non-Influence and Non-Collusion Affidavit, Certificate of Bidder, Construction Agreement, Performance Bond and Labor & Material Payment Bonds, Certificates of Insurance, Notice to all Bidders, General Conditions of the Contract for Construction, Supplementary Conditions; all Sections of Division 01 of the General Requirements

of the Contract; All Divisions and Sections of the Technical Specifications; all Drawings; all Addenda, if any, issued prior to the receipt of Bids, all post-bid and additional information, if any, requested and accepted by the County and submitted by the Contractor in support of the County's determination for acceptance of the Contractor's Bid for award of the Contract; the letter of Notice of Award, the letter of Notice to Proceed. The intent of these documents being to define, to determine and to include all materials, appliances, tools, labor, plant & equipment, project and construction management and supervision and all other needed services of every kind necessary for the proper execution by the Contractor of the Work, and the terms and conditions of payment therefore. The Contract Documents shall be considered as one, and whatever is called for by any one of them shall be as binding as if called for by all.

"Contract" or "Construction Agreement" shall mean this Construction Agreement and all its requirements and attachments and exhibits and references regarding the terms and conditions for the performance of the Work by the Parties to the Construction Agreement.

"Contract Price" or "Contract Sum" shall mean the total monies payable to the Contractor under the terms and conditions of the Contract Documents.

"Contract Time" or "Construction Time" shall mean the number of calendar days stated in the Contract Documents for the completion of the Work.

"Contractor" or "General Contractor" shall mean the individual, firm, or corporation undertaking the execution of the Work as an independent contractor under the terms of the Contract and acting through his or its agents or employees.

"County" shall mean Cherokee County, a political subdivision of the State of Georgia, acting by and through its governing authority, the Cherokee County Board of Commissioners; or its Capital Projects Office responsible for the administration of this Contract on behalf of the County.

"Day" shall mean a calendar day.

"Drawings" shall mean the part of the Contract Documents which show largely through graphical presentation the characteristics and scope of the Work to be performed and which have been prepared or approved by the Architect or Engineer.

"Field Order" shall mean a written order effecting a minor change, modification or clarification in the Work not involving an adjustment in the Contract Price or an extension of the Contract Time, issued by the Architect or Engineer to the Contractor during construction.

"Notice of Award" shall mean the written notice of the acceptance of the Bid from the County to the successful Bidder as evidenced by return receipts of registered or certified letters.

"Notice to Proceed" shall mean written communication issued by the County to the Contractor authorizing him to proceed with the Work and establishing the dates of commencement and substantial and final of the Work as evidenced by official receipt or acknowledgment of personal delivery by the Contractor.

"Owner" shall mean the County, as described and defined above herein.

"Parties" or "Parties to the Contract" shall mean the County, the first Party to the Contract, and the

Contractor, the second party to the Contract, each as described and defined herein.

"Project" shall mean the undertaking of the Work to be performed as provided in the Contract Documents.

"Shall" or "Will" is mandatory; and "May" is permissive on the part of the Parties to the Contract.

"Shop Drawings" or "Submittals" shall mean all drawings, diagrams, illustrations, brochures, schedules, and other data which are prepared by the Contractor, a Subcontractor, Manufacturer, Vendor, Supplier, or Distributor, which illustrate how specific portions of the Work shall be fabricated or installed.

"Site" or "Site of the Work" or "Site of the Project" shall mean the physical location where the Project is to be constructed by the Contractor, and may be additionally defined by the limits of construction on the Site where the Contractor is performing all the Work of the Project.

"Specifications" shall mean a part of the Contract Documents consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards, and workmanship specified for this Project.

"Subcontractor", "Sub-Subcontractor", "Manufacturer", "Vendor", "Supplier", or "Distributor" shall mean an individual, firm, or corporation having a direct contract with the Contractor or with any other Subcontractor for the performance of a part of the Work at the site.

"Substantial Completion" shall mean that date determined by the Owner when the construction of the Project or an expressly stipulated part thereof is sufficiently completed, in accordance with the Contract Documents, so that the Project or the expressly stipulated part can be fully utilized for the purposes for which it is intended.

"Supplementary Conditions" shall mean a part of the Contract Documents consisting of modifications to the General Conditions.

"Superintendent" shall mean the Contractor's authorized on-job representative designated in writing by the Contractor prior to commencement of any work.

"Suppliers", "Manufacturer", "Vendor", "Supplier", or "Distributor" shall mean any person or organization who only furnishes or supplies materials or equipment for the Work, including that fabricated to a special design, but who does not perform labor at the site.

"Contract Time" or "Time of Performance" shall be the period of time by which the Contractor is required to perform all the Work of the Project for completion by the dates for Substantial and Final Completion.

"Work" or "work" of the Contractor or Subcontractor or Sub-Subcontractor or Manufacturer or Vendor or Supplier, or Distributor, shall include all labor, material, equipment, transportation, skill, tools, machinery and other equipment, and things useful or necessary in order to complete the Contract.

SECTION 02
APPLICABLE REQUIREMENTS

The work shall comply with the Contract Documents and with all applicable codes, laws, and regulations of the County, State, or Federal agencies which may have cognizance of any part of the Work. In the event of any conflict between the terms of this Contract and such codes, laws, and regulations, the codes, laws, and/or regulations shall prevail. If the Contractor performs any work knowing it to be contrary to such codes, laws, or regulations, and without such notice to the County, he shall assume full responsibility therefore and shall bear any and all costs necessary to correct the Work.

SECTION 03
CONTRACT SECURITY AND BONDING

The Contractor shall furnish a Contract Performance Bond and a Labor & Material Payment Bond, each equal to one hundred percent (100%) of the Contract Price. Bonds given shall meet the requirements of the law of the State of Georgia. The surety on each Bond shall be a surety company satisfactory to the County and listed in the Federal Register and licensed to write surety insurance in the State of Georgia. The required Performance and Labor & Material Payment Bonds shall be issued by a Surety Company licensed to do business in the State of Georgia and listed in the Department of the Treasury Circular 570, latest edition. The Surety Company shall have an A.M. Best Company minimum rating of "A" with a financial size of VII "7" or better.

The Performance and Labor & Materials Payment Bonds shall be provided only on the forms required herein of these Bidding Documents, as set forth by the Construction Agreement. No other forms shall be acceptable by Cherokee County. Failure of the Contractor to provide the required bonds in the manner and form prescribed, and within the time required, may form the basis for Cherokee County to determine that the Contractor has failed to comply with contracting conditions and to determine the Bid Proposal offer from the Contractor to be non-responsive and void, therein allowing Cherokee County to select another Contractor.

SECTION 04
NOTICE AND SERVICE THEREOF

Any notice to the Contractor from the County or the Architect or Engineer relative to any part of this Contract shall be in writing and considered delivered and the service thereof completed, when said notice is posted by mail, to the said Contractor at his last given address or delivered in person to said Contractor or his authorized representative on the work site.

SECTION 05
SPECIFICATIONS

The Specifications, the Drawings accompanying them and the other Contract Documents shall be supplementary to each other, and any material, workmanship, and/or service which may be in one, but not called for in the others, shall be as binding as if indicated, called for, or implied by all.

The Contractor will be held responsible to furnish all labor and materials and the management thereof necessary for the Contractor to complete the Work as indicated by the Contract Documents.

Unless otherwise stipulated, the Contractor shall provide and pay for all materials, labor, water, tools,

equipment, light, power, transportation, and other facilities, and project and construction management and supervision, necessary for the execution and completion of the Work. He shall be responsible for entire Work and every part thereof.

Each Division, Section or type of work is described separately in the Technical Specifications; however, should any item of material, equipment, work, or combinations of such be required in one section, and not be described in that section and a similar item described in another section, that description shall apply regardless of the section under which it is described, and shall be as binding as if indicated, called for, or implied by all.

Upon award of the Contract by the County, the Contractor will supply the Owner, free of charge, up to Five (5) complete printed sets of the Contract Drawings and Specifications, including all issued Addenda and post-bid information or data, if any. All additional sets of Drawings and Specifications, and issued Addenda and post-bid information or data, in excess of these sets shall be furnished at cost by the County's reproduction service of choice, at the Contractor's expense, paid directly to the reproduction service firm.

SECTION 06
DRAWINGS AND SPECIFICATIONS

It is the intent of the Drawings and Specifications that the Contractor shall furnish all labor, materials, tools, equipment, and transportation, and project and construction management and supervision, necessary for the proper execution of the Work in accordance with the Contract Documents and all incidental work necessary to complete the Project in an acceptable manner, ready for use, occupancy, or operation by the County.

In case of conflict between the Drawings and Specifications, the Specifications shall govern. Figure dimensions on Drawings shall govern over scale dimensions, and detailed drawings shall govern over general drawings, and larger scaled drawings or details shall govern over the smaller scaled drawings or details.

If existing utilities or structures are indicated by the Contract Documents, no warranty is made by the County as to the accuracy or completeness of such indication or indications.

Any discrepancies found between the Drawings and Specifications and site conditions or any inconsistencies or ambiguities in the Drawings or Specifications shall be immediately reported to the Architect or Engineer, in writing, who shall promptly endeavor to correct such inconsistencies or ambiguities in writing to the Contractor. Work done by the Contractor after his discovery of such discrepancies, inconsistencies, or ambiguities shall be done solely at the Contractor's risk.

The Architect or Engineer may (without changing the scope of the Work) furnish the Contractor additional instructions and/or detail drawings, as necessary to carry out the Work required by the Contract Documents. The additional drawings and instructions thus supplied will become a part of the Contract Documents. The Contractor shall carry out the Work in accordance with the additional detail drawings and instructions, unless written exception is taken or additional information or exploration of the previously unknown or differing information becomes known to the Contractor.

Abridging: Attention is directed to the fact that the detailed Specifications and separate sections may be written in short or abridged form. In regard to every Division or Section of the Specifications and all parts thereof, mentioned therein, or indicated on the Drawings of articles, materials,

operations, or methods requires that the Contractor:

A. Provide each item mentioned and indicated, of quality or subject to qualifications noted,
B. Perform according to conditions stated, each operation prescribed, and/or
C. Provide therefore all necessary labor, equipment, and incidentals.

Wording: Whenever in the Specifications or on the Drawings the words "directed," "required," "permitted," "ordered," "instructed" or words of like import are used, it shall be understood that the direction, requirement, permission, instructions or order of the County is intended, and similar words, "approved," "acceptable," "satisfactory," or words of like import shall mean approved by, acceptable to, or satisfactory to the County.

Specification Divisions and Sections: For convenience of reference and to facilitate the letting of contracts and subcontracts, these Specifications are separated into titled divisions and sections. Such separation shall not and do not operate to make the County an arbiter to establish limits to the contracts between the Contractor and Subcontractors, nor shall such separation be interpreted as superseding normal union jurisdictions.

Language: Notwithstanding the appearance of such language in the various divisions and sections of the Specifications as, "The Paving Contractor," "The Grading Contractor," etc., the Contractor is the Party to the Construction Agreement responsible to the County for the entire Work of the Contract and Project, and the execution of all work referred to in the Contract Documents.

SECTION 07
PRESENT DOCUMENTS GOVERN

The Contractor shall in no case claim a waiver of any requirements of the Drawings or Specifications on the basis of previous prior approval of material or workmanship on other jobs of the County, or any other owner or project, of like nature or on the basis of what might be considered "standard" for material or workmanship in any particular location, or by the Architect or Engineer or the County. The Contract Documents for this Project shall govern the Work of this Project.

SECTION 08
CONTRACTOR'S SHOP DRAWINGS AND SUBMITTALS

The approved Drawings will be supplemented by the preparation and submittal by the Contractor to the Architect or Engineer of such Shop Drawings and other Submittals as are defined or required by the approved Drawings or needed by the Contractor to adequately control, manage or install the Work. It is mutually agreed that all authorized alterations affecting the requirements and information given on or by the approved Drawings and Specifications shall be in writing.

Shop Drawings and Submittals to be furnished by the Contractor for any structure shall consist of such detailed drawings and other supporting submittals as may be required as necessary for the prosecution of the Work.

Shop Drawings and Submittals shall be approved by the Architect or Engineer before the work in question indicated by or in the Shop Drawing or Submittal is performed. Drawings for false work, centering, and form work may also be required, and in such cases shall be likewise subjected to submittal and approval unless approval is waived by the Contractor and Architect and Engineer, upon consultation with the County. It is expressly understood, however, that approval by the Architect or

Engineer or the County, of the Contractor's Shop Drawings and Submittals does not relieve the Contractor of any responsibility for accuracy of dimensions and details. It is mutually agreed that the Contractor shall be responsible for agreement and conformity of his Shop Drawings and Submittals with the approved Drawings and Specifications, and the Shop Drawings and Submittals of the various other Subcontractors, Sub-Subcontractors, Manufacturers, Vendors, Suppliers, and Distributors contracted to and by, and under the control and management of the Contractor.

It is the responsibility of the Contractor to check, and he shall check, all Shop Drawings and Submittals before same are submitted to the Architect or Engineer for approval. Shop Drawings and Submittal which have not been checked and approved by the Contractor shall not be submitted, and will not be approved by the Architect or Engineer, and at the discretion of the Architect or Engineer may be returned to the Contractor with no action taken.

Shop Drawings and Submittals shall be submitted to the Architect or Engineer only by the Contractor who shall indicate by a signed stamp on the Shop Drawings and Submittals that the Contractor has checked the Shop Drawings and Submittals, and that the work shown on the Shop Drawings and Submittals are in accordance with the requirements of the Contract Documents, and have been checked for dimensions and relationship with work of all other trades involved. Under no conditions shall Shop Drawings and Submittals be accepted by the Architect or Engineer from anyone other than the Contractor.

The Contractor shall furnish the Architect or Engineer with at sufficient copies of all Shop Drawings and Submittals for review and approval, as mutually determined by the Contractor, Architect and Engineer and the County. The number of finally approved copies to be returned to the Contractor for his use shall also be mutually determined by the Contractor, Architect and Engineer and the County.

The Contract Price shall include the cost of furnishing all Shop Drawings and Submittals, and the Contractor will be allowed no extra compensation for such Shop Drawings and Submittals.

The approval of such Shop Drawings and Submittal by the Architect and Engineer, or the County, shall not relieve the Contractor from responsibility for deviations from the Drawings and Specifications unless the Contractor has in writing called attention to such deviations, and the Architect or Engineer, and the County, have approved the changes or deviations in writing at the time of submission, nor shall it relieve the Contractor from the responsibility for errors of any kind in Shop Drawings and Submittals.

When the Contractor does call such deviations to the attention of the Architect or Engineer, the Contractor shall state and affirm in his letter of transmittal of such Shop Drawings and Submittals whether or not such proposed or requested deviations involve any extra cost. If this is not so started or affirmed by the Contractor in writing, at time of submittal, it shall be a confirmation by the Contractor that no extra cost or time are involved for making the deviation or change, or the approval of the deviation by the Architect or Engineer, or the County.

SECTION 09
INSTRUCTIONS, CHANGES, ETC.

All changes, alterations, or instructions in regard to any feature of the Work that differ from the Drawings and Specifications must be approved in writing by Change Order in all cases, and no verbal orders will be regarded as a basis for claims for extra work.

If the Contractor claims that any instructions by the Drawings or Specifications, or by any part of the Contract Documents, involve extra cost or an extension of the contract time, the Contractor shall notify the Architect or Engineer in writing within ten (10) days after the receipt or knowledge of such instructions and in any event before proceeding to execute the Work. Thereafter, the procedure shall be the same as that described for Changes in the Work. No such claim shall be valid unless made in accordance with the terms of this section.

No claims for extra cost will be considered based on an escalation of material prices throughout the period of the Contract.

No extra work is to be performed or any changes made that involve any extra cost or extension of time unless approved by the Architect or Engineer and authorized by an agreed upon and executed Change Order to the Construction Agreement.

SECTION 10
EXAMINATION OF WORK BY CONTRACTOR

It is understood and agreed that the Contractor has, by visiting the Site, and by careful examination, satisfied himself as to the nature and location of the Work, the conformation of the ground, the character, quality, and quantity of the facilities needed preliminary to and during the prosecution of the construction of the Work, the general and local conditions, and all other matters which can in any way affect the Work or the cost or time for construction thereof under this Contract. No verbal agreement or conversation with any officer, agent, or employee of the County or the Architect or Engineer, either before or after the execution of the Contract, shall affect or modify any of the terms or obligations herein contained.

SECTION 11
MATERIALS, SERVICES, AND FACILITIES OF AND BY THE CONTRACTOR

The Contractor shall at all times employ sufficient labor and plant and equipment, and project and construction management and supervision services for prosecuting the Work for full completion in the manner and time specified. Failure by the Contractor to provide such adequate, needed and necessary labor and plant and equipment, and project and construction management and supervision services throughout the full and entire terms and time of the Contract may result in default of the Contract. The labor and plant and equipment, and project and construction management and supervision services to be determined to be needed and necessary to be used in the prosecution of the Work by the Contractor shall be sufficient to meet the requirements of the Work and shall be such as to produce a satisfactory quality of work, in accordance with accepted industry practices within the time and Contract Sum specified in the Contract.

Materials and equipment shall be so stored and handled as to ensure the preservation of their quality and fitness for the Work. All stored materials and equipment to be incorporated in the Work shall be located so as to facilitate prompt inspection by the Architect or Engineer. No product which has in any way become unfit for the intended purpose, as determined by the Architect or Engineer, in consultation with the County, shall be incorporated into the Work.

Manufactured articles, materials, and equipment shall be applied, installed, connected, erected, cleaned, and conditioned as directed or instructed by the manufacturer.

Materials, supplies, and equipment to be incorporated into the Work shall be new and unused unless otherwise specifically stated in the Contract Documents. The source of supply for all such products shall be submitted to the Architect or Engineer, together with detailed descriptions thereof in the form of samples, Shop Drawings and Submittals, tests, mock-ups at the site, or other means necessary to adequately describe the items proposed. If, after trial, review or inspection by the Architect or Engineer, or the County, it is determined by the Architect or Engineer, or the County, that the sources of supply, even though previously approved or accepted by the Architect or Engineer, have not furnished products meeting the intent of the Contract Documents, the Contractor shall thereafter promptly furnish products from other approved or acceptable sources, and the Contractor shall thereafter promptly remove all or any completed Work incorporating products which have not, or do not meet the Contract requirements.

SECTION 12
REQUESTS FOR SUBSTITUTIONS

All Contractor requests for substitutions of proprietary products or of a particular manufacturer or vendor that have been indicated or the Drawings or specified or required by the Specifications to be provided or installed by the Contractor in the Work must be accompanied by written documentary proof of equality, and difference in price and deliveries, if any, in the form of certified and attested quotations from the Supplier or Suppliers of both the specified and proposed system, product, equipment or item of the Work.

The item proposed for substitution shall be equal to or superior to the specified item or items, in construction, efficiency, and utility in the opinion of the Architect or Engineer, with consultation with the County. The opinion of the Architect or Engineer, with consultation with the County, shall be final and no substitute material or article shall be purchased or installed without such written approval. The Architect or Engineer, or the County, are under no obligation to accept for review any request for any substitution by the Contractor, and any such request or requests may at the discretion of the Architect or Engineer, or the County, be denied without explanation or consideration for review or evaluation.

In case of a difference in price, the County shall receive all benefits of the difference in cost involved in any substitution, when lower, and the Contract altered by Change Order to credit the County with any savings to be obtained. However, the County shall not be charged for any additional cost in case of a price difference.

SECTION 13
INSPECTION AND TESTING OF MATERIALS

Unless otherwise specifically provided for, the inspection and testing of materials and finished articles to be incorporated in the Work at the site shall be made by bureaus, laboratories, or agencies approved by the Architect or Engineer. The Contractor shall furnish evidence satisfactory to the Architect or Engineer that the material and finished articles have passed the required tests prior to the incorporation of such materials and finished articles in the Work.

The cost of such inspection and testing shall be paid by the Owner. Reporting of all materials testing, as required for the Work, shall be in accordance with the Drawings and Specifications, including reporting of all such materials testing.

At any time during the Contractor's performance of the Work, without explanation or cause, the

Architect or Engineer, or the County, may order special or additional testing for any portion of the Work being constructed or to be constructed. Should such additional or special testing fail, the Contractor shall remove or repair such portions of the Work affected by the failed tests without additional compensation or extension in contract time, and shall compensate the County for all costs associated with the failed testing, including additional time and expenses of the Architect or Engineer, or the County, or other involved consultants. If such additional or special testing pass, the County shall bear the costs of the additional or special testing, but shall not be obligated to compensate the Contractor in any way for the conducting of the additional or special testing.

SECTION 14
INSPECTION OF WORK

The Contractor shall, at all times, permit and facilitate inspection or review or testing of the Work by authorized representatives of the Architect or Engineer, the County and public authorities having jurisdiction in connection with the Work of this Contract. The presence or observations of the Architect or Engineer or its representative at the site of the Work shall not be construed to, in any manner, relieve the Contractor of the Contractor's responsibility for strict compliance with the provisions of the Contract Documents.

If the specifications, County's instructions, laws, ordinances, or a public authority require any work to be specially tested or approved, the Contractor shall give the Architect or Engineer timely notice of its readiness for observation or inspection. If the inspection is by another authority, then the Architect or Engineer shall be advised of the date fixed for such inspection. Required certificates of inspection shall be secured by the Contractor. Contractor having secured all certificates of inspection will deliver same to the Architect or Engineer upon completion. If any work should be covered up without approval or consent of the Architect or Engineer, it shall, if required by the Architect or Engineer, be uncovered for examination at the Contractor's expense.

Should any disagreement or difference arise as to the estimate, quantities, or classifications or as to the meaning of the Drawings or Specifications, or any point concerning the character, acceptability, and nature of the several kinds of work, any materials and construction thereof, the decisions of the Architect or Engineer shall be final and conclusive and binding upon the Contractor

The Contractor may at his option conduct additional or other special testing to confirm his findings or determination, but only at his cost and expense, without additional time being granted by the County for the performance of the Work to be constructed by the Contractor. If such additional or special testing by the Contractor allow or provide for the Architect or Engineer to revise or amend a previous decision or determination, the County will review and may provide compensation to the Contractor for such additional or special testing in whole or in part, or none at all, without further discussion or review by the County.

SECTION 15
AUTHORITY OF THE ARCHITECT OR ENGINEER

The Contractor shall perform all of the Work herein in strict accordance with the Contract Documents, and to the entire satisfaction, approval, and acceptance of the Architect or Engineer, and the County. The Architect or Engineer shall decide all written questions relating to measurements of quantities, the character of the Work performed, and as to whether the rate of progress is such that the Work will be completed within the time limit of the Contract. All questions as to the meaning of the Drawings and Specifications shall be submitted in writing to the Architect or Engineer by the

Contractor, and will be finally decided by the Architect or Engineer in a prompt and timely manner.

The review or approval by the Architect or Engineer of any materials, plants, equipment, Drawings, Specification, or of any other items executed, or proposed by the Contractor, shall be construed only to constitute a review and approval for conformance with the general design and requirements of the Contract Documents. Such review or approval shall not relieve the Contractor from the performance of the Work in accordance with the Contract Documents, or from any duty, obligations, performance guarantee, or other liability imposed upon him by the provisions of the Contract.

SECTION 16
PROHIBITED INTERESTS

No official of the County who is authorized in such capacity and on behalf of the County to negotiate, make, accept, or approve, or to take part in negotiating, making, accepting, or approving any architectural, engineering, inspection, construction, or material supply contract, or any subcontract in connection with the construction of the Project, shall become directly or indirectly interested personally in this Contract or in any part hereof. No officer, employee, Architect or Engineer, attorney, engineer, or inspector of or for the County who is authorized is such capacity and on behalf of the County to exercise any legislative, executive, supervisory, or other similar functions in connection with the construction of the Project, shall become directly or indirectly interested personally in this Contract or in any part thereof, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the Project.

SECTION 17
REJECTION OF WORK AND MATERIALS

All materials and equipment furnished and all work done by the Contractor that is not in accordance with the Drawings or Specifications, or the Contract Document, or that is defective will be rejected by the Architect or Engineer, or the County. All rejected materials, equipment, or work shall be removed immediately. If rejected materials, equipment, or work is not removed within forty-eight (48) hours from the date of letter of notification by and from the Architect or Engineer, or the County, the County, or the Architect or Engineer, upon consultation with the County, shall have the right and authority to stop the Work of Contractor immediately, and/or shall have the right to arrange for the removal of said rejected materials, equipment, or work at the cost and expense of the Contractor. All rejected materials, equipment, or work shall be replaced with other material, equipment, or work which conforms with the Drawings and Specifications at no additional cost to the County.

Review, observation or inspection of the Work at any time during the contract time by the Architect or Engineer, or the County, or any authorized agency or authority, shall not relieve the Contractor of any of his obligations to fulfill his Contract and defective work shall be made good regardless of whether such work, material, or equipment has been previously reviewed, observed inspected by the Architect or Engineer and accepted or estimated for payment. The failure of the Architect or Engineer or any or authority or agency to condemn improper materials or workmanship shall not be considered as a waiver of any defect which may be discovered later, or for work actually defective. All work, material, and/or equipment shall be guaranteed against defects for a period of one year from date of Project acceptance as established by the County.

SECTION 18
WEATHER CONDITIONS

The Contractor will be required to protect all work and materials against damage or injury from the weather. If, in the opinion of the Architect or Engineer, any work or materials shall have been damaged or injured by reason of failure to protect such, all such materials or work shall be removed and replaced at the expense of the Contractor.

In visiting the Site where the Work is to be constructed, the Contractor shall have familiarized himself with the local conditions that may or could be affected by weather normal to the site of the Work. Such weather conditions that are determined by the Architect or Engineer, or the County, or local or area climitalogical date or information or authorities, shall not relieve the Contractor of his duty to protect the Work and to perform the Work in a timely and proper manner, as required by the Contract Documents, and shall not form the basis of any request for adjustment in contract price of contract time.

SECTION 19
ROYALTIES AND PATENTS

The Contractor shall hold and save the County and its officers, agents, servants, and employees, harmless from liability of any nature or kind, including cost and expenses for, or on account of, any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the Contract, including its use by the County, unless otherwise specifically stipulated in the Contract Documents.

SECTION 20
CONTRACTOR'S PERSONNEL

The Contractor will supervise and direct all aspects of the Work. He will be solely responsible for the means, methods, techniques, sequences, and procedures of construction. An experienced Superintendent and necessary assistants competent to supervise the particular types and parts of the Work involved shall be assigned to the Project and at the necessary time at the Project Site by the Contractor, and such Superintendent and necessary competent assistants shall be available at all times when work is in progress. The name of the Superintendent shall be submitted by the Contractor as a Key Personnel with qualifications of same prior to start of the Work and shall be subject to the approved of the Architect or Engineer, with consultation with the County, prior to start of the Work in whole or in part.

The Superintendent so named by the Contractor as that Key Personnel shall be employed by the Contractor and shall have served in a supervisory capacity on at least one Project of similar or like description and size performed by the Contractor during the previous twelve (12) calendar months, or by another Contractor during the previous twenty-four (24) calendar months. Under no circumstances shall an employee of any Subcontractor serve as the Contractor's Key Personnel Superintendent. The Contractor's Superintendent shall represent the Contractor, and all directions given to the Superintendent shall be as binding as if given to the Contractor.

Only persons skilled in the type of work which they are to perform shall be employed. The Contractor shall, at all times, maintain discipline and good order among his employees, and shall not employ on the Work any unfit person or persons or anyone unskilled in the work assigned him. If any person employed or working at the site is determined by the Contractor, or the Architect or Engineer, or the

County, or a governing agency or authority, to be disruption to the performance of any part of the Project, or determined not to be skilled in the type of work which they are to perform shall be employed, they shall be immediately removed by the Contractor, without any adjustment in the contract time or Contract Sum.

SECTION 21
LINES, GRADES, AND MEASUREMENTS

Such stakes and markings as the Architect or Engineer may set or may have previously set for the benefit of the Project or for the sole benefit of the Architect or Engineer for either its or the Contractor's guidance shall be preserved by the Contractor. Failure to protect such stakes or markings, or gross negligence on the Contractor's part resulting in loss of same, may result in the Contractor being charged by the County for their replacement as compensation to the affected entity.

The Contractor shall at all time during the performance of the Work in its entirety, exercise proper care and caution to verify the grades and figures given to the Contractor before proceeding with the Work, and the Contractor shall be solely responsible for any damage or defective work caused by his failure of such care and caution. The Contractor shall provide prompt written notification to the Architect or Engineer of any errors or discrepancies discovered, and shall offer or suggest corrective action, in order that the proper corrections may be made in a prompt and timely manner.

SECTION 22
PERMITS AND INSPECTION FEES

Permits shall be secured by the Contractor and inspections will be required by the governing authority for jurisdiction where the Work is located. If the project is in Cherokee County and under the jurisdiction of Cherokee County, or the County has been granted delegated authority by the governing jurisdiction, the County will not charge the Contractor for such permits and inspections obtained from Cherokee County, and the Contractor is advised he need not include such permits fees in his Bid or Contract Sum.

The Contractor shall include in his Bid and Contract Sum, and shall secure and pay for any permits, printing costs and inspection fees required by any other governmental entity or agency, including but not limited to any City within Cherokee County, or the Cherokee County Water and Sewerage Authority, unless otherwise stated, set forth or required by the Bid Documents or Contract Documents.

SECTION 23
LAWS AND REGULATIONS

The Contractor's attention is directed to the fact that all applicable Federal, State, and County laws, municipal ordinances, applicable building codes, and the rules and regulations of all authorities having jurisdiction over construction of the Project shall apply to the Contract throughout, and they will be deemed to be included in the Contract Documents the same as though herein written out in full.

The Contractor shall keep himself fully informed of all laws, ordinances, codes, and regulations of the Federal, State, and County in any manner affecting those engaged or employed in the Work or the materials used in the Work or in any way affecting the conduct of the Work and of all orders and decrees of bodies or tribunals having any jurisdiction or authority over same. If any discrepancy or

inconsistency should be discovered by the Contractor at any time in the performance of the Work of this Contract, or in the Drawings or Specifications, or the Contract Documents herein referred to, in relation to any such law, regulation, code, ordinance, order, or decree, the Contractor shall promptly report the same, in writing, to the Architect or Engineer.

The Contractor shall at all times observe and comply with all such laws, ordinances, codes, and regulations, and shall protect and indemnify the County and its agents against any such law, ordinance, regulation, order, or decree, whether by himself or by his employees.

SECTION 24
CONTRACTOR'S OBLIGATIONS

The Contractor shall, in a good workmanlike manner, do and perform, all work and furnish all supplies and materials, machinery, equipment, facilities, and means, project and construction management and supervision, necessary, or proper to perform and complete all the Work required by this Contract, within the time herein specified, in accordance with the provisions of this Contract and said Specifications and in accordance with the Drawings of the Work covered by this Contract and any and all supplemental drawings of the Work covered by this Contract, unless and except as herein otherwise expressly specified.

The Contractor shall furnish, erect, maintain, and remove such construction, plants, materials, and other such temporary works as may be required for the construction of the Work of the Project. The Contractor alone shall be responsible for the safety, efficiency, and adequacy of his plants, appliances, and methods, and for any damage which may result from their failure or their improper construction, maintenance, or operation.

The Contractor shall observe, comply with, and be subject to all terms, conditions, requirements and limitations of the Contract and Specifications, local ordinances, codes, and State and Federal laws; and shall do, carry on, and complete the entire Work.

SECTION 25
SUBCONTRACTING

The Contractor understands and agrees that it shall be a breach of this Contract to subcontract any portion of the Work on this Project unless the Work and the Subcontractor and/or others proposed to perform it have been declared by the Contractor at the time of commencement of the Work; or the Contractor shall have obtained written approval from the County.

THE CONTRACTOR FURTHER UNDERSTANDS AND AGREES THAT ANY WORK ON THIS PROJECT WHICH THE CONTRACTOR SECURES IN VIOLATION OF THIS PROVISION SHALL BE DEEMED A GRATUITY FROM THE CONTRACTOR FOR WHICH CHEROKEE COUNTY SHALL NOT BE OBLIGATED TO PAY.

Nothing contained in this Contract shall create any contractual relation between any of the Contractor's named or not named Subcontractor, Sub-Subcontractor, Vendor, Suppliers or Manufacturer, and the County.

SECTION 26
ASSIGNMENTS

The Contractor shall not assign the whole or any part of this Contract or any monies due or to become due hereunder without the prior written consent of the County, as may be set forth by a written and properly executed Change Order.

SECTION 27
CONTRACTOR'S HOLD HARMLESS AGREEMENT

Contractor's hold harmless and indemnification of Cherokee County shall be as set forth in the Construction Agreement.

SECTION 28
INSURANCE REQUIREMENTS

Contractor's insurance requirements for the project and Cherokee County shall be as set forth in the Construction Agreement.

SECTION 29
LAND AND RIGHTS-OF-WAY

Prior to entering on any land or right-of-way, the Contractor shall ascertain the requirements of applicable permits or easements obtained by the County, and shall conduct his work in accordance with requirements thereof including the giving of notice. The Contractor shall be fully responsible for performing work to the requirements of any permit or easement granting entity even though such requirements may exceed or be more stringent than that otherwise required by the Contract Documents, and shall compensate the County fully for any loss or expense arising from failure of the Contractor to perform as required by such entity.

The Contractor shall provide at his own expense and without liability to the County any additional land and access thereto that the Contractor may desire for temporary construction facilities, or for storage of materials.

SECTION 30
PROTECTION OF WORK, PROPERTY AND PERSONS

The Contractor will be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. He will take all necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury or loss to all employees on the Work and other persons who may be affected thereby, all the Work and all materials or equipment to be incorporated therein, whether in storage on or off the site, and other property at the site or adjacent thereto, including trees, shrubs, lawns, lakes, drainage ways, walks, pavements, roadways, structures, and utilities not designated for removal, relocation or replacement in the course of construction.

The Contractor will comply with all applicable laws, ordinances, rules, regulations, codes, and orders of any public body having jurisdiction. He will erect and maintain, as required by the conditions and progress of the Work, all necessary warning safeguards for devices and safety and protection of the Work, the public, and adjoining property. He will notify owners of adjacent utilities when

prosecution of the Work may affect them. The Contractor will remedy all damage, injury, or loss to any property caused, directly or indirectly, in whole or in part, by the Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable.

The Contractor shall, prior to commencing other on-site work or off-site work, accurately locate above and below ground utilities and structures which may be affected by the Work, using whatever means may be appropriate. The Contractor shall accurately mark, or cause to have accurately marked, the location of existing utilities and structures, not otherwise readily visible, with flagging, stakes, barricades, or other suitable means, and shall preserve and protect all utilities and structures not designated for removal, relocation, or replacement in the course of construction. He shall notify the Architect or Engineer promptly on discovery of any conflict between the Contract Documents and any existing facility.

In emergencies affecting the safety of persons or the Work or property at the site or adjacent thereto, or unanticipated conditions where delay would substantially impact the time or cost of work, the Contractor shall endeavor to immediately provide notification to the Architect or Engineer, or the County, but in any event the Contractor shall immediately take action and act to prevent threatened damage, injury, or loss.

Any claim for compensation or extension of time by the Contractor due to such extra work shall be submitted to the Architect or Engineer within ten (10) days of the date of commencing to perform such emergency or protective action or work or deviations in the manner prescribed by the Contract Documents for review to determine the basis for additional compensation or an extension in the Contract Time, both or either to be written and confirmed by a properly executed Change Order.

All existing utilities, both public and private, including water, gravity or force main or pressure sewer or sewerage, natural gas, electrical, cable, and telephone services, etc., shall be protected and their operation shall be maintained through the course of the Work. Any temporary shutdown of an existing service shall be arranged directly between the Contractor and the responsible agency or utility owner. The Contractor shall assume full responsibility and hold the County harmless from the result of any damage that may occur as a result of the Contractor's activities.

SECTION 31
PRIOR USE BY COUNTY

Prior to substantial and final completion of the Work or any portion or part therein for either a building or structure or the site or grounds of the Work, the County may take over operation and/or use of the in completed Project or portions thereof. Such prior use of facilities by the County shall not be deemed as acceptance of any work or relieve the Contractor from any of the requirements of the Contract Documents for the completion and full performance of the requirements of the Work of the Project.

SECTION 32
CLEANING UP

The Contractor shall at all times keep the premises of the entire Site of the Work free from and clean of any accumulation of waste materials or rubbish caused by Contractor's employees or work, including mud, dirt or debris on private or public streets, roadways and drives. Upon completion of the Work, the Contractor shall remove all his plants, tools, materials, and other articles from the

property of the County.

SECTION 33
BARRICADES

The Contractor shall provide continuously burning lanterns at all barricades and at protective barriers around excavations so that the public is adequately warned of such hazards. Lanterns shall remain lighted from sundown to sunrise and at all other times when the labor forces are not on the job site.

Access to Site for workers and other parties and for the delivery of construction materials and equipment shall be only from locations approved by the County.

SECTION 34
CHANGES IN THE WORK

The County may at any time, and without prior notification to the Contractor, order changes within the scope and terms and conditions, and time and price of the Work without invalidating the Construction Agreement. If such changes increase or decrease the amount due under the Contract Documents, or in the Contract Time required for performance of the Work by the Contractor, an adjustment may be authorized by a written and properly executed Change Order.

The Architect or Engineer, also, may at any time, by issuing a Field Order make minor changes in the details of the Work, not affecting or involving the Contract Sum or Contract Time. The Contractor shall proceed with the performance of any changes in the Work so ordered by the Architect or Engineer unless the Contractor believes that such Field Order entitles or requires a change in Contract Price or Time, or both, in which event the Contractor shall give the Architect or Engineer written notice thereof within ten (10) days after the receipt of the written Field Order or other written ordered change, and the Contractor shall not execute or implement or effect such changes until or upon the receipt of an executed Change Order or further written instruction or instructions by and from the County.

The Contract Price may be changed only by a Change Order. The value of any work covered by a Change Order or of any claim for increase or decrease in the Contract Price shall be determined by one or more of the following methods in the order of precedence listed below:

A. Unit prices previously approved, or
B. An agreed lump sum, or
C. Force Account, based upon the Contractor's written and fully documented and witnessed actual cost for labor, direct overhead, materials, supplies, equipment, and other services necessary to complete the Work.

For any Change Order based upon any of the above described methods of determining costs or value, the Contractor may add for the cost of the Contractor's general overhead and profit an amount agreed upon, but in no instance shall the amount exceed ten percent (10%) of the actual cost of such work to cover.

For any Subcontractor or Sub-Subcontractor, vendor or supplier contracted directly to the Contractor, the cost of that party's general overhead and profit shall not exceed fifteen percent (15%) of the actual cost of such work to cover.

For any work performed directly by the Contractor or his own permanently directly employed forces, the Contractor's general overhead and profit shall not exceed fifteen percent (15%) of the actual cost of such work to cover.

Note: In any Change Order, the Contractor's general overhead and profit amount shall include, but not be limited to, all project management, supervision, executive, clerical, administration and/or other similar costs associated with implementing the approved change, without exceeding the percentages listed above.

SECTION 35
TIME FOR COMPLETION

It is hereby understood and mutually agreed, by and between the Contractor and the County, that the date of beginning, the rate of progress, and the time for substantial and final completion of all the Work are essential conditions of this Contract; and it is further mutually understood and agreed between and by the Parties to the Construction Agreement that the Work embraced in this Contract shall be commenced on the date to be specified in the Notice to Proceed issued by the County.

The Contractor agrees that said work shall be prosecuted regularly, diligently, and uninterrupted at such rate of progress as will ensure full completion thereof within the time specified. It is expressly understood and agreed, by and between the Contractor and the County, that the time for the substantial and final completion of all the Work described herein by the Contract Documents is a reasonable time for the completion of the same, taking into consideration the average climate range and usual conditions prevailing in the locality of the location of the Project.

It is further agreed that time is of the essence of each and every portion of this Contract and of the Drawings and Specifications and the Contract Documents, wherein a definite portion and certain length of time is fixed for the performance of any act whatsoever; and where under the Contract an additional time maybe allowed for the completion of any portion of the Work, the new time limit fixed by such extension shall become the essence of the Contract. Provided, that the Contractor shall not be charged with any excess cost when the delay in completion of the Work maybe due to unforeseeable causes beyond the control and without the fault or negligence of the Contractor, the County or the Architect or Engineer, including, but not restricted to, acts of God, or to the public enemy, acts of the County, acts of another contractor in the performance of the contract with the County, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and unusually most severe weather exceeding the average climatological conditions in the area of the Work, as may be described and outlined by the Contract Documents for the information and understanding of the Contractor in bidding and performing the Work to be constructed.

Provided further, that the Contractor shall within ten (10) days from the beginning of each such specific weather related delay, notify the County, in writing, of the causes of the weather related delay, and the Architect or Engineer and the County shall ascertain the facts and extent of the weather related delay and provide written notification to the Contractor within a reasonable time of its decision in the matter.

Where the County has established occupancy of a facility, building, structure of site, or a usable portion thereof prior to the specific date for substantial or final completion of the specified Contract Time period or date, and where contract work items remain outstanding to be completed by the Contractor, the County, at its option, may charge the Contractor for actual cost of administering the Contract for the period subsequent to expiration of the Contract completion date.

SECTION 36
PAYMENTS TO CONTRACTOR

The Contractor shall prepare and submit to the County, through the Architect and Engineer a detailed cost breakdown of the project Contract Price within five (5) calendar days from the date of receipt of the Notice to Proceed. This detailed cost breakdown shall be based on values of parts of the Work as maybe divided according to project and construction management and supervision, overhead and profit, bonds and insurance, Work of the project as maybe self-performed by the Contractor, and the awards of subcontracts and purchase orders for the various Divisions and Sections of the Specifications, and shall be further subdivided into labor and materials.

All equipment, materials, and work covered by progress payments that shall become a permanent part or fixture of the Work shall, upon payment thereof, become the sole property of the County, but this provision shall not be construed as relieving the Contractor from the sole responsibility for the care and protection of equipment, materials, and work upon which payments have been made, or the restoration of any damaged work, and is not intended to mean or include temporary or rental structures, equipment, materials and work needed to effect the construction of the Project.

The Contract Sum for the work to be performed by the Contractor for the work shall be established in the Construction Agreement. The final Contract Sum, including authorized adjustments thereto by Change Order as provided in the Contract Documents, is the total amount due and payable to the Contractor for the performance of the Work under the Contract Documents for the work. Cherokee County shall withhold as a retainage from each monthly partial application for payment from the Contractor an amount equal to ten percent (10%) of the sum requested by the Contractor for that application for payment. No reduction or release of retainage shall be made or come due the Contractor until and unless the Work of the Project has been completed and accepted by Cherokee County as set forth by the Contract Documents.

Before the first Application for Payment, the Contractor shall submit a Schedule of Values allocated to the various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as Cherokee County may require. This schedule shall be used as the basis for the Contractor’s Applications for Payment to Cherokee County.

Contractor’s Schedule of Values shall contain a line item for warranty at the greater of one-half percent (0.5%) the total contract value or twenty-five thousand dollars ($25,000) which will be held through the duration of the warranty period. The entirety of this amount will be held through the full duration of the warranty period and until all warranty items that arise during the warranty period are corrected to the satisfaction of the architect and owner. If Contractor fails to resolve a warranty issue in a timely manner as determined by the opinion of the owner, the owner may provide a pre-approved county vendor on Contractor's behalf and deduct the cost from the contract.

After the Contractor has issued a Certificate, the County shall, subject to the provisions of the Construction Agreement, pay the Contractor the portion of the Contract Sum properly allocable to labor, materials, and equipment incorporated in the Work, suitably stored at the site or at some other location suitably insured agreed upon in writing by the parties as of the date the Application for Payment is submitted to Cherokee County, less retainage and the aggregate of previous payments in each case.

No certification of an Application for Payment, any payment, or any partial or entire use or occupancy

of the Project by Cherokee County, shall constitute an acceptance of any Work not in accordance with the Contract Documents.

Cherokee County shall have any obligation to pay or to see to the payment of any monies to any subcontractor or subconsultant except as may otherwise be required by law.

The Contractor shall promptly pay each party to which it owes money for performance for the Project upon receipt of payment from Cherokee County, out of the amount paid to the Contractor on account of such Contractor's Work, the amount to which said parties are entitled, reflecting the percentage actually retained, if any, from payments to the Contractor on account of such Contractor's Work. The Contractor shall, by an appropriate agreement with each party to which it is contracted for the Project, require each and all other parties to make prompt and accurate payments to their subcontractors in a similar manner.

Applications for Payment shall be submitted by the Contractor to Cherokee County, through the Project Consultant, no more frequently than monthly. Each Application for Payment shall be supported by such data substantiating the right to payment as the Cherokee County may require, and reflecting retainage, if any, as provided for in the Contract Documents. The Project Consultant will review the Application for Payment submitted by the Contractor to determine the amount to be recommended for payment by the County, and shall certify its recommendation and forward a Certificate for Payment to Cherokee County for review and processing.

The Contractor warrants to Cherokee County that title to all Work, materials and equipment covered by an Application for Payment will pass to Cherokee County either by incorporation in the construction or upon receipt of payment by the Contractor, whichever occurs first, free and clear of all liens, claims, security interests or encumbrances, hereinafter referred to in the Contract as "liens"; and that no Work, materials or equipment covered by an Application for Payment will have been acquired by the Contractor, or by any other person performing Work at the site or furnishing materials and equipment for the Project, subject to an agreement under which an interest therein or an encumbrance thereon is retained by the seller or otherwise imposed by the Contractor on such other person.

Unless otherwise provided in the Contract Documents, no payments will be made on account of materials or equipment not incorporated in the Work. Any payments for materials or equipment stored on the Project site shall be conditioned upon submission by the Contractor of bills of sale or other such procedures satisfactory to Cherokee County to establish Cherokee County's title to such materials or equipment or otherwise protect Cherokee County's interest, including applicable insurance.

The Project Consultant will with reasonable promptness upon receipt of the Contractor's Application for Payment, review the Application for Payment and either issue a Certificate for Payment to Cherokee County with a copy for distribution to the Contractor for such amounts as the Project Consultant determines are properly due, or shall notify the Contractor in writing of the reasons for withholding a Certificate for Payment.

By issuing a Certificate for Payment, it shall not thereby be deemed to be represented that the Project Consultant or Cherokee County have made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, have reviewed the construction means, methods, techniques, sequences or procedures, or has made any examination to ascertain how or for what purpose the Contractor has used any monies previously paid on account of the Contract Sum.

Cherokee County may decline to certify payment, and may withhold a certification for payment in whole or in part to the extent necessary to reasonably protect Cherokee County, if in Cherokee County's opinion, Cherokee County and the Project Consultant are unable to make representations as to the accuracy of the Application for Payment to reflect the current status of the Work. If the Contractor, Project Consultant and Cherokee County cannot agree on a revised amount, Cherokee County may issue a Certificate for Payment for only the amount for which Cherokee County is able to make such representations. Cherokee County may also decline to certify payment or, because of subsequently discovered evidence or subsequent observations, Cherokee County may also nullify the whole or any part of any Certificate for Payment previously issued to such extent as may be necessary, in Cherokee County's opinion, to protect Cherokee County from loss for several reasons including, but not limited to:

- defective Work not remedied.
- third party claims filed or reasonable evidence indicating probable filing of such claims;
- failure of the Contractor to make payments properly to subcontractors or sub-consultants, or for labor, materials or equipment;
- reasonable belief that the Work cannot be completed for the unpaid balance of the Contract Sum for the line items under discussion;
- damage to Cherokee County or another contractor, or to existing site or other conditions;
- reasonable evidence that the Work will not be completed within the Contract Time; or
- persistent or repeated failure by the Contractor to carry out the Work in accordance with the Contract Documents or written direction provided by the Project Consultant or Cherokee County.

When the grounds above are removed, payment may be made by Cherokee County in a forthcoming monthly application for payment for amounts withheld.

When the Contractor considers that the Work, or a designated portion thereof which is acceptable to Cherokee County, is substantially complete, the Contractor and Project Consultant shall prepare for Cherokee County a list of items to be completed or corrected. The Contractor shall promptly proceed to complete and correct all items on the list. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

Upon receipt of the list of items to be completed or corrected, Cherokee County shall make an inspection to determine that the Work or designated portion thereof is substantially complete. On the basis of inspection and in consultation with the Project Consultant determines that the Work or designated portion thereof is substantially complete, the Project Consultant will then prepare a Certificate of Substantial Completion of the Work, on the latest version of AIA Document G704, Certificate of Substantial Completion, which shall establish the Date of Substantial Completion of the Work, shall state the responsibilities of Cherokee County and the Contractor for security, maintenance, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall complete the items listed therein as incomplete or requiring correction. The Certificate of Substantial Completion shall be submitted to Cherokee County, and the Contractor for their written acceptance of the responsibilities assigned to them in such Certificate.

Prior to and as a condition of the Certificate of Substantial Completion being issued, all Project Closeout Documents including, but not limited to project record documents (as-builts), operation and

maintenance manuals, warranties and other documents, shall have been submitted to Cherokee County ten (10) prior to the indicated date for review and approval by the Project Consultant for transmittal to Cherokee County.

Warranties required by the Contract Documents shall commence on the Date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion of the Work or designated portion thereof. Warranties for Work that is not accepted by the County shall commence on a date when the Work is finally accepted by Cherokee County.

Following issuance of the approved Certificate of Substantial Completion of the Work or designated portion thereof, and the Contractor's final completion of the Work, the Contractor shall forward to the Project Consultant a written notice that the Work is ready for final inspection and acceptance, and shall also forward to Cherokee County a final Application for Payment, along with a final accounting of the Cost of the Work. The Project Consultant and Cherokee County shall make such inspections and if finds the Work acceptable and fully performed, the Project Consultant shall certify the final Application for Payment, subject to review of the final accounting of the Cost of the Work, which will approve the final payment due the Contractor. This approval shall constitute a representation that, to the best of the Project Consultant's knowledge, information and belief, and on the basis of observations and inspections, the Work has been completed in accordance with the Terms and Conditions of the Contract Documents and that the entire balance found to be due the Contractor, and noted in said certified final Application for Payment, is due and payable.

Final payment, including all remaining retainage, shall not become due until the Contractor has submitted to the Project Consultant, and the Project Consultant has submitted to Cherokee County notarized affidavits (AIA Document G706, Contractor's Affidavit of Payment of Debts and Claims, latest version) that all payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which Cherokee County or Cherokee County's property might in any way be responsible, have been paid or otherwise satisfied, and a Consent of Surety to Final Payment (AIA Document G707, latest version), has also been provided, and other data to be submitted as determined by Cherokee County establishing payment or satisfaction of all such obligations, including receipts, releases and waivers of liens arising out of the Contract, to the extent and in such form as may be designated by Cherokee County, including, but not limited to, AIA Document G706A, Contractor's Affidavit of Release of Liens, latest version.

If any Contractor refuses to furnish a release or waiver required by Cherokee County, the Contractor may furnish, at the Contractor's full expense and cost, a bond satisfactory to Cherokee County to indemnify Cherokee County against any such lien. If any such lien remains unsatisfied after all payments are made, the Contractor shall immediately refund to Cherokee County all monies that the latter may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

The making of final payment by Cherokee County to any Contractor shall, after the Date of Substantial Completion, constitute a full, final and absolute waiver of all claims by the Contractor against Cherokee County, except those arising from:

- unsettled liens;
- faulty or defective Work appearing after Substantial Completion of the Work;
- failure of the Work to comply with the requirements of the Contract Documents; and

- terms of any special warranties required by the Contract Documents.

The acceptance of final payment by the Contractor shall, after the Date of Substantial Completion of the Work, constitute a waiver by the Contractor of all claims against Cherokee County, except those previously made in writing and identified by the Contractor as unsettled at the time of the final Application for Payment.

In the event Cherokee County timely disputes the amount of final payment due a Contractor, the amount due shall be deemed by Cherokee County to be an unliquidated sum, and no interest shall accrue or be payable on the sum finally determined to be due for any period prior to final determination of such sum, whether such determination be by agreement or by final judgment of the proper court in the event of litigation between the parties. The Contractor specifically waives and renounces any and all rights it may have and agrees that in the event suit is brought against Cherokee County for any sum claimed by the Contractor under the Contract or for any extra or additional Work, no interest shall be awarded on any sum found to be due from Cherokee County in the final judgment entered in such suit. All final judgments shall draw interest at the legal rate, as specified by law.

All provisions of the Construction Agreement, including without limitation those establishing obligations and procedures, shall remain in full force and effect notwithstanding the making or acceptance of final payment prior to the Date of Substantial Completion of the Work.

SECTION 37
SCHEDULES, REPORTS, AND RECORDS

The Contractor shall submit to the Architect or Engineer such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records, and other data as the Architect or Engineer may request concerning work performed or to be performed.

Prior to submittal of the first partial application and certificate for payment, the Contractor shall submit to the Architect or Engineer a detailed project construction schedule showing the order in which the Contractor proposes to carry on the Work, including milestone and interim dates at which the Contractor will start the various parts of the Work, including the estimated dates of completion of each part; and, as applicable, the dates at which special detail drawings will be required and prepared, and respective dates for submission by the Contractor of Shop Drawings and Submittals, and the beginning and completion dates for the manufacture, the testing and the installation of materials, supplies and equipment of the many parts and portions of the total Project.

The Contractor shall also submit a schedule of payments that he anticipates he will earn during the course of the Work.

At a time and date mutually acceptable to the Contractor, the Architect or Engineer and the County, the Parties shall meet at the Project site to review the Contractor's preliminary, draft application and certificate for payment for the period covering the preceding thirty (30) calendar days. Based upon the review and determination of monies to be owed and payable to the Contractor by the County set forth by the preliminary, draft application and certificate for payment, the Contractor shall promptly prepare and submit the formal application and certificate for payment to the Architect or Engineer for his signature and recommendation and transmittal to the County for payment. It is agreed by all the Parties that this proposed early review of the preliminary, draft application and certificate for payment in advance of its due date is intended to speed the review, submittal, approval and payment

process for the Contractor for the Work performed and due for payment by the County.

All lien waivers and other documents required for acceptance for payment by the County need only be submitted with the submittal of the formal application and certificate for payment, but it is understood by the Contractor that the advance review does not delete or modify the requirements for the submission of such necessary waivers and other documentation for payment by the County.

SECTION 38
COUNTY'S RIGHT TO SUSPEND OR TERMINATE WORK

If the Contractor is adjudged bankrupt or insolvent, or if he makes a general assignment for the benefit of his creditors, or if a trustee or receiver is appointed for the Contractor or for any of his property, or if he files a petition to take advantage of any debtor's act or to reorganize under the bankruptcy or applicable laws, or if he repeatedly fails to supply sufficient skilled workers or suitable materials or equipment, payments to Subcontractors or others, or for labor, materials or equipment, or if he disregards laws, ordinances, rules, codes, regulations or orders of any public body having jurisdiction of the Work, or if he otherwise violates any provision of the Contract Documents, then the County may, without prejudice to any other right or remedy and after giving the Contractor and his surety a maximum of seven (7) calendar days from delivery of a written notice by the County to the Contractor, declare the Contract in default, take possession of the Project and the site, and of all materials, equipment, tools, construction equipment and machinery thereon owned or rented or leased by the Contractor, and call upon the surety of and for the Performance and Labor & Material Payment Bonds to finish the Work of the Contract Documents by whatever method deemed expedient by the surety, upon consultation with the County.

Where the Contractor's services have been so terminated by the County, the termination shall not affect any rights or remedies of the County against the Contractor then existing or which may therefore accrue. Any retention or payment of monies due the Contractor by the County will not release Contractor from liability. If the Contractor can establish or it is otherwise determined that the Contractor was not in default or that the failure to perform is excusable, any issued termination for default will be considered to have been a termination for the convenience by the County and the rights and obligations of the parties governed accordingly.

Upon seven (7) calendar days' written notice to the Contractor by the County, the County may for its own convenience and at its sole option, without cause and without prejudice to any other right or remedy available to or for the County, elect to terminate the Contract. In such case, Contractor shall be paid, without duplication of any items:

A. For completed and acceptable work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such work;
B. For expenses sustained in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with Uncompleted Work;
C. For amounts paid in settlement of terminated contracts with Subcontractors and Suppliers;
D. Reasonable expenses directly attributable to termination including, but not limited to, fees and charges of engineers, Architect or Engineers, attorneys and other professionals, and court costs;
E. Contractor shall not be paid on account of anticipatory profits or overhead or consequential damages; and

F. Any payments made by the County to the Contractor in prior progress payments of the Project or to its surety as outlined or set forth above, shall not exceed the total contracted Contract Sum.

SECTION 39
ACCEPTANCE OF WORK
AND FINAL PAYMENT

Before final acceptance of the Work and final payment to the Contractor by the County of the withheld percentage retained by the County, the following requirements shall be complied with:

A. Final Inspection: Upon notice from the Contractor that the Work of the Project is completed, the Architect or Engineer shall make a final inspection of the Work, and shall notify the Contractor of all instances where the Work fails to comply with the Drawings and Specifications, as well as any defects the Architect or Engineer may discover. The Contractor shall immediately make such alterations as are necessary to make the Work comply with the Drawings and Specifications.
B. Contractor Inspection: Prior to calling for the inspection of the Work of the Project by the Architect or Engineer, the Contractor shall have performed a detailed inspection of the Work of the Project, and shall have made a determination of the Works' readiness for inspection by the Architect or Engineer, and the County.
C. Final Payment: When the Work under this Contract is completed, a final payment request shall be submitted representing the original Contract Price and Change Orders to the Contract. The final payment shall not be due until the Contractor shall have completed all work necessary and reasonably incidental to the Contract, including final clean-up.

Acceptance of the Work by the Architect and Engineer, and the County, and the making of final payment by the County shall not constitute a waiver of any claims by the County. At any time during and throughout the time for construction, and any time beyond the schedule dates for completion by the Contractor, payments otherwise due the Contractor may be withheld by the County because of defective work not remedied and unadjusted damage to others by the Contractor or Subcontractors, vendors, or laborers.

All claims for final payment must be submitted within thirty (30) calendar days after the Work has been finally completed and accepted by the County. Failure by the Contractor to present in writing said claims within that period shall constitute a waiver of the claim by the Contractor. All claims are subject to final approval and a separate audit by the Board of Commissioners of Cherokee County by an independent auditor.

SECTION 40
GUARANTEE AND CORRECTION
OF WORK

The Contractor shall guarantee all Work to have been accomplished in conformance with the Contract Documents. Neither the final certificate of payment nor any provision of the Contract Documents, nor partial or entire occupancy or use of the Work by the County, shall constitute an acceptance of any part of the Work not done in accordance with the Contract Documents, or relieve the Contractor of liability for incomplete or faulty materials or workmanship.

The Contractor shall promptly remedy any omission or defect in the Work and pay for any damage to other improvements or facilities resulting from such omission or defect which shall appear within

a period of one (1) year from the date of final acceptance, unless a longer period is elsewhere specified. In the event that the Contractor should fail to make repairs, adjustments, or other remedy that may be made necessary by such defects, the County may do so and charge the Contractor the cost thereby incurred. The Performance and Labor & Material Payment Bonds shall remain in full force and effect through the guarantee period.

It is agreed to by the Contractor and the Architect and Engineer, and the County, that eleven (11) months from the date of substantial completion, or when the warranty period has agreed to have commenced for the Work of the Project, the and the Architect and Engineer, and the County shall walk the project to make a determination of items requiring correction under the warranty requirements of the Project.

SECTION 41
VENUE

The law of the State of Georgia shall govern the construction of this Contract. The courts of Cherokee County, Georgia, shall have exclusive jurisdiction to try disputes arising under or by virtue of this Contract.

END OF GENERAL CONDITIONS
OF THE CONTRACT FOR CONSTRUCTION

SECTION 00870
CONTRACTOR APPLICATION AND CERTIFICATE FOR PROGRESS, SUBSTANTIAL AND FINAL PAYMENTS AND WAIVERS OF LIEN

PART ONE - GENERAL

1.01 DESCRIPTION:

Contractors shall for each progress, substantial and final application and certificate for payment for the project use AIA Document G702 and G703, current Edition, and shall attach to each application and certificate for payment the required waiver of lien, and submit to Cherokee County not later than the date each month set forth by the Construction Agreement, or as mutually agreed between the Parties to the Construction Agreement.

At a time and date mutually acceptable to the Contractor, the Architect or Engineer and the County, the Parties shall meet at the Project site to review the Contractor's preliminary, draft application and certificate for payment for the period covering the preceding thirty (30) calendar days. Based upon the review and determination of monies to be owed and payable to the Contractor by the County set forth by the preliminary, draft application and certificate for payment, the Contractor shall promptly prepare and submit the formal application and certificate for payment to the Architect or Engineer for his signature and recommendation and transmittal to the County for payment. It is agreed by all the Parties that this proposed early review of the preliminary, draft application and certificate for payment in advance of its due date is intended to speed the review, submittal, approval and payment process for the Contractor for the Work performed and due for payment by the County.

All lien waivers and other documents required for acceptance for payment by the County need only be submitted with the submittal of the formal application and certificate for payment, but it is understood by the Contractor that the advance review does not delete or modify the requirements for the submission of such necessary waivers and other documentation for payment by the County.

END OF SECTION

SECTION 01010
SUMMARY OF WORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Work
B. Contractor's Use of Site
C. Work Sequence Phasing and Completion
D. County Occupancy

1.02 DESCRIPTION OF WORK

A. General: The Work to be performed and completed by the Contractor under this Contract is shown on the drawings and specified in Contract Documents.

B. The Work to be included and provided by the Contractor includes:

1. Furnishing of all needed and necessary labor, material, project management, superintendence, layout & engineering, safety, protection of personnel & equipment and materials, materials and other testing, plant, power, light, heat, fuel, water, tools, appliances, enclosures, equipment, supplies, shoring, lifting, scaffolding, hoisting, product certifications, inspections, services and other means of necessary temporary and permanent construction necessary or proper for performing and completing the Work.
2. Sole responsibility for adequacy of plant and equipment.
3. Maintaining the Work area and site in a clean and acceptable manner.
4. Maintaining existing facilities in service at all times.
5. Protection of finished and unfinished Work.
6. Repair and restoration of Work or existing facilities damaged during construction.
7. Furnishing as necessary proper equipment and machinery, of a sufficient capacity, to facilitate the Work and to handle all emergencies normally encountered in Work of this character.
8. Furnishing, installing, and protecting all necessary guides, bearing plates, anchor and attachment bolts, and all other appurtenances needed for the installation of the devices included in the equipment, where or when specified. Make anchor bolts of appropriate size, strength and material for the purpose intended. Furnish substantial templates and shop drawings for installation.

C. Implied and Normally Required Work: It is the intent of these Contract Documents for the Contractor to provide the County with complete operable systems, subsystems and other items of Work. Any part or item of Work, which is reasonably implied or normally required to make each installation satisfactorily and completely operable, is deemed to be included in the Work and the Contract Amount. All miscellaneous appurtenances and other items of Work incidental to meeting the intent of these Contract Documents are included in the Work and the Contract Amount even though these appurtenances may not be specifically called for in the Contract Documents.

D. Quality of Work: Regarding the or any apparent silence of the Contract Documents as to any detail, or the apparent or unintended omission from the Contract Documents of a detailed description concerning any Work to be done and materials to be furnished as meaning that only the best general practice is to prevail and that only new materials and

workmanship of the best quality are to be used. All interpretations by the architect or engineer or the County of these Contract Documents will be made upon this basis.

1.03 CONTRACTOR'S USE OF SITE

A. In addition to the requirements of the Contract Documents, the Contractor shall limit the use of site and premises for work and storage to allow for the following:
   1. Coordination of the Work under this Contract with the work of the other contractors or the County, or other Contractors of the County, or other governmental agencies and authorities or utility owners and their contractors, where Work under this Contract encroaches on the Work of other contractors.
   2. County occupancy and access to operate existing facilities.
   3. Coordination of site use with architect or engineer, and the County.
   4. Responsibility for protection and safekeeping of products under this Contract.
   5. Providing additional off-site storage at no additional cost to the County as needed.

1.04 WORK SEQUENCE

A. Construct Work in stages to accommodate the County's use of premises during construction period and in accordance with the limitations on the sequence or phasing of construction specified. Coordinate construction schedules and operations with architect or engineer.

B. Coordinate Work of all subcontractors.

1.05 COUNTY OCCUPANCY

A. Provide means to permit County to occupy premises during entire period of construction if necessary or requested. Cooperate with the County's representative in all construction operations to minimize conflict, and to facilitate County usage.

B. Conduct operations with the least inconvenience to the general public.

1.06 PROTECTION OF EXISTING UTILITIES

A. In case of damage to existing utilities caused by Contractor construction activities, contact the owner of the utility or appropriate County department immediately. Repair any damage to existing utilities caused by Contractor construction activities in coordination with or as directed by the owner of the utility and the County at the expense of the Contractor.

B. In case of damage to newly constructed, or in process of being constructed, utilities caused by Contractor's construction activities, contact the contractor of the other utility construction work, owner of the utility and the appropriate County department immediately. Repair any damage to existing utilities caused by Contractor construction activities in coordination with or as directed by the other utility contractor, owner of the utility and the County at the expense of the Contractor.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

A. Starting Work: Start Work within ten (10) calendar days following the date stated in the Notice to Proceed and execute with such progress as may be required to prevent delay to other contractors or to the general completion of the project. Execute Work at such items and in or on such parts of the project, and with such forces, material and equipment, as to complete the Work in the time established by the Contract. At all times, schedule and direct the Work so that it provides an orderly progression to completion within the specified time for completion.

END OF SECTION

SECTION 01020 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing allowances.

1. Selected materials and equipment are specified in the Contract Documents by allowances. In some cases, these allowances include installation. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Quantity allowances.

1.3 DEFINITIONS

A. Suitable soil/materials are soils or materials defined as satisfactory or approved backfill and fill material or granular fill acceptable to the Owner, Testing Agency and Engineer of Record.

B. Unsuitable soil/material are soils or material defined as unsatisfactory and/or that are not suitable or appropriate for their intended use as determined by the Owner, Testing Agency or the Engineer of Record.

1.4 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise the Architect of the date when the final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At the Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by the Architect from the designated supplier.

1.5 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show the actual quantities of materials delivered to the site for use in fulfillment of each allowance.

1.6 ALLOWANCES, GENERAL

A. Owner reserves the right to use unused portions of Allowances for other Work required by the Project.

1. The Owner or Architect shall direct the Contractor as to the use of any unused Allowances.

1.7 QUANTITY ALLOWANCES

A. Use quantity allowances as scheduled in this section in conjunction with unit prices listed on the RFP Form and described in Specification Section 01026 – Unit Prices to determine line item values associated with the quantity allowances schedule.

B. Line items for each quantity allowance scheduled shall be included on the "Schedule of Values" included with application for payments.

C. Contractor's costs associated with these line item values shall include all costs necessary, including but not limited to: materials, delivery, installation, insurance, applicable taxes, overhead and profit, labor burden, etc.

D. Should the quantity allowances be exceeded, change orders authorizing additional quantities shall use the same unit prices as scheduled on the RFP Form for any additional costs.

E. At project closeout, credit all unused allowances remaining in the Schedule of Values to Owner by change order.

1.8 LUMP-SUM ALLOWANCES

A. Line items for each lump sum allowance scheduled shall be included on the "Schedule of Values" included with the Application for Payment.

B. At project closeout, credit all unused allowances remaining the Schedule of values to Owner by Change Order.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Back fill and fill materials shall be provided as indicated in Division 2 – Earthwork or as recommended by Testing Company and approved by the Owner and Engineer of Record.

PART 3 - EXECUTION

3.1 EXAMINATION

A. If unsuitable soils or rock are encountered during the Project, the Owner, Testing Company and the Engineer of Record shall be notified immediately.

3.2 UNSUITABLE SOILS AND ROCK

A. Removal, disposal and placement of unsuitable soils materials and any rock shall be at the recommendation of the Project's Testing Company and as approved by the Owner and Engineer of Record.

1. Removal shall include removal by acceptable methods and equipment of the minimum quantities deemed necessary by the Project's Testing Company and as approved by the Owner and Engineer of Record.
2. Disposal shall include disposal of materials either on site or off site as indicated. Disposal of materials on site shall be at the direction of the Owner and Engineer of Record. Rock materials disposed of on site shall be placed in fill slopes as directed by the Owner and Engineer of Record. Disposal of materials off site shall be in accordance with applicable laws and regulations. It shall be the responsibility of the Contractor to dispose of off site materials accordingly.

3. Placement shall include obtaining suitable backfill and or fill materials or some obtained from on-site or off-site sources as indicated and placing materials and compacting to Project requirements. Materials obtained from on-site sources shall be obtained from on site locations as directed by the Owner and Engineer of Record.
4. **No allowances shall be paid unless all quantities are qualified, quantified and approved by the Projects Testing Company, Owner and the Engineer of Record.**

3.3 REMOVAL AND RELOCATION OF EXISTING UTILITIES

A. Removal or relocation of utilities shall be coordinated by the Contractor.

3.4 SCHEDULE OF ALLOWANCES:

Note: The Quantity Allowance / Unit prices are in addition to work already included in the contract documents.

A line item for these allowances shall be included on the "Schedule of Values" included with application for payments.

At project closeout, credit the remaining amount of all allowances in the Schedule of Values to the Owner by change order.

A. Quantity Allowances

1 Include in the proposal an amount to remove and dispose of 250 cubic yards of Mass Rock off site.
2. Include in the proposal an amount to remove and dispose of 250 cubic yards of Trench Rock off site.
3. Include in the proposal an amount to remove and dispose of 750 cubic yards of unsuitable soil off site.
4. Include in the proposal an amount to haul in 750 cubic yards of suitable soil from off-site and compact in-place to replace excavated rock or unsuitable soil.
5. Include in the base bid an amount to haul in and place 30 cubic yards of #4 stone.
6. Include in the base bid an amount to haul in and place 30 cubic yards of GAB.
7. Include in the base bid an amount to haul in and place 30 cubic yards of #57 stone.
8. Include in the base bid an amount to haul in and place 10 cubic yards of Rip Rap.
9. Include in the base bid an amount for material and placement of 200 square yards of Tensar BX 1100 Geogrid or approved equal.
10. Include in the base bid an amount to furnish and place 150 lineal feet of French Drain.
11. Include in the Base bid $1,200 per 1000 bricks. All calculations for brick quantities are the responsibility of the contractor. See section 04200 Masonry for additional information.

B. Lump Sum Allowances

1. Include the lump sum amount of $10,000.00 for coordination of the Owner's Radio System Integration.
2. Include the lump sum amount of $50,000.00 for purchase & installation of the Owner's selected Station Alerting system.
3. Include the lump sum amount of $15,000.00 to furnish and install Technology materials **in addition to those shown in the Contract Documents**. This allowance shall be used at the Owner's discretion.
4. Include the lump sum amount of $15,500.00 for purchase & installation of the Owner's selected Monument Sign.
5. Include the lump sum amount of $15,000.00 to furnish and install landscape materials **in addition to those shown in the Contract Documents**. This allowance shall be used at the Owner's discretion.

6. Include the lump sum amount of $50,000.00 for Unforeseen Conditions. This allowance shall be used at the Owner's discretion.

END OF SECTION

SECTION 01026 - UNIT PRICES

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 administrative and procedural requirements for unit prices.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Earthwork" for requirements and procedures regarding rock excavation.

1.3 DEFINITIONS:

A. Unit price is an amount proposed by bidders, stated on the Request For Proposals Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if the estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES:

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, profit, and applicable taxes.

B. Measurement and Payment: All measurements shall be verified by an on site representative from the Owner's geotechnical testing firm. Refer to individual Specification Section 01020 – Allowances for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in that Section.

C. Schedule: A "Unit Price Schedule" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 UNIT PRICE SCHEDULE: Reference Section 01020 and RFP Form

END OF SECTION

SECTION 001300 - SUBMITTALS

PART ONE - GENERAL

1.01 DESCRIPTION:

A. Submittals: General term including samples, shop drawings and product data, as applicable and as defined by the General Conditions.

B. General Provisions:
1. Provisions in this section are mandatory procedures for review, approval and submitting samples, shop drawings and product data in accordance with the General Conditions.
2. Submittals which are received directly from sources other than through the Project Architect Engineer's office will be returned to the Contractor "without action".
3. All submittals, samples or other items that require review or approval by Cherokee County shall be submitted to and through the Project Architect Engineer's office.
4. Job delays occasioned by requirement of re-submission of samples, shop drawings, on-site and off-site mock-ups, and product data not in accord with Contract Documents and/or submittals sequenced contrary to the agreed schedule are the Contractor's responsibility, and will not be considered valid justification for extension of contract time or increase in the contract sum.

1.02 SAMPLE PREPARATION:

A. Prepare samples in sizes, shape and finish in accord with provisions of individual specification sections.

B. Samples are not to be confused with full size, on-site or off-site "Mock-Ups" called for in some specification sections.

C. Samples shall be submitted for the Cherokee County's selection and approval in accordance with the Contractor's submittal schedule or sooner as needed to maintain construction progress. Approvals and color selections will not be made unilaterally where samples or selections of adjacent materials must be made for the purpose of aesthetics. Submit samples for adjacent and interrelated materials concurrently. The Owner will approve all colors before the Cherokee County can take action.

D. The number of samples submitted shall be the number required by the Contractor, plus six (6), which will be retained by the Cherokee County and the Owner, unless otherwise indicated.

1.03 SHOP DRAWING PREPARATION:

A. Drawing shall conform to the following requirements:
1. Number sheets consecutively.
2. Indicate working and erection dimensions and relationships to adjacent work.
3. Show arrangements and sectional views, where applicable.
4. Indicate material, gauges, thicknesses, finishes and characteristics.
5. Indicate anchoring and fastening details, including information for making

connections to adjacent work.

6. Provide drawings suitable for printing at 8 ½ x 11 or 11 x 17 copies.
7. Indicate working and erection dimensions and relationships to adjacent work. Concurrent submittals of different aspects of work may be required by the Cherokee County as deemed necessary to demonstrate Contractor's ability to understand these relationships and coordinate the Work.
8. Provide 6" x 6" clean space in the lower right hand area for entry of review stamps.
9. Cross-reference drawing details and specification paragraphs applicable to the submittal data.

B. Form: All submittals will be provided electronically to Cherokee County and the Design Professional. Hard copies of full size drawings or other small scale submittals may be required if requested by Cherokee County.

1.04 PRODUCT DATA PREPARATION:

A. Include product manufacturer's standard printed material, dated, with product description and installation instructions indicated. Data not related to this project shall be deleted or marked "VOID" as applicable.

B. Form: All submittals will be provided electronically to Cherokee County and the Design Professional. Hard copies of full size drawings or other small scale submittals may be required if requested by Cherokee County.

C. Submitted material shall be:
1. Legible.
2. Sized suitable for printing at 8 ½ x 11 or 11 x 17 copies.
3. Stamped (either on a clean-area space or the reverse side) with the Contractor's approval action.

D. All submitted data shall bear the Contractor's approval action stamp plus his review notes, comments, and corrections as required. Submittals without the required stamp shall be returned with marked for re-submittal.

1.05 CONTRACTOR'S REVIEW:

A. Review submittals and stamp with approval prior to submission; Contractor's stamp shall bear the Contractor's name, the word "Approved", the signed initials of the approving agent, and the date of his approval action. By so noting, the Contractor indicates to the Cherokee County, and Owner that he has reviewed and approves the materials, equipment, quantities and dimensions represented by the particular submittal.

B. Where work is indicated "By others", Contractor shall indicate responsibility for providing and coordinating such work.

C. Submissions made without Contractor's approval indicated thereon will be returned without being reviewed for compliance with this requirement. Such action by the Contractor requiring re-submittal will not be considered valid justification for extension of contract time or increase in the contract sum.

D. Date each submittal and indicate name of Project, Project Architect Engineer, Cherokee

County, Contractor, Sub-Contractor, as applicable, description or name of equipment, material or product and identify location at which it is to be used in the Work. Cross-reference to specific drawing and specification references.

E. Accompany submittal with transmittal letter containing project name, Contractor's name, number of samples or drawings, titles and other pertinent data. Transmittal shall outline deviations, if any, in submittals from requirements of Contract Documents.

1.06 CHEROKEE COUNTY'S REVIEW:

A. Cherokee County's review will be in accordance with the procedures noted or outlined above.

B. Cherokee County may elect to retain all submittals and other information for its records and files. Contractor shall take such possible action into consideration when making submittals for review and other action by Cherokee County.

1.07 RESUBMISSION:

A. Make corrections and changes indicated for unapproved submissions and resubmit in same manner as specified above, until Project Architect Engineer’s or Cherokee County’s review is obtained or completed.

B. In resubmission transmittal, the Contractor shall direct specific attention to revisions other than corrections requested by Project Architect Engineer or Cherokee County on previous submissions, if any.

C. Contractor shall be responsible for bearing all costs associated with the review and approval process of resubmitted (and/or substituted) submittal data.

1.08 DISTRIBUTION:

A. Contractor is responsible for obtaining and distributing copies of reviewed submittals which carry the Project Architect Engineer's appropriate stamp to his subcontractors and material suppliers after, as well as before, final approval.

B. Contractor shall maintain a file of approved submittals for duration of project, which shall be delivered to Cherokee County, through the Project Architect Engineer’s Office as a part of project close-out documents.

C. The Contractor shall maintain a file of all approved submittals, bearing the Stamp of the Project Architect Engineer, at the project site. In the event Project Architect Engineer or Cherokee County should question the installation of any aspect of the work requiring approved submittal data, the inability of the Contractor or its Superintendent to produce the required approved submittal data upon demand at the job site shall constitute cause for a "stop work" order to be issued on that particular questioned aspect of the work and all relevant appurtenant work. The cause shall be equal to the Contractor not having received required approval of the submittal data. If so issued, such "stop orders" shall not be considered valid justification for extensions of contract time and/or claims for additional monetary compensation.

1.09 SCHEDULE OF SUBMITTALS:

A. The Contractor shall, within ten (10) calendar days following the Notice to Proceed of the Contract, submit his proposed schedule of submittals to the Project Architect Engineer Cherokee County for review.

B. The purpose of the schedule is to:
1. Demonstrate that all submittals, shop drawings, data, samples and mock-ups required for the Work are addressed by the Contractor.
2. Demonstrate consistency with the Contractor's proposed Construction Schedule.
3. Assist Cherokee County in scheduling timely review/approval action of submittals.

C. The schedule shall contain the description of the submitted item, the proposed date of submittal and the proposed date of requested return by the Project Architect Engineer or Cherokee County

D. After Project Architect Engineer’s receipt of the Contractor's submittal schedule, the Project Architect Engineer and the Contractor shall jointly review the schedule and mutually agree to acceptability or necessary modifications.

E. Contractor shall submit his final accepted schedule within five (5) calendar days after the date of the joint review.

END OF SECTION

SECTION 001310 - CONSTRUCTION SCHEDULES

PART ONE - GENERAL

1.01 DESCRIPTION: This section and any supporting graphic phasing schedule that may be included with and a part of the Drawings, cover provisions for construction or phasing schedules for the work of this Project as a whole, integrating the schedules and dates of performance of the many contractors. The Bidder and Contractor shall have carefully reviewed these schedule or phasing requirements and shall have included in his bid and contract sum all necessary and needed construction procurement and procedures. Where called for, required or generally inferred by the Contract Documents or by any utility agency or authority, the Contractor shall coordinate any utility shut down, disconnection, and re-connection.

1.02 RELATED REQUIREMENTS:

A. Schedule of Values: General Conditions of the Contract for Construction.

B. Progress Meetings: General Conditions of the Contract for Construction and Section 013120 Project Meetings.

C. Submittals: Section 013000 Submittals.

1.03 GENERAL:

A. Project Construction Schedule: The Contractor's developed and submitted working schedule information and data, including costs, activities, durations and sequence, shall be used by the Contractor to plan, organize, and execute the project as a whole, integrating the schedules and dates of performance of the many contractors of this contract, and any other separate contractors or the County; and to record and report actual performance, progress and cost; and demonstrate how Contractor plans to perform and complete his work.

B. Contractor's Responsibility: Nothing in these requirements shall be deemed to be usurpation of Contractor's authority and responsibility to plan and schedule work as he sees fit, subject to all other requirements of Contract Documents.

1.04 SCHEDULES:

A. Preliminary Project Construction Schedule: At time of the Pre-construction Conference, the Contractor shall work with the architect and engineer and the County to develop a preliminary schedule for review, comment and incorporation into the project master construction schedule of the following elements and requirements:

1. Reflect intended detailed sequence and duration of work activities for period commencing with Notice to Proceed and continuing through first ninety (90) calendar days.
2. Schedule in sufficient detail to clearly portray work activities, including procurement and submittals sequence of activities, along with phasing, and

milestones associated with this period. Site work activities to be clearly distinguished from the building's activities.

3. Schedule shall be consistent with As-Planned Schedule specified below.
4. Schedule will be reviewed by the Contractor for acceptability of form and format, and or integration with all other elements of the work of the total project for construction.
5. Progress Payments: Submittal of the requested information from the Contractor, and acceptance by the County is a prerequisite for Contractor's first progress payment.

C. As-Planned Project Construction Schedule: No later than twenty-one (21) calendar days after Notice to Proceed the Contractor shall submit his As-Planned Project Construction Schedule for review and comment by the architect or engineer. Schedule will also be reviewed by the County for acceptability.

1. Schedule shall reflect intended detail of work activities for entire period of contract performance commencing with Notice to Proceed of work for fabrication, delivery, on-site work and continuing through Contract Completion.
2. Schedule in sufficient detail to clearly portray all work activities and entire cycle of submittal, approval, fabrication and delivery as related to significant items of design, material, and permanent equipment fixtures. Schedule to indicate separately site work activities from building activities. With respect to the building, schedule should group interior activities distinctly from exterior shell and structural activities that are required to be completed prior to building being weather tight.
3. Schedule information provided shall allow for a fully detailed Project Construction Schedule.
4. The Schedule shall reflect the number of normal bad weather days as stated for each month in the Contract Documents.
5. The Schedule shall reflect the project cost breakdown as submitted in the applications for payment including any approved Change Orders as separate line items.
6. Progress Payments:
    a. Initial acceptance of As-Planned Project Construction Schedule and submittal of Schedule Updates by Contractor shall be prerequisite for progress payments commencing with second progress payment after Notice to Proceed and continuing to Contract Completion.
    b. The Contractor shall indicate on the completed Project Construction Schedule the work-in-place cost for each activity. The cumulative amount for all activities shall equal the total contract price. Overhead and profit shall be pro-rated on all activities for the entire project length. Final cost loading of the Contractor’s activities is subject to final approval and acceptance by the County.

1.05 UPDATING AND REPORTING INFORMATION TO BE PROVIDED BY CONTRACTOR:

A. Schedule Updates: Update Project Construction Schedule monthly based on actual progress. Reflect actual start and/or finish dates of activities along with percentage of completion for activities started and not yet complete.

B. Monthly Status Reports: Submit Monthly Status Report and Updated Project Construction Schedule with each monthly application and certificate for payment. Summarize work performed during preceding month, indicate milestones achieved and update Schedule of Values. Include separate listing of activities which are causing delay to work progress. Include narrative to define problem areas, anticipate delays and impact on schedule. Report corrective action taken, or proposed, and its effect, including effect of changes on schedules of separate contractors. Include items which the Contractor perceives as being delays to the timely completion of its work and the project as a whole.

C. Schedule Progress Meetings: Discuss progress of project in conjunction with Project Construction Schedule at progress meetings. Include:

1. Actual completion dates for work items completed since last meeting.
2. Actual start dates for work items started since last meeting.
3. Estimating remaining durations for work items in progress.
4. Estimated start dates for work items scheduled to start before next meeting.
5. Changes in durations of work items.
6. Identification of current and most critical paths to required completion dates.
7. Discussion on narrative report.
8. Submission of weekly "Look Ahead" report and statement indicating what achievements are anticipated prior to the next meeting.
9. Discussion on procurement schedules, material and equipment fabrication and/or shipping updates.
10. Weather activities for each calendar day, noting low and high temperatures, and total precipitation (all forms) at the site for each calendar day. As documentation of the occurring event at the time, and as maybe an ongoing event, the Contractor shall note weather extremes that have or may have an affect upon the timely progress of completion of the Work. Failure by the Contractor to note, describe and to document any such occurring or occurred weather event by this reporting procedure shall be a waiver by the Contractor of any future or other impact to the Project or the Work.

D. Work Progress:

1. Should any activity or activities fail to be completed within seven (7) days after indicated schedule date, Contractor shall expedite completion of activity by whatever means deemed appropriate and necessary without additional compensation to Contractor, and without additional costs to the Project or the County.
2. Should any activity be ten (10) or more days behind schedule, the Contractor shall promptly prepare and implement a recovery schedule to correct the indicated delay, at no additional costs to the Project or the County or the Architect or Engineer.
3. Should any activity be ninety (90) or more days behind schedule, the County shall have the right to directly perform activity or have activity performed by whatever method the County may deem appropriate. Costs incurred by the County in this activity shall be deducted from Contractor’s Contract Price during next progress payment period.
4. It is expressly understood and agreed that failure by the County to exercise the above or any other option to expedite any delayed activity shall not be construed as precedent for any other activities or as waiver of the County’s rights to exercise its rights on subsequent occasions.

1.06 SUBMITTALS:

A. Submit updated schedules monthly concurrent with pay application, accurately depicting progress to first day of each month.

B. Submit on forms and in format required for the County's review.

END OF SECTION

SECTION 01312
PROJECT MEETINGS

PART ONE - GENERAL

1.01 SUMMARY

A. Project meetings:
   1. The Contractor will conduct regular meetings throughout Project life for discussion and resolution of Project issues. These meetings will be held on a frequency related to Project status, i.e., weekly, bi-weekly, monthly, or others.
   2. Attendance by the Contractor shall be as determined by the County. Contractor's subcontractors, suppliers, and others are to attend on an as-needed basis or as directed by the County
   3. Suggested general agenda:
      a. Technical issues concerning project and bid package scope of work,
      b. Schedule,
      c. Submittal's status,
      d. Change Order status,
      e. RFI status,
      f. Status of invoicing and payments by the County,
      g. Other business, and
      h. Confirmation of prior meetings and minutes.

B. Requirements below are intended for Contractor, subcontractors, sub-subcontractors, and material suppliers for discussion and resolution of Project specific situations.
   1. Meetings between Contractor and the County for purpose of discussing Project progress or resolving problems are delineated above.
   2. The County may attend Contractor's meetings to ascertain work is expedited consistent with Contract Documents and construction schedules.

C. The Contractor's duties include:
   1. Schedule and administer periodic progress meetings, and specially called meetings throughout work progress.
   2. Prepare and distribute agenda for meetings.
   3. Distribute written notice and agenda of each meeting three (3) days in advance of meeting date.
   4. Make physical arrangements for meetings.
   5. Preside at meetings.
   6. Record minutes; include significant proceedings and decisions.
   7. Reproduce and distribute copies of minutes within seven (7) days after each meeting as follows:
      a. One copy to each participant in meeting.
      b. One copy to parties affected by decisions made at meeting.

D. Representatives attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

E. Related Sections:
   1. Section 01310: Construction Schedule

2. Section 01300: Submittals

F. Pre-construction meeting:
1. Within five (5) calendar days after date of Notice to Proceed for On-site Construction.
2. Location: Central site, convenient for all parties, designated by The County
3. Attendance:
   a. The County and its and professional consultants.
   b. Contractor's Project Manager and Superintendent.
   c. Major subcontractors and sub-subcontractors.
   d. Major suppliers and vendors.
   e. Others, as appropriate, or requested and invited to attend by the County
4. Suggested Agenda:
   a. Distribution and discussion of:
      1) List of major subcontractors and suppliers, and
      2) Projected Construction Schedules.
      3) Site safety and security.
   b. Critical work sequencing over the first thirty (30) days.
   c. Major equipment deliveries and priorities.
   d. Project coordination: Designation of responsible personnel.
   e. Procedures and processing of:
      1) Field decisions, and directives, including force account work
      2) Requests for Information (RFI's),
      3) Proposal requests,
      4) Submittals,
      5) Change Orders, and
      6) Applications and Certificates for Payments, and waivers of lien.
   f. Adequacy of distribution of Contract Documents.
   g. Procedures for maintaining Record Documents.
   h. Use of premises:
      1) Office, work, employee parking and storage areas.
      2) Site access and control,
      3) Owner's requirements and separate work of the Owner.
   i. Temporary facilities, controls, and construction aids.
   j. Temporary utilities.
   k. Safety and first-aid procedures.
   l. Security procedures.
   m. Housekeeping procedures.
   n. Other.

G. Project meetings:
1. The Contractor will schedule regular periodic project meetings as required.
2. The Contractor will hold called special meetings as required by progress of work.
3. Meeting's locations: Project field office of the Contractor.
4. Attendance:
   a. Contractor, Subcontractors, and Sub-subcontractors as appropriate to agenda, as determined by the County
   b. Suppliers and vendors, as determined by The County as appropriate.
   c. The County and its professional consultants, as needed or required.
   d. Others, as determined by the County
5. Suggested agenda:

a. Introduction and sign-in of attendees.
b. Review, corrections and approval of minutes of previous meeting.
c. Review of work in progress since previous meeting.
d. Field observations, problems, and conflicts.
e. Review of Technical/Design Issues
    1) Civil
    2) Structural
    3) Architectural
    4) Mechanical
    5) Plumbing
    6) Fire Protection
    7) Electrical
    8) Security Equipment
    9) Security Electronics
    10) Materials Testing & Reporting
    11) FF&E
    12) Other
f. Review of Schedule.
    1) 2-week "look ahead."
    2) Weather: precipitation & temperatures at site.
    3) Recovery action; if and as needed, to regain project schedule.
    4) Review of off-site fabrication, delivery schedules.
    5) Revisions and modifications to Progress Schedule.
    6) Coordination of schedules and work of the various Contractors.
g. Review submittal schedules and logs; expedite as required.
    1) By Contractors in preparation for submittal.
    2) By the County
    3) By Others, as needed.
    4) Update of submittal logs and schedule.
h. Maintenance of quality standards.
i. Review status of submitted, pending and returned Requests for Information.
j. Review status of submitted, pending and returned change order proposals and change orders, including status of supporting cost information.
k. Review and status of field directives and force account work
l. Review of Contractor requested changes and substitutions for effect on:
    1) Progress schedule and on completion date, and
    2) Other contracts of Project.
m. Review Monthly Pay Applications, and status of payments.
n. Site safety and security.
o. Record Documents.
p. Summary of critical issues.
q. Other.
r. Adjournment.

END OF SECTION

SECTION 01400
STATEMENT OF SPECIAL INSPECTIONS

PART ONE - GENERAL

1.01 DESCRIPTION

A. See attached Statement of Special Inspections for this project as prepared by William J. Peltier and Associates.

STATEMENT OF SPECIAL INSPECTIONS

PROJECT: CHEROKEE COUNTY EMS STATION #30

LOCATION: 2017 E. CHEROKEE DRIVE, WOODSTOCK GA. 30188

PERMIT APPLICANT: _____

APPLICANT'S ADDRESS: _____

ARCHITECT OF RECORD: _____

STRUCTURAL ENGINEER OF RECORD: WILLIAM J PELTIER, PE

MECHANICAL ENGINEER OF RECORD: _____

ELECTRICAL ENGINEER OF RECORD: _____

REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE: WILLIAM J PELTIER, PE

This Statement of Special Inspections is submitted in accordance with Section 1704.3 of the 2018 International Building Code. It includes a *Schedule of Special Inspection Services* applicable to the above-referenced Project as well as the identity of the individuals, agencies, or firms intended to be retained for conducting these inspections. If applicable, it includes *Special Inspections for Seismic Resistance* and/or *Special Inspections for Wind Resistance*.

Are *Special Inspections for Seismic Resistance* included in the *Statement of Special Inspections*?	☒ Yes	☐ No
Are *Special Inspections for Wind Resistance* included in the *Statement of Special Inspections*?	☐ Yes	☒ No

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

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

__Weekly __Bi-Weekly X Monthly Other; specify:_____

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

Statement of Special Inspections Prepared by:

WILLIAM J PELTIER, PE
Type or print name

Signature

DECEMBER 08, 2023
Date

Preparer's Seal

Building Official's Acceptance:

Signature Date

Permit Number:

Frequency of interim report submittals to the Building Official:

__Monthly __Bi- Monthly __Upon Completion Other; specify:_____

Statement of Special Inspections
Requirements for Seismic Resistance

See the Schedule of Special Inspections for inspection and testing requirements

Seismic Design Category: C

Statement of Special Inspection for Seismic Resistance Required (Yes/No): YES
Description of seismic force-resisting system subject to special inspection and testing for seismic resistance:
(Required for Seismic Design Categories C, D, E or F in accordance with IBC Sections 1705.11.1 through 1705.11.3, 1707.12.1 and 1705.12.2.)

Special Reinforced Masonry Shear Walls

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

Description of additional seismic systems and components requiring special inspections and testing:
(Required for systems noted in IBC Section 1705.11, cases 3, 4 & 5 in Seismic Design Categories C, D, E or F.)

Periodic inspection during anchorage of electrical equipment for emergency or standby power systems
Periodic inspection during the installation and anchorage of piping systems & mechanical unit containing flammable, combustible, or highly toxic materials.
Periodic inspection during the installation and anchorage of vibration isolation systems
Periodic inspection during the installation of mechanical and electrical equipment where automatic fire sprinkler systems are installed.

Statement of Responsibility:
Each contractor responsible for the construction or fabrication of a system or component described above must submit a Statement of Responsibility.

SECTION 01500
CONTRACTOR'S TEMPORARY
ON-SITE FACILITIES

PART ONE - GENERAL

1.01 TEMPORARY ON-SITE FACILITIES TO BE PROVIDED BY CONTRACTOR:

A. Temporary Offices: Provide sufficient space for Contractor's personnel.
1. Provide temporary office facilities complete with lighting, heating and air conditioning and telephone service.
2. Location of temporary office shall be subject to County's acceptance.
3. Temporary on-site facilities required under this section relate only to the Contractor's needs.
4. **NO ON-SITE FACILITIES are required for the Architect or Engineer, or the County.**
5. Contractor shall relocate offices and other storage buildings or facilities as necessary, at no additional costs to allow the work of the project and the other contractors to be performed.

B. Temporary Storage Facilities: Install and maintain storage and fabrication sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters of fully enclosed spaces. Locations and adequacy of storage facilities shall be subject to the County's approval.

C. Electrical Service: Provide temporary electrical service, including extensions and connections necessary for construction work.

D. Temporary Lighting: Provide the following minimum light levels for construction purposes. Comply with OSHA requirements for temporary lighting:

E. Temporary Heat and Ventilation to be provided by the Contractor for the timely performance and protection of its work:
1. Provide temporary heat in enclosed spaces to provide minimum temperatures of 40^{O}F until time finishing work begins.
2. After building is totally enclosed and installation of finishes begins, maintain spaces in a temperature range of 60^{O}F to 80^{O}F at all times, except as may otherwise be required by product manufacturers for proper product installation and performance. Contractor shall maintain until Date of Substantial Completion has been established by the County.
3. Maintain relative humidity in a range of 50% to 65% in enclosed spaces after building is enclosed and installation of finishes begin; except as may otherwise be required by product manufacturers for proper product installation and performance.
4. Provide ventilation to prevent accumulation of dust, fumes or gases and to properly cure materials and disperse humidity.

F. Telephone Service: Provide temporary telephone service to temporary offices for duration of project. Contractor to pay costs for installation and services.

G. Water Service: Provide temporary water for construction purposes, including extensions and connections necessary for work, including but not limited to any irrigation requirements of the Work of the Project.

H. Sanitary Toilet Facilities: Provide and maintain temporary toilet facilities for construction and site visitors and other personnel. Permanent new facilities may not be used by personnel.

I. Relocate temporary facilities during construction as required by progress of the Work at no additional cost.

J. Power for Contractor's temporary office and storage trailers shall be paid by the Contractor.

K. At completion of Work, or at time of permanent utility connections, as applicable, remove temporary facilities, including connections and debris resulting from temporary installation.

1.02 STAGING AREA:

A. The Contractor shall establish staging areas WITHIN the designated Limits of Work area for this Contract; no staging or materials storage will be permitted outside the Limits of Work area.

B. The Contractor is solely responsible for all security, protection, safeguards, etc. of materials and personnel within the established staging area (areas).

1.03 TEMPORARY CONTROLS:

A. Noise Control: Contractor shall make every effort to effect a satisfactory noise abatement Construction. Use sound deadening materials where required to reduce disturbances to classroom in session.

B. Dust Control: Where cutting or removing materials which will generate dust and dirt, the Contractor shall provide temporary dust curtains, solid barricades, or the like, to retain and control dust relative to the area in which work is occurring. Clean areas of dust as practicable so as not to allow its spread by pedestrian traffic.

1.04 CONTRACTOR'S USE OF PREMISES: The Contractor is reminded that the Project is limited by its nature to certain physical areas. The facilities may be occupied (except as provided for work areas) while the work progresses, therefore, restrict personnel to areas where such occupancy exists.

1.05 PARTIALLY OCCUPIED NEW BUILDING AND SITE SECURITY:

A. Contractor is responsible for operating in a manner that will maintain the security of the building and its contents, and the site areas where affected.

B. Any temporary barriers between new work and existing to be secured with solid temporary walls.

C. Required emergency exit ways shall be maintained at all times at buildings and the site in general.

D. Contractor shall be responsible for the security of the entire site for the entire duration of the construction n period. Before leaving at the end of each work day or work shift, Contractor shall check all gates, doors, windows, etc. to be certain that they are closed, locked and secure. Contractor shall leave premises in a condition to allow normal operation by the County for its intended uses.

END OF SECTION

SECTION 01630
SUBSTITUTIONS

PART ONE - GENERAL

1.01 REQUIREMENTS INCLUDED: Substitutions for products specified shall be allowed only under the conditions stated in this section.

1.02 SUBSTITUTIONS/PRIOR APPROVALS:

A. If it is desired to use products different from those indicated in the Contract Documents, the party requesting the substitution shall make written application as described herein. The burden of proving equality of proposed substitutions rests on the party making the request for substitution.

B. Requests for substitution shall reach the Architect or Engineer not less than ten (10) calendar days prior to the date for opening of bids. Requests received after this date will not be considered.

C. Nothing contained by these requirements shall prevent and should not discourage the Contractor from making a reasonable request for a product substitution for review. However, until such a substitution is approved and accepted, the Contractor shall be held accountable and responsible for fulfilling the requirements of the Contract Documents for the price submitted and for meeting the requirements for schedule, completion and performance.

D. Requests for Substitution made at any time throughout the project by any party shall follow these procedures. All such requests shall be through and by the Contractor, and submitted to the Architect or Engineer for review and determination for approval in consultation with the Contractor.

E. Submittal of any request by the Contractor from another contractor or party under its control or contract shall constitute an approval and acceptance by the Contractor as to costs and time impact to the project for completion within the contracted sum and time.

1.03 SUBMITTALS:

A. Submit a separate request for each substitution. Support each request with:
   1. Date of request.
   2. Name of party proposing substitution.
   3. Project name.
   4. Specification reference.
   5. Complete data substantiating compliance of proposed substitution with requirements stated in Contract Documents:
      a. Product identification, including manufacturer's name and address.
      b. Manufacturer's literature, identify:
         (1) Product description.
         (2) Reference standards.
         (3) Performance and test data.
         (4) Manufacturer's recommendations for use and installation.

c. Samples, as applicable.
d. Name and address of similar projects on which product has been used, and date of each installation.

6. Itemized comparison of the proposed substitution with product specified, list all variations.
7. Data relating to changes in construction schedule.
8. Any effect of substitution on other contractors and parties under the control or contract to the Contractor, to any and all separate contracts under the control or contract to the County.
9. List of changes required in other work or products.
10. Designation of required license fees or royalties.
11. Designation of availability of maintenance services, sources of replacement materials.

If a proposed substitution is approved, an addendum will be issued to prospective Bidders not less than three (3) calendar days prior to the date set for opening bids. If a substitution does not appear in an addendum it shall mean that the request has not been approved, and the product and the successful Bidder shall be responsible for furnishing materials and products in accordance with the Contract Documents.

If a proposed substitution is approved by the Architect or Engineer, upon consultation with the County after the contract has been executed by the parties, a Change Order shall be prepared by the County and distributed for approval and execution by both parties to the contract. No substitution shall be approved or binding upon the County unless said Change Order has been executed.

1.04 CONTRACTOR'S REPRESENTATION: In connection with the use of any substitute item approved by the County it shall be the Contractor's responsibility to see that such items meet all space requirements, and that any alterations to connecting items necessitated by use of the alternate items are properly made at no increase in cost to the County, and that all items are in compliance with the specification requirements. In submitting a request for any substitution, the Contractor represents and shall waive all claims for additional costs and contract time caused by substitutions which may subsequently become apparent or made necessary in the performance of the work of the project by the County, or any of its other contractors.

1.05 If substituted product or equipment requires any redesign of the building's architecture, structure, foundation, piping, mechanical system, security electronics systems, wiring, and/or other items, such redesign, including any new drawings, specifications and details shall be prepared by the requesting Contractor, vendor and/or supplier, at his sole expense and submitted to the Architect or Engineer, for consultation with the County for review and acceptance, prior to proceeding to incorporate the substitution work. Any additional required engineering and/or construction management or supervision performed by the County due to the substitution shall also be paid by the requesting Contractor, vendor or supplier.

1.06 If the substituted product affects other work in the project and/or requires changes in that other separate work, as shown and required by the contract documents, the requesting Contractor, vendor and/or supplier shall also fully pay for these other needed or necessary changes in the work of the project. This shall include any modifications known at the time of the substitution's approval and/or later found and determined by the County to be necessary or needed.

END OF SECTION

SECTION 01640
REQUEST FOR INFORMATION (RFI)
FORM & PROCEDURES

PART ONE - GENERAL

1.01 SUMMARY

A. Included within this Section and attached is the Requests for Information (RFI) form to be used by the Contractor for the project in submitting requests for information or clarifications to the Architect or Engineer, or the County.

B. Unless otherwise agreed by and among the parties, ONLY THIS FORM SHALL BE USED FOR REQUESTS FOR INFORMATION TO THE ARCHITECT OR ENGINEER OR TO THE COUNTY.

C. The Contractor will assign each request a unique number upon its receipt and forwarding for review and response.

D. The Contractor in making a request for information or clarification shall first have thoroughly and carefully reviewed the contract documents for the needed information before submitting any request.

E. All requests shall be completed by the Contractor in a manner to allow the receiving party to understand and to be able to respond as requested.

F. Responses will be made in a timely manner consistent with the thoroughness of the requesting information and question.

G. The Contractor shall maintain at his primary office and at the Project site offices, a central master file of all requests, by number, for later use or reference.

H. Each request's response shall be promptly "posted" by the Contractor to its documents so as to fully inform its employees and workers of the information needed to properly complete the work in a timely manner.

1.02 SUBSTITUTIONS

A. In accordance with the procedures set forth in Section 01630 Substitutions, the Request for Information form shall NOT be used for purposes of the Contractor making a request for substitution. The Contractor's attention is directed to the section on substitutions for procedures concerning those types of requests.

B. Requests for substitutions using the request for information form will be rejected and promptly returned to the requesting party for re-submittal in the proper form and format.

END OF SECTION

PROJECT NAME: _____

ARCHITECT OR ENGINEER: _____

REQUEST FOR INFORMATION (RFI)

RFI Number: _____ **Issue Date: _____**

Information provided is a clarification to the drawings and specifications.
***THIS IS NOT AN* AUTHORIZATION**
for *additional costs, time, or to proceed with any additional work or authorization for extra costs.*
If extra contract time or work is involved, written authorization per the contract must be obtained prior to proceeding.

DESCRIPTION: *(attach additional sheets and/or sketches as necessary)*

CONTRACTOR: _____

SUBMITTED BY: _____

REPLY: ***(attach additional sheets and/or sketches as necessary)***

REPLY DATE: _____ REPLY BY: _____

SECTION 01650
PROJECT RECORD DOCUMENTS
BY CONTRACTOR

PART ONE - GENERAL

1.01 REQUIREMENTS INCLUDED:

A. **THE CONTRACTOR SHALL MAINTAIN AT THE PROJECT SITE FOR USE BY ALL CONTRACTORS, THE "OFFICIAL" COPY OF THE PROJECT RECORD DOCUMENTS:**

1. Drawings.
2. Project Manual/Specifications.
3. Addenda.
4. Change Orders and other Modifications to Contract.
5. Field Orders or written instructions, including RFI's.
6. Approved & Approved As Noted Shop Drawings, Product Data & Samples.
7. Field Test Records.
8. Other relevant project record data or information.

B. The Contractor will make Record Documents available at all times to the Architect or Engineer, or the County. The Contractor shall not less than WEEKLY update and record on or to the "official" set all modifications and changes made during the previous time period, and shall sign an acknowledge that the information provided is accurate and a true representation of all modifications and changes made, and that the Architect or Engineer, and the County can rely upon the information and data provided.

C. The Contractor shall submit final Record Documents with Closeout Documents.

1.02 QUALITY ASSURANCE:

A. Make entries after receipt of information, except note dimensional corrections and new dimensional data immediately upon determination.

B. Contractor shall not permit the field record documents set of contract documents to be used for any other purpose.

1.03 RECORD DOCUMENTS:

A. Field Record Drawings: Entries shall be made by each Contractor on line prints provided by the County with each sheet bearing rubber stamp impression reading "Record Drawings".

1. Identify each entry by "cloud" type circle around affected Work. Initial and date each entry.

2. The Contractor shall record the following:
   a. Horizontal location and elevation of underground, embedded or covered and concealed portions of his Work.
   b. Location, size and arrangement of underground, embedded or covered and concealed mechanical and electrical portions of his Work, including

conduit, piping, valves, ductwork, outlets, and equipment.

c. Location, size and arrangement of exposed mechanical and electrical portions of his Work.
d. Changes and corrections to dimensions.
e. Changes to materials, products, equipment and finishes.
f. Changes and deviations in Work from that indicated in Contract Documents.
g. Identify equipment, valves, piping, conduit, fixtures and devices using symbols and designations corresponding to those used in Contract Documents.

B. Final Record Drawings: Will be provided by the Contractor, and submitted to the Architect or Engineer for review by the Architect or Engineer, for use by the Architect or Engineer in the updating of the electronic set of record documents to be furnished by the Architect or Engineer to the County.

C. Field Record Specifications: One complete set of Project Manual/Specifications within which changes to materials, products, equipment, and systems are recorded; also, note which specified manufacturer was used. Make corrections with colored pencil and mark the Manual "Record Specifications" on outside back binding.

END OF SECTION

SECTION 01700
CONTRACT CLOSEOUT

PART ONE - GENERAL

1.01 DEFINITIONS:

Contract Closeout is hereby defined to include the general requirements near the end of the Contract Time, in preparation for final acceptance, final payment, normal termination of the Contract, occupancy by the County (at project completion), and similar actions evidencing completion of the work required under this project's total construction and completion. Specific requirements for individual units of work are specified in the sections of the Specification Divisions. The time of closeout is recognized to be directly related to "Substantial Completion" and "Final Completion" and therefore may be either a single time period for the entire work or a series of time periods for individual parts of the work which have been certified as substantially complete at different dates.

After the Contractor receives from the Architect or Engineer an executed copy of the "Notice of Substantial Completion" of the total project, the Contractor shall prepare, assemble and transmit to the Architect or Engineer, and the County, the documents, brochures and drawings herein required in one package.

1.02 CERTIFICATION OF SUBSTANTIAL COMPLETION: Prior to requesting inspection for Substantial Completion and execution of the Certification of Substantial Completion (for either the entire work or portions thereof) the Contractor shall complete the following and list all known exceptions in the request:

A. Submit last progress-payment request, with sworn and notarized statement showing one-hundred percent (100%) completion of the work, complete with associated releases, consents and all other supporting documentation.

B. Advise the Architect or Engineer, and the County in writing of pending insurance changeover requirements.

C. Obtain and submit operating certificates, certificate of occupancy from governing officials, final inspection/test certificates, and similar releases enabling the County's full and unrestricted use of the work and access to services and utilities.

D. Deliver tools, spare parts, extra stocks of materials, and similar physical items to the County.

E. Make final changeover of locks and transmit key and/or access cards to the County, and advise the County's personnel to changeover in security provisions.

F. Complete start-up testing of systems and instructions of the County's operating/maintenance personnel.

G. Submit all maintenance and operating manuals.

H. Touch-up and otherwise repair and restore marred exposed finishes.

I. Fire Extinguishers: Leave extinguishers charged and ready for use. Extinguishers shall bear a tag showing the date tested and by whom. All costs incurred shall be borne by the Contractor.

J. Valve Tag Schedules: Furnish two (2) copies of schedules with the Close-Out Documents and mount one additional copy, framed under glass, in each mechanical room.

1.03 CERTIFICATION OF FINAL ACCEPTANCE: Prior to requesting the County's final inspection for certification of final acceptance and final payment, as required by the General Conditions, complete the following and list known exceptions (if any) in request:

A. Submit final payment request with final releases and supports not previously submitted and accepted.

B. Submit record drawings, and similar final record information.

C. Submit record documents, special guarantees, warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.

D. Submit three (3) copies, in hard copy and electronic format, of the County's final punch-list of itemized work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance.

E. Complete the final cleaning.

1.04 SUBMITTALS:

A. General: Specific requirements for submittal documents are indicated in individual Sections of these Specifications. The general requirements are indicated in this Section.

B. Warranties:

1. Warranty-Contractor and Subcontractors: Reference is hereby made to the General Conditions in which the one (1) year warranty of the Contractor and each subcontractor (the subcontractor's warranty shall be made to the County, not the Contractor) is required to be submitted, unless a warranty for a longer period of time is specified for certain Sections of the Work in Divisions 2 through 16, in which case the longer period shall govern. (Submit on forms attached in triplicate.)
2. The words "Warranty" and "Guarantee" as used anywhere in the text of the Contract Documents shall be interchangeable and synonymous meaning "a legally binding guarantee".
3. Specific warranties do not diminish implied warranties, and shall not deprive the County of actions, rights and remedies otherwise available to the County for the Contractor's failure to fulfill requirements of the Contract Documents. Periods of warranties shall not be interpreted as limitations on the time in which The County can pursue actions, rights or remedies.

4. Coincidental product warranties which are in conflict with the requirements of the Contract Documents will be rejected.
5. Warranties for items beyond the one (1) year limit: Refer to individual Sections for requirements.
6. All warranties shall commence on the Date of Substantial Completion or the date the maintenance and operating manuals are submitted, whichever date is the latest.
7. All warranties shall cover all costs for necessary material and labor to promptly replace or restore the failing unit of work and other work damaged from its failure.

C. Statutory and Non-Influence Affidavits (Contractor and Subcontractor): Before final acceptance of the Work or Final Payment, the Contractor shall furnish Statutory and Non-Influence Affidavits on the forms attached.

D. Inspection Reports: Secure and submit to the County, a sworn and notarized letter of certification from the local governmental agency or agencies that the construction has been inspected as required by laws or ordinances and that the building is acceptable for occupancy. (Certificate of Occupancy)

E. Certificate of Substantial Completion and Certificate of Final Completion: A Certificate of Substantial Completion on AIA Form No. G704, for the project will be prepared by the Architect or Engineer for the purpose of establishing a date when the project is substantially complete, identification of a punch list and determining actual damages or liquidated damages. Submit a Certificate of Final Completion upon final inspection of the project verifying that punch list items are complete and all closing documents are in order, as shown by the accompanying project close-out check off list, and that all final payments are in order and establishing a date of final acceptance.

F. Record Documents Drawings: Submit one (1) copy of each in hardcopy and electronic format.

G. As-Built Stormwater Detention Facility: On projects incorporating new or modified detention facilities, the Contractor shall prepare an as-built survey of the new and modified detention facilities, and shall submit hardcopy and electronic format copies thereof to the Architect or Engineer, and the County prior to the County's execution and issuance of the Substantial Completion Certificate.

H. Maintenance Manuals: Organize maintenance and operating manual information into suitable sets of manageable sizes, and bind into individual binders identified and indexed (thumb-tabbed); examples: Air Conditioning Equipment Maintenance, Roof Maintenance. Include emergency instructions, spare part listing, warranties, guarantees, wiring diagrams, recommended "turn-around" cycles, inspection procedures, shop drawings, product data, and similar applicable information. Bind each manual of each set in a heavy duty 3-ring vinyl-covered binder and include pocket folders for folded sheet information. Legibly mark identification on both the front and spine of each binder. SUBMIT THREE (3) COPIES OF EACH PRIOR TO SUBSTANTIAL COMPLETION.

PART TWO - PRODUCTS: There are no products in this Section.

PART THREE - EXECUTION

3.01 CLOSEOUT PROCEDURES

A. General Maintenance Instructions: Prior to requesting the County's inspection for certification of Substantial Completion, arrange for each installer of work requiring maintenance or operation, to meet with the County's personnel, in the County's presence, at the project site, to provide basic instructions needed for proper operation and maintenance of the entire Work. Include instructions by manufacturer's representatives where installers are not expert in the required procedures. Review maintenance manuals, record documentation, tools, spare parts and materials, lubricants, and similar shut-down, emergency operations, noise and vibration adjustments, safety, economy/efficiency adjustments, and similar operations. Review maintenance and operations in relation with applicable guarantees, warranties, agreements to maintain, bonds, and similar continuing commitments.

B. Listing of Instructions, as related to work performed under the total project: See "Acknowledgement of Instruction" form at the end of this section. Fill-out one form for each of the items, and submit in TRIPLICATE to the County with closeout Documents. Specifically, but not necessarily by way of limitation, provide instruction to The County's personnel on the following categories of Work:

1. Commercial Hardware Doors & Frames and Glazing.
2. Electrical systems
3. Cleaning & Care of Hard Tile Surfaces
4. Cleaning & Care of Resilient Floor and Base
5. Cleaning & Care of Carpet
6. Cleaning & Care of Painted Surfaces
7. Operation of Fire Extinguishers
8. Food Service Equipment
9. Walk-in Cooler & Freezer
10. HVAC Systems and Equipment
11. Fans
12. HVAC Controls
13. Plumbing Fixtures
14. Water Heaters
15. Motor Starters and Motor Control Centers
16. Fire Dampers
17. Lighting Fixtures and systems
18. Fire Alarm System
19. Burglar Alarm System
20. Intercom System
21. Voice/Data Network System
22. Audio/Visual System
23. Master Television System
24. Emergency Generator
25. Electric Heat Units

C. Key and/or access cards and/or Access Cards: Transmit key and/or access cards and/or access cards, except construction master key and/or access cards directly to The County from supplier. Supplier shall index, tag and place key and/or access cards and/or access

cards in key and/or access card cabinet (when applicable) as described below. Secure from The County or his designated agent a signed receipt in TRIPLICATE acknowledging receipt of key and/or access cards and/or access cards and schedule. Retain one (1) copy and forward two (2) copies of receipt to the County

1. Key and/or access cards and/or access cards shall be tagged, indexed and submitted to the County. Tag as follows: One key and/or access card and/or access card (record key and/or access card and/or access card) for each lock or lockset shall be placed on a numbered tag having a non-opening clip. The remaining key and/or access card and/or access card(s) (Use Key and/or access card and/or access cards) for the lock or lockset shall be placed on a numbered tag board having the same number as the tag for the Record Key and/or access card and/or access card, both numbered tags containing the key and/or access cards shall then be placed on the corresponding numbered hook in the key and/or access card cabinet if sufficient capacity exists. If not, bag and turn over to the County. Record Key and/or access card tags shall be hexagonal shaped, red in color, with numbers embossed in white. Use key and/or access card tags shall be trilobal in shape, white in color, with numbers embossed in black.
2. Contractor shall provide the County with an index (by tag number) in sequential order giving a description of the location of the lock or lockset that the corresponding key and/or access card operates, additionally, the Contractor shall provide the County with index (by Key and/or access card number) in sequential order giving a description of the location of the lock or lockset that the corresponding key and/or access card operates. Indexes shall be typed and on the forms furnished with the key and/or access card cabinet for each type index required. If no forms are furnished with the key and/or access card cabinet, Contractor may use 20 weight bond paper for typing indexes.

3.02 FINAL CLEANING

A. General: Special cleaning for specific units of work is specified in the Sections of Division 2 through 16.

B. Provide final cleaning of the Work, at and not later than the time indicated, consisting of cleaning each surface or unit of work to the normal "clean" condition expected for a first-class building cleaning and maintenance Construction. Comply with manufacturer instructions for cleaning operations. The following are examples, but not by way of limitation, of the cleaning levels required:

1. Remove labels which are not required as permanent labels.
2. Clean transparent materials, including mirrors and window/door glass, to a polished condition, removing substances which are noticeable as vision-obscuring materials. Replace broken glass.
3. Clean exposed exterior and interior hard-surfaced finishes, including metals, masonry, concrete, painted surfaces, plastics, tile, wood, special coatings, and similar surfaces, to a dirt free condition, free of dust, stains, films and similar noticeable distracting substances. Except as otherwise indicated, avoid the disturbance of natural weathering of exterior surfaces. Restore reflective surfaces to original reflective condition.
4. Wipe surfaces of mechanical and electrical equipment clean, including equipment in addition to that specified in Division 15 and 16; remove excess lubrication and other substances.

5. Remove debris and surface dust from limited-access spaces including roofs, plenum shafts, trenches, equipment vaults, manholes, attics and similar spaces.
6. Clean concrete floors in non-occupied spaces broom clean.
7. Vacuum clean carpeted surfaces and similar soft surfaces.
8. Clean plumbing fixtures to a sanitary condition, free of stains including those resulting from water exposure.
9. Clean light fixtures and lamps so as to function with full efficiency.
10. Clean project site (yard and grounds), including landscape, development areas, of litter and foreign substances. Sweep paved areas to a broom-clean condition; remove stains, petro-chemical spills and other foreign deposits. Rake grounds clean of all debris that accumulated as a result of the construction.

C. Time of Final Cleaning: Following the County's certification of "Substantial Completion", and immediately before the "Final Acceptance" inspection by the Architect or Engineer, or the County.

D. Removal of Protection:
1. Except as otherwise indicated or requested by the County, remove temporary protection devices and facilities which were installed during the course of the work to protect previously completed work or hazardous conditions during the remainder of the construction period.
2. Temporary silt fence and erosion control devices shall remain in place until one year following Substantial Completion, after which date they shall be removed by the Contractor and the surrounding areas dressed up as required. This item of work remaining to be completed after Final Completion and Final Payment, shall be noted and accepted by the Contractor’s Surety and Bonding Company, and confirmed in writing from the Contractor’s Surety and Bonding Company to be covered by the Project’s bonds.

E. Compliance: Comply with safety standards and governing regulations for cleaning operations. Do not burn waste materials at the site, or bury debris or excess materials on the property, or discharge volatile or other harmful or dangerous materials into drainage systems; remove waste materials from the site and dispose of in a lawful manner satisfactory to County's solid waste disposal ordinance. Where extra materials of value remaining after completion of the associated work have become the County's property, dispose of these to the County's best advantage as directed.

3.03 CONTINUING INSPECTIONS: Except as otherwise required by special guarantees, warranties, agreements to maintain, workmanship bonds, and similar continuing commitments, comply with The County's requests to participate in inspections at the end of each time period of such continuing commitments. Participate in the general inspection(s) of the work approximately one year beyond the date(s) of Substantial Completion.

PART FOUR - CHECK OFF LIST AND FORMS
PROJECT CLOSEOUT CHECK-OFF LIST

DOCUMENT	NO. OF COPIES	DATE RECEIVED
1. Contractor's Warranty to the County	_____	
2. Subcontractors' Warranty to the County	_____	
3. Special Extended Warranties beyond l year to the County	_____	
4. Statutory Affidavit	_____	
5. Non-Influence Affidavit	_____	
6. Certificate of Occupancy issued by the Governing authority	_____	
7. As-Built Drawings and Record Documents	_____	
8. Maintenance Manuals & Equipment Brochures *		
a. Air Conditioning Equipment	_____	
b. Electrical Equipment	_____	
c. Test and Balance Reports	_____	
d. Wiring and Controls	_____	
e. Diagrams for Equipment	_____	
9. Maintenance & Staff Instructions	_____	
10. Key and/or access cards		
a. Schedule as specified	_____	
b. Certificate of receipt of key and/or access cards	_____	
11. Schedule of valve tags, locations and function	_____	
12. Punch List Items Completed	_____	
13. Hazardous Materials Certificate	_____	
14. Engineer's Certificate		
a. (As-Built Stormwater Detention Facility)	_____	
15. Certificate of Substantial Completion AIA G704*	_____	
16. Consent of Surety to Final Payment, AIA G707 Document	_____	

17. Contractors Affidavit of Payment
    a. Debts and Claims, AIA G706 Document _____

18. Certificate of Final Completion** _____

19. Certificate of Final Payment to Contractor _____

**** Submit following the County's acceptance of building, facilities or site for use.***

***** Hold all other documents and submit in a package when all requirements are complete. (No exceptions; piecemeal submittals will be returned.)***

I certify that, being familiar with the Contract Documents for this project, to the best of my knowledge, the items checked off herein above constitute all that are applicable to this project.

_____ _____
Contractor's Signature Date
(For Submitting to the County)

_____ _____
Architect's or Engineer's Signature Date
(Reviewed and Accepted for forwarding to the County for Acceptance)

_____
Date Submitted to Cherokee County

_____ _____
Cherokee County's Signature Date Accepted by Cherokee County
(For Acceptance by Cherokee County)

WARRANTY
BY CONTRACTOR
To: CHEROKEE COUNTY

PROJECT/JOB NAME: _____

CONTRACTOR: _____

ADDRESS: _____

COUNTY OF: _____ STATE OF: _____

DATE: _____

As Contractor on the above job I/we do hereby guarantee that all work executed under the plans and Specifications will be free from defects of materials and/or workmanship for a period of: ONE (1) CALENDAR YEAR,

beginning on _____, the agreed upon date accepted by all the parties of the Construction Agreement and Project as the recorded date of Substantial Completion, and that all defects occurring within the warranty period shall be replaced or repaired at no cost to the County and Owner.

This guarantee by the Contractor covers all work as shown on the plans and specified in the Specifications and Contract Documents. Nothing in the above shall be deemed to imply that this guarantee shall apply to any work which has been abused or neglected by the County.

Legal Name of Contractor:

By: _____

Title: _____

_____

Notary Public

This _____ day of _____, 20____.

WARRANTY
BY SUBCONTRACTOR TO CONTRACTOR
To: CHEROKEE COUNTY

PROJECT/JOB NAME: _____

TO: CHEROKEE COUNTY

FROM CONTRACTOR: _____

FROM SUBCONTRACTOR: _____

ADDRESS: _____

COUNTY:_____ STATE OF:_____

DATE: _____

As a Sub-Contractor to the Contractor for the identified work, on the above job, I/we do hereby guarantee that all work executed under the plans and Specifications will be free from defects of materials and/or workmanship for a period of: ONE (1) CALENDAR YEAR,

beginning on _____, the agreed upon date accepted by all the parties of the Construction Agreement and Project as the recorded date of Substantial Completion, and that all defects occurring within the warranty period shall be replaced or repaired at no cost to the County and Owner.

This guarantee by the Sub-Contractor covers all work as shown on the plans and specified in the Specifications and Contract Documents. Nothing in the above shall be deemed to imply that this guarantee shall apply to any work which has been abused or neglected by the County.

Legal Name of Sub-Contractor:

By: _____

Title: _____

_____

Notary Public

This _____ day of _____, 20____.

SPECIAL EXTENDED WARRANTY

To: CHEROKEE COUNTY

PROJECT/JOB NAME: _____

TO: CHEROKEE COUNTY

FROM CONTRACTOR: _____

PRIME WARRANTOR: _____

COUNTY OF:_____ STATE OF:_____ DATE: _____

(Insert above the name of the PRIME WARRANTOR and circle appropriate source below) as (SUPPLIER) (MANUFACTURER) (SUBCONTRACTOR) on the above referenced bid package scope of work for:

_____

(Insert description of work or materials provided on the line above)

The Prime Warrantor named above and the Contractor (co-signed below) do hereby guarantee that the above executed under the criteria of the Contract Drawings and Specifications will be free of defects in material and workmanship for a period of: ONE (1) CALENDAR YEAR,

beginning on _____, the agreed upon date accepted by all the parties of the Construction Agreement and Project as the recorded date of Substantial Completion, and that all defects occurring within the warranty period shall be replaced or repaired at no cost to the County. This warranty covers all work as shown on the Contract Drawings and Contract Specifications with warranty criteria outlined in

_____

(Insert the Technical Specification Section and Paragraph requiring the warranty)

Nothing in the above shall be deemed to imply that this warranty shall apply to any work or materials which has been abused or neglected by The County.

_____

Legal name of Prime Warrantor Legal name of Contractor

_____

By (Officer) By (Officer)

_____

Title Title

Notary Public This _____ day of _____, 20____.

STATUTORY AFFIDAVIT
To: CHEROKEE COUNTY

COUNTY OF: _____ STATE OF: _____

FROM: _____
(Contractor)

TO: CHEROKEE COUNTY

RE: Contract entered into the _____ day of _____, 20____, between the above-mentioned parties for the construction of the following Project:_____

at: _____.

KNOW ALL MEN BY THESE PRESENTS:

1. The undersigned hereby certifies that all work required under the above contract has been performed in accordance with the terms thereof, that all materialmen, subcontractors, mechanics, and laborers have been paid and satisfied in full and that there are no outstanding claims of any character arising out of the performance of the contract which have not been paid and satisfied in full.
2. The undersigned further certifies that to the best of his knowledge and belief there are no unsatisfied claims for damages resulting from injury or death to any employees, subcontractors, or the public at large arising out of the performance of the contract, or any suits or claims for any other damage of any kind, nature, or description which might constitute a lien upon the property of The County
3. The undersigned makes this affidavit as provided by law and for the purpose of receiving final payment in full settlement of all claims arising under or by virtue of the contract, and acceptance of such payment is acknowledged as a release of the County from any and all claims under or by virtue of the contract.

IN WITNESS WHEREOF, the undersigned has signed and sealed this instrument the

_____ day of _____, 20___.

Personally appeared before the undersigned, _____

and _____ who after being duly sworn, depose(s) and say(s) that the facts stated in the above affidavit are true.

Notary Public, the _____ day of _____, 20___.

NON-INFLUENCE AFFIDAVIT

To: CHEROKEE COUNTY

COUNTY OF: _____ STATE _____

I do solemnly swear on my oath that as to the contract dated _____20___, for

_____

between

_____

and Cherokee County, I have no knowledge of the exertion of any influence or the attempted exertion of any influence on the firm on behalf of which this affidavit is made in any way, manner, or form in the purchase of materials, equipment, or other items involved in the construction, manufacture or employment of labor under the aforesaid contract, by any member of the Cherokee County Board of Commissioners, or any employee or any person connected with Cherokee County, or with the State Government of Georgia in any way whatsoever.

This _____ day of _____ 20____.

_____

Name (Typed or Legibly Printed)

_____

Signature

_____

Title

_____

Firm

County of _____ State of _____

Personally before me, the undersigned, appeared

_____,

who is known to me to be an official of the firm of

_____

who, after being duly sworn, stated on his oath that he had read the above statement and that the same is true and correct.

Notary Public: _____ My commission expires _____.

ACKNOWLEDGEMENT OF INSTRUCTION

To: CHEROKEE COUNTY

PROJECT NAME: _____

CONTRACTOR NAME: _____

CONTRACTOR ADDRESS: _____

By signature below, Cherokee County and the Contractor each acknowledge that the Contractor (and/or his representative) has satisfactorily instructed the County in the use, operation, and maintenance of:

_____

_____

_____

_____

_____

_____

_____

DATE: _____

CONTRACTOR'S INSTRUCTING PERSONNEL: (All names legibly printed)

_____

_____

_____

THE COUNTY'S PERSONNEL INSTRUCTED: (All names legibly printed)

_____

_____

_____

HAZARDOUS MATERIALS CERTIFICATE
CERTIFICATE OF CONTRACTOR
To: CHEROKEE COUNTY

COUNTY OF: _____ STATE OF: _____

PROJECT NAME: _____

DATE: _____

_____, as Contractor on the above job, I/we do hereby certify that all materials, products and assemblies supplied and installed in this project and on the site are totally free of asbestos, PCB or other hazardous materials.

This certificate covers all materials required by the contract documents and/or permanently installed by the Contractor.

Nothing in the above shall be deemed to imply that this certificate shall apply to materials furnished by the County or installed by the County.

LEGAL NAME OF CONTRACTOR:

BY: _____

TITLE: _____

NOTARY PUBLIC

THIS _____ DAY OF _____, 20____.

My commission expires _____

CERTIFICATE OF FINAL COMPLETION

To: CHEROKEE COUNTY

PROJECT NAME: _____

DATE OF CONTRACT: _____

DATE OF THIS CERTIFICATE: _____

CONTRACTOR (Name, Address) _____

_____

_____

TO: CHEROKEE COUNTY

THIS CERTIFICATE COVERS THE ENTIRE PROJECT. By execution of this document, the Contractor and Cherokee County each certify that the work performed under this Contract has been reviewed at a final inspection on _____ and found to be complete as certified by the attached project close-out check off list, and the County accepts the project as complete on the date of this certificate. Final payment to the Contractor is authorized.

Execution and acceptance of this certificate by Cherokee County shall in no way waive or void any conditions of the Contract Documents. A Certificate of Substantial Completion has been issued establishing _____ as the date of occupancy and the commencement of all Warranties and Guarantees required by the Contract Documents.

Cherokee County has assumed full and formal responsibility for insurance, utilities and routine maintenance as of: _____.

_____ _____

CONTRACTOR BY DATE

_____ _____

CHEROKEE COUNTY BY DATE

END OF SECTION

SECTION 01731 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the following:

1. Divisions 2 through 16 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

    a. Requirements in this Section apply to mechanical and electrical installations. Refer to Divisions 15 and 16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.3 DEFINITIONS

A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
3. Products: List products to be used and firms or entities that will perform the Work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.

7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

1. Primary operational systems and equipment.
2. Air or smoke barriers.
3. Fire-protection systems.
4. Control systems.
5. Communication systems.
6. Electrical wiring systems.
7. Operating systems of special construction in Division 13 Sections.

C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Exterior curtain-wall construction.
4. Equipment supports.
5. Piping, ductwork, vessels, and equipment.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.

B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to interruption of services to occupied areas.

E. Maintain all existing exits and corridors in operation throughout construction.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.

5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting. Patch back surrounding surfaces.
6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang existing ceilings if scheduled to remain as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

END OF SECTION 01731

SECTION 02000 - EROSION CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. THIS SECTION INCLUDES:

1. Erosion and sedimentation control devices and measures.
2. State of Georgia NPDES permit monitoring and reporting requirements.

1.02 RELATED DOCUMENTS/SECTIONS

A. Contract documents and drawings, geotechnical soils engineering report. Refer to appropriate related sections as applicable.

1.03 REFERENCED STANDARDS

A. The current Manual for Erosion and Sediment Control in Georgia (**MESCG**).
B. State of Georgia current NPDES permit requirements for proposed construction activity.

When standards or specifications are indicated herein by reference, the referenced portion shall apply to the most recent edition of the publication and shall have the same force and effect as if they were included herein in their entirety.

1.04 DESCRIPTION OF WORK

A. This work shall consist of erosion and sedimentation control measures and devices, installation and maintenance as shown on the drawings or directed by the authority having jurisdiction for the life of the Contract.

B. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, or specifications, the more stringent requirement shall apply as determined by the Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All materials and construction shall conform to the **Manual for Erosion and Sediment Control in Georgia** (hereinafter referred to as **MESCG**), current edition.

B. Temporary and permanent grassing, landscaping, trees or other vegetation shall conform to the Contract documents, plans, and drawings and the MESCG. Contractor shall coordinate with Architect/Engineer on all phases of landscaping. Refer to MESCG for detailed planting specifications, dates, and appropriate materials.

C. All erosion control Matting and Blankets materials shall be temporary matting and blankets and shall be biodegradable and photodegradable. Do not install permanent type matting or blankets which are non-biodegradable or non-photodegradable unless specifically shown on plans.

PART 3 – EXECUTION

3.01 EXECUTION

A. **All erosion and sedimentation control measures shall be installed prior to any land disturbing activity in accordance with the MESCG.**

B. **PERMANENT GRASSING REQUIREMENTS:**

THE CONTRACTOR SHALL ESTABLISH PERMANENT GRASSING PER PLANS AND SPECIFICATIONS ON ALL DISTURBED AREAS WHETHER SHOWN ON THE PLANS OR NOT. GRASS TYPE AND MATERIAL SUBJECT TO OWNER/ARCHITECT APPROVAL.

C. NPDES STORM WATER DISCHARGE MONITORING REQUIREMENTS:

CONTRACTOR SHALL FULLY COMPLY WITH THE CURRENT STATE OF GEORGIA NPDES PERMIT REQUIREMENTS FOR NOTIFICATION, DOCUMENTATION, MONITORING, MAINTENANCE AND REPORTING REQUIREMENTS. CONTRACTOR SHALL SIGN AND CERTIFY SOLELY AS OPERATOR THE NOTICE OF INTENT (NOI), AND ANY OTHER CERTIFICATIONS, FORMS, FEES, OR APPLICATIONS REQUIRED FOR FULL COMPLIANCE. CONTRACTOR SHALL COPY TO OWNER IMMEDIATELY ALL

NOTIFICATION, REPORTING, AND DOCUMENTATION REQUIRED OR RELATED TO NPDES PERMIT REQUIREMENTS.

D. Construction exit shall be maintained in a condition which will prevent tracking or flow of mud onto public streets.

E. All erosion control grassing and landscaping shall comply ata a minimum with the "Vegetative Considerations" in the MSECG.

F. All measures shown on the construction plans shall be installed. Additional measures may be required as necessary by the local authority having jurisdiction or the project Engineer.

G. Erosion control devices shall be periodically inspected and repaired, cleaned out, or restored as needed in order to function properly until permanent erosion control measures are established.

H. All disturbed areas shall be permanently grassed and landscaped as soon as possible after grade is established.

J. All naturally occurring water, streams, creeks, lakes, springs, etc. present on site shall have a minimum 25 foot undisturbed natural buffer measured from the top of bank. Tributaries to the Chattahoochee River, designated trout streams, or other such water sources, shall have a buffer of 35 feet or more.
Contractor shall confirm minimum buffer width as required by the State of Georgia. Local authority may require buffer width(s) greater than State of Georgia. Contractor shall determine minimum buffer width and maintain said buffer throughout construction. The Contractor shall not encroach this buffer whether shown on the plans or not unless a buffer waiver permit has been acquired.

K. Install Rock Dams (Rd) at any and all points of concentrated flow which impacts any and all Silt Fence (Sd1). Concentrated flow may occur naturally or as a result of construction or temporary or final grading. The Contractor is responsible for field verification of any concentrated flow points which impact Silt Fence (Sd1) and installation of Rock Dams (Rd) at all such locations. Remove Silt Fence for required width of Rock Dam(s). Install Rock Dams so that all concentrated flow is filtered through the Rock Dams and no flow is allowed to bypass around the sides of the Rock Dams or between the Rock Dams and Silt Fence.

END OF SECTION 02000

SECTION 02100 – AS BUILT SURVEY

PART 1 - GENERAL

1.01 SUMMARY

A. THIS SECTION INCLUDES:

1. As built survey requirements.

1.02 RELATED DOCUMENTS/SECTIONS

A. Contract documents and drawings. Refer to appropriate related sections as applicable.

1.03 REFERENCED STANDARDS

A. State of Georgia surveying and plat laws and regulations.

1.04 DESCRIPTION OF WORK

A. This work shall consist of as built survey and drawings for the entire completed site and building improvements.
B. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, or specifications, the more stringent requirement shall apply as determined by the Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Reserved

PART 3 – EXECUTION

3.01 EXECUTION

A. Contractor shall provide to Owner and Architect/Engineer a complete as built survey to include horizontal and vertical information for the

entire site and building improvements. The drawings and plats shall include, but not be limited to:
Boundary survey, location, site location map, elevation, height and square footage of all buildings, parking areas, drives, utilities, walls, storm sewer, all storm, sanitary, or other pipe sizes, depths, inverts, storm water pond(s) or facilities with complete topographic information on dams, volumes, complete as built information for all pond outlet control structures with drawings for structures, weirs, orifices, notches, spillways, and all other improvements, fences, out buildings, canopies, sidewalks, ramps, roadway improvements, decel lanes, left turn lanes, dumpster pads, transformers, loading areas, parking spaces, islands, play areas, signs, water meters and vaults, and all other site or building improvements.

B. As Built survey(s) and drawings shall comply with Local Authority Having Jurisdiction (LAHJ) standards and specifications. The Contractor is responsible for verification of and compliance with LAHJ standards and specifications PRIOR TO CONSTRUCTION. As built survey(s) and drawings shall comply with horizontal and vertical datum as specified by the LAHJ. In the absence of LAHJ requirements for vertical and horizontal datum, contact Owner/Architect/Engineer for direction regarding horizontal and vertical datum requirements for survey prior to construction.

C. As Built Survey(s) and drawings shall be completed and submitted to Owner/Architect/Engineer in a timely manner to allow for review and approval. Contractor shall not receive final release until As Built Survey(s) and drawings are approved by Owner/Architect/Engineer and accepted and approved by the LAHJ.

END OF SECTION 02100

CHEROKEE COUNTY
ENGINEERING DEPARTMENT
1130 Bluffs Parkway - Canton, Georgia 30114
678-493-6074 - Fax 678-493-6088
www.cherokeega.com

As-built Checklist

1) The applicant should review all standards and specifications outlined on the approved construction documents. The items listed below are not comprehensive. Cherokee County reserves the right to require additional items prior to Certificate of Occupancy per ordinance #2004-Z-001 7.5-3.3-h

2) Boundary survey

3) Address of Site

4) Building Setbacks

5) Location, elevation, height, and square footage of building (s)

6) Parking areas

7) Striping (crosswalks, turn arrows, ADA, stop bars)

8) Signage (stop, yield, speed limit, etc.)

9) Sight distance easements

10) Sidewalk and ADA Ramps

11) Provide DOT acceptance letter for applicable state routes.

12) Utilities (water, sanitary, meters, vaults, valves, etc.)

13) Retaining walls and associated features (handrails, drainage swales, easements, etc.) Engineer's certification is needed for all retaining walls under separate cover.

14) Zoning Buffers

15) Landscape strips

16) Zoning Conditions/Variance Information

17) Floodplain Limits, Cross-sections, Elevations, Zones and Associated Finished Floor Elevations if applicable.

18) Stream Buffers and Impervious Setbacks

19) Location, size and type for all storm drains.

20) A topographical map of all detention areas and a stage/storage table showing the volume of the pond.

21) An as-built detail of all outlet control structures.

22) All drainage easements that were shown on the approved construction plans including stormwater ponds.

23) Access easement around all stormwater facilities (show gate/fence).

24) Show all 100-year storm upstream headwater elevations at all pipes and in stormwater facilities.

25) A signed, dated, and sealed statement by a Professional Engineer, Registered Land Surveyor, or Registered Landscape Architect currently registered in the State of Georgia shall be included on the as-built:

The "as-built" condition of the storm drainage system will function as designed and engineered in the approved construction plans.

26) Provide an engineering certification on the stormwater facilities for volume, flowrates, treatment, etc. on the site as-built. Any sediment removal or volume excavation should be complete prior to site release. Engineer should fill out the as-built certification letter found at https://www.cherokeega.com/Stormwater-Management/documents.php

27) A Maintenance Agreement is required for this project prior to the site release/certificate of occupancy. A draft copy of the required agreement can be downloaded from https://www.cherokeega.com/Stormwater-Management/_resources/documents/Maintenance_Agreement-Updated_7_20_2010.pdf

The agreement should be submitted via e-mail or on Citiview for preliminary review and approval. Please note that Exhibits A, B, C, and D must be included and must be applicable to the project under review. After preliminary approval, the original complete document should be submitted to the Engineering Department for signature by the County Engineer and notarizing. Then, the agreement must then be picked up by the applicant and recorded with the Cherokee County Clerk of Court (deeds and records). Deeds and records only accepts original documents with the notary, and they must be 8.5x11 or 8.5x14. The recorded document can be emailed or returned to Cherokee County Engineering prior to issuance of a final plat or site release/certificate of occupancy.

SECTION 02110 - SITE CLEARING & DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. THIS SECTION INCLUDES:

1. Protection of existing trees to remain.
2. Removal of surface debris, trees, and other vegetation not designated to remain.
3. Topsoil excavation.
4. Clearing and grubbing.
5. Demolition.
6. Disposal of waste materials.

1.02 RELATED DOCUMENTS / SECTIONS

A. Contract documents and drawings, geotechnical soils engineering report. Refer to appropriate related sections as applicable.

1.03 REGULATORY REQUIREMENTS

A. Verify and conform to all Federal, State, County or local requirements concerning site clearing and related activities.

B. Coordinate and obtain approval for all clearing and demolition work with all appropriate utility companies prior to start of construction.

C. **WARNING:**
CONTRACTOR SHALL: COMPLY WITH ALL OSHA, FEDERAL, STATE, LOCAL, AND INDUSTRY STANDARD SAFETY MEASUES, DEVICES, PROCEDURES, PRECAUTIONS, AND EQUIPMENT FOR ALL WORK OR OTHER ACTIVITIE(S). NO PERSON(S) SHALL ENTER MANHOLES, CONFINED SPACES, OR OTHER UNDERGROUND STRUCTURES, SPACES, TRENCHES, OR EXCAVATIONS WITHOUT PROTECTIVE BREATHING APPARATUS AND ALL OTHER REQUIRED SAFETY MEASURES, DEVICES, PROCEDURES, AND EQUIPMENT, AND AT LEAST ONE OTHER PERSON PRESENT ABOVE GROUND FOR SAFETY AND MONITORING AT ALL TIMES. CONTRACTOR SHALL PROVIDE AND ENSURE USE OF SAFETY KITS, HELMETS, GLOVES, EMERGENCY OXYGEN RESUSCITAOR KITS, AND AIR QUALITY AND GAS DETECTORS FOR VOLATILE, TOXIC, OR EXPLOSIVE

GASES OR SUBSTANCES. VERIFY SAFE OXYGEN CONTENT PRIOR TO ENTERING MANHOLES, CONFINED SPACES, OR OTHER UNDERGROUND STRUCTURES.

1.04 DESCRIPTION

A. This work shall consist of clearing, grubbing, removal and disposal of all vegetation and debris (not designated to remain) within the limits of construction, and demolition of all existing items, structures, improvements, or other elements designated to be removed or required to be removed for the completion of the work.

B. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, and specifications, the more stringent requirement shall apply as determined by the Engineer.

PART 2 - EXECUTION

2.01 PREPARATION / PROTECTION

A. Traffic: Do not close or obstruct streets, walks, or other occupied or used facilities without written permission from Owners or authorities having jurisdiction.

B. Existing improvements: Provide measures necessary to protect adjoining properties and Owner's property from damage during site clearing. Damaged improvements shall be restored by the Contractor to their original condition, as acceptable to property owners.

C. The contractor shall coordinate with the all utility authorities the location, size and material, origin, identification, and verification of all existing utilities onsite. Utilities which are to remain shall be protected from damage during construction.

D. Existing trees, shrubs, or other vegetation designated to remain shall be protected and clearly delineated or marked for visual identification. The contractor shall coordinate with the Architect/Engineer on protection measures to ensure that any necessary cutting, grading, or other work in close proximity to trees or other vegetation is done in a manner which will minimize potential damage.

E. The contractor shall protect bench marks and existing structures from

damage or displacement.

2.03 CLEARING

A. Definition: Clearing consists of the removal from the site and proper disposal of all exposed objectionable matter such as trees, brush, logs, grass, weeds, roots, decayed vegetable matter, poles, stubs, rubbish, refuse dumps, sawdust piles, loose boulders of one cubic yard or less outside of construction limits, and other debris resting on or protruding through the ground surface, or appearing on the site.

B. Clearing also includes the removal and proper disposal of all obstructions not to be retained.

C. Clearing may be done by any legal method the contractor elects to use provided no damage is done to the property, trees or vegetation to be retained, in or outside of the site.

D. Remove any remaining pavement, curbing, or other site improvement or obstruction necessary to facilitate the proposed construction as shown on the contract documents and drawings.

2.04 GRUBBING

A. Definition: Grubbing consists of the removal from the site and proper disposal of objectionable matter defined above under CLEARING, which is imbedded in the underlying soil.

B. Use only hand methods for grubbing required within five feet of drip lines of trees designated to remain and tree protection limits.

C. Objectionable Roots: Objectionable roots are defined as (1) matted trees and brush roots regardless of the size of the roots; (2) individual roots more than 3/4 inch diameter; (3) individual roots more than 36 inches long regardless of the size; (4) large quantities of lesser size roots present in the top 12 inches of the finished subgrade.

D. When these items are removed as clearing and grubbing, they shall be removed to the following depths:

(1) Under pavements: Remove to a depth of 3.0 feet minimum below finish subgrade.

(2) Beneath other structures: Remove to a depth of 3.0 feet

minimum below finish subgrade.

(3) Elsewhere on the site: Remove to a depth of 3.0 feet minimum below the finished surface for slopes and shoulders, 1.0 feet below natural ground outside construction limits.

2.05 TOPSOIL EXCAVATION

A. Definition: Topsoil is defined as friable clay loam surface soil found in varying depths onsite. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 1/2 inch in diameter, without weeds, roots, or other objectionable material as defined in section 2.03 (A.)

B. Topsoil excavation: Excavate topsoil to depths encountered in a manner which will minimize intermingling with underlying subsoil or objectionable material. Stockpile topsoil in storage piles to provide free drainage of surface water. Cover storage piles, if necessary, to prevent wind or water erosion. Dispose of unsuitable or excess topsoil as specified for disposal of waste materials. Do not excavate wet topsoil.

2.06 DEMOLITION

A. **THE CONTRACTOR IS FULLY AND COMPLETELY RESPONSIBLE FOR LOCATION, VERIFICATION, PROTECTION, STORAGE, MAINTENANCE, DEMOLITION, REMOVAL, RELOCATION OR ALTERATION OF ALL EXISTING SITE UTILITIES, SITE IMPROVEMENTS, STRUCTURES, OR CONSTRUCTION ELEMENTS AS REQUIRED TO COMPLETE THE WORK, WHETHER SHOWN ON THE PLANS OR NOT. THE CONTRACTOR SHALL VISIT THE SITE AND BECOME THOROUGHLY FAMILIAR WITH ALL EXISTING IMPROVEMENTS, UTILITIES, AND SITE CONDITIONS PRIOR TO BIDDING AND CONSTRUCTION.**

B. Items designated or required to be removed shall be completely removed and disposed of offsite in a legal manner. All items to be removed shall be removed in their entirety including all associated elements, layers, materials, sections, foundations, equipment, or levels; removal shall continue to the natural soil subgrade level at which all items designated for removal have been removed. No digging or removal past the natural soil subgrade level at which all items designated for removal have ben removed is permitted.

C. Protect all items not designated for removal from damage, encroachment, or disturbance. All damaged items shall be restored completely by Contractor at no expense to Owner.

2.07 DISPOSAL OF WASTE MATERIALS

A. Contractor shall dispose of all waste material offsite in a legal manner.

B. Burning: Burning will be permitted only by legally authorized permit, subject to permit requirements.

C. Burying onsite is prohibited.

END OF SECTION 02110

SECTION 02200 – EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

A. THIS SECTION INCLUDES:

1. Project conditions
2. Quality assurance
3. Rough Grading
4. Proof rolling
5. Submittals
6. Excavating
7. Backfill and fill
8. Trenching
9. Rock removal
10. Disposal

1.02 RELATED DOCUMENTS / SECTIONS

A. Contract documents and drawings, geotechnical soils report (if available). Refer to appropriate related sections as necessary.

1.03 REFERENCES

A. AASHTO - M147 - Materials for aggregate and soil aggregate.
B. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb. (4.45 kg) Rammer and an 18-in. (457 mm) drop.
C. ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Course Aggregates.
D. ANSI/ASTM D698 - Standard Proctor Test - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using a 5.5 lb. (2.49 kg) Rammer and 12 inch (304.8 mm) drop.
E. ANSI/ASTM D1557 - Modified Proctor Test - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.45 kg) Rammer and 18 inch (457 mm) Drop.
F. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
G. ASTM D2487 - Classification of Soils for Engineering Purposes.
H. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

I. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
J. ASTM D4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
K. ANSI/ASTM D1556 - Test Method for Density of Soil using the Sand-Cone Method.
L. GE - Geotechnical Engineer, Engineering Report, Recommendations.
M. NFPA - Code for explosive materials

When standards or specifications are indicated herein by reference, the referenced portion shall apply to the most recent edition of the publication and shall have the same force and effect as if they were included herein in their entirety.

1.04 REGULATORY REQUIREMENTS

A. Verify and comply with all Federal, OSHA, State, County, City or local requirements concerning earthwork, excavation, and related activities.

B. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, or specifications, the more stringent requirement shall apply as determined by the Engineer.

C. **WARNING:**
CONTRACTOR SHALL: COMPLY WITH ALL OSHA, FEDERAL, STATE, LOCAL, AND INDUSTRY STANDARD SAFETY MEASUES, DEVICES, PROCEDURES, PRECAUTIONS, AND EQUIPMENT FOR ALL WORK OR OTHER ACTIVITIE(S). NO PERSON(S) SHALL ENTER MANHOLES, CONFINED SPACES, OR OTHER UNDERGROUND STRUCTURES, SPACES, TRENCHES, OR EXCAVATIONS WITHOUT PROTECTIVE BREATHING APPARATUS AND ALL OTHER REQUIRED SAFETY MEASURES, DEVICES, PROCEDURES, AND EQUIPMENT, AND AT LEAST ONE OTHER PERSON PRESENT ABOVE GROUND FOR SAFETY AND MONITORING AT ALL TIMES. CONTRACTOR SHALL PROVIDE AND ENSURE USE OF SAFETY KITS, HELMETS, GLOVES, EMERGENCY OXYGEN RESUSCITAOR KITS, AND AIR QUALITY AND GAS DETECTORS FOR VOLATILE, TOXIC, OR EXPLOSIVE GASES OR SUBSTANCES. VERIFY SAFE OXYGEN CONTENT PRIOR TO ENTERING MANHOLES, CONFINED SPACES, OR OTHER UNDERGROUND STRUCTURES.

1.05 PROJECT CONDITIONS

A. Site information: All earthwork, cutting, filling, compaction, and related operations shall conform to the requirements and recommendations of the geotechnical Soils Engineer. In the absence of a qualified geotechnical Soils Engineer, the Contractor shall be fully responsible for the integrity, suitability, quantity, compaction, selection, and quality of the soils used in the completion of the Work.

B. Protection of persons and property:

1. Barricade all open excavations occurring as part of this work and post with warning lights.
2. Operate warning lights or devices for all excavations, restricted or dangerous areas, or other areas as required for safety of all person(s) onsite or in the work area, as required BY OSHA, Federal, State, and local laws, or recommended by authorities having jurisdiction. All warning lights or devices shall be illuminated for night or low visibility conditions.
3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, or other hazards created by earthwork operations.
4. The Contractor, and all sub-contractors, shall be responsible for all safety measures, procedures, or devices as required by OSHA, Federal, State, or local authorities. No person shall enter a manhole or other underground structure without protective breathing apparatus, and at least one other person present for safety. All earthwork, trenching, and grading operations shall conform to minimum OSHA requirements for safety, shoring, bracing, and protective measures.

1.06 QUALITY ASSURANCE

A. Testing and Inspection service: Contractor shall employ and pay for a qualified independent Geotechnical Engineer (GE) and geotechnical testing laboratory to perform soil testing and inspection services during earthwork operations and as specified by the Architect/Engineer. All testing, earthwork, excavation, cut and fill operations and associated work shall comply with GE recommendations and standards at a minimum. GE shall be subject to approval of Owner/Architect/Engineer.

B. Testing Laboratory Specifications: The Contractor shall obtain approval

from the Owner/Architect/Engineer for the (GE) and the Testing Laboratory prior to beginning work.

C. Field Testing: Allow testing laboratory to test and approve each subgrade and fill layer before further backfill or construction is performed.

1. Field density tests shall be in accordance with ASTM D 698.
2. The placement, location, number, and frequency of tests shall be as directed by the Geotechnical Engineer or authorized qualified Technician (GE or GT.)

1.07 SUBMITTALS

A. Test reports: Submit the following test reports directly to the Architect, Engineer, and Owner or Owner's representative from the Testing Laboratory, with a copy to the Contractor:

1. Test reports on borrow material.
2. Field reports, in-place soil density tests.
3. One optimum moisture-maximum density curve for each soil type encountered.
4. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.
5. Topographic as-built survey (2.04 F)

PART 2 - EXECUTION

2.01 ROUGH GRADING

A. Definition: Cutting, grading, filling, and rough contouring the site for building pads, structures, paving areas, or other improvements.

2.02 EXAMINATION

A. All existing contours, elevations, structures, utilities, and other improvements shown on the plans are taken from the best information available at the time and are believed to be reasonably true and correct. Any errors, omissions, or discrepancies between the actual field conditions and the plans discovered during construction must be reported immediately to the Architect and the Engineer. Any work

done by the Contractor after such discovery without written approval from the Architect or Engineer will be at the Contractor's risk.

2.03 PREPARATION

A. Identify and verify required lines, levels, contours, and datum.

B. Utilities: Stake and flag locations of all utilities. Coordinate with all utilities and have existing locations clearly marked prior to construction. Protect above and below grade utilities to remain from damage. Notify prior to construction and coordinate with any utilities that will require removal and/or re-location.

C. Provide protective measures or devices for all existing features to remain, including but not limited to: trees and vegetation, existing buildings and appurtenances, adjacent property improvements, or other structures.

2.04 EXCAVATION

A. General: Comply with safety requirements of all Federal, State, County, City, or local authorities having jurisdiction.

B. Excavate subsoil as shown on approved plans. Make grade changes gradual. Blend slopes into level areas.

C. EARTHWORK VOLUME(S) FOR CUT AND FILL WILL NOT BALANCE. The contractor is solely responsible for establishing finished grades as shown on approved plans, including any earthwork export (haul-off) or earthwork import (offsite hauled in) required to establish permanent grades. All exported earthwork shall be disposed of offsite in a legal manner by the contractor. All imported earthwork shall be approved suitable material documented by the GE for conformity with specifications, intended use, and volume(s) imported.

D. Provide Temporary Dewatering as required to facilitate all proposed earthwork and construction. See Dewatering specifications.

E. Tolerances: Top surface of subgrade: Plus or minus 1/10 foot,

provided positive drainage is established according to the design intent of the plans and specifications.

F. As-Built topographic survey:
After rough grades are established, and before building foundations or other site improvements begin, the Contractor shall provide to the Owner at Contractor's expense an as-built topographic survey of the grades and graded areas as shown on the approved plans. The as-built topographic survey must be signed and sealed by a registered Surveyor licensed in the State where the project is located, and must show grading elevations, slopes, and contours to the extent necessary for the Owner to verify that the grading is in compliance with the approved plans and specifications. Do not proceed with any work in any area of the site until Owner is satisfied with results of as-built topographic survey. It is the Contractor's responsibility to schedule the as-built survey and account for the required time to complete the review process with the Owner to avoid delays to the project schedule.

G. All soils used for fill in earthen dams or water impoundment areas shall be ML or CL low plasticity clays per the Unified Soil Classification, and must be approved by the Geotechnical Engineer. All organics, topsoil, or other unsuitable material shall be removed from the entire fill area. All fill shall be placed in maximum 6 inch lifts, minimum compaction is 95% of standard maximum density. No gravel, aggregate or gravel pipe bedding, or any pervious material shall be placed in the dam or fill area(s) or adjacent to any water impoundment perimeter(s). Scarify existing subgrade prior to placing fill.

2.05 ROCK EXCAVATION

A. Rock excavation shall consist of all material which cannot be excavated except by drilling, blasting or wedging. It shall consist of un-decomposed stone hard enough to ring under a hammer, and the amount of solid stone shall be not less than one (1) cubic yard in volume. Rock is further defined as follows:

1. General Excavation: Any material occupying an original volume of more than one cubic yard which cannot be excavated with a single-tooth ripper drawn by a crawler tractor having a minimum draw bar pull rated at not less than 80,000 pounds sable pull (Caterpillar D-8 or larger), see 2.05(B).

2. Trench Excavation: Any material occupying an original volume of more than one half cubic yard which cannot be excavated with a backhoe having a bucket curling force rated at not less than 40,000 pounds, using a rock bucket and rock teeth (a John Deere 790 or larger).

B. When rock is encountered, the earth shall be cleared away and any rock shall be exposed for classification.

Rock must be classified and verified as follows:
In the presence of the Owner, Architect, Engineer, and the Testing Lab, at the expense of the Contractor, rock must be pulled in three different and distinct directions with a single-tooth ripper drawn by a crawler tractor having a minimum draw bar pull rated at not less than 80,000 pounds sable pull (Caterpillar D-8 or larger). After pulling in three different directions, rock shall be classified according to 2.05 (A) (1.)

The Architect/Owner/Engineer shall be notified before any rock has been blasted or removed in any way.

C. Boulders over one (1) cubic yard or rock as defined above shall be removed at a contractual unit price. Once rock is uncovered, grading sections shall be taken. When rock is completely removed, new grading sections shall be taken to determine the quantity of rock removed. Contractor shall bear the expense of taking grading sections.

D. All blasting shall be done in accordance with local ordinances, and permits shall be obtained where required by law.

E. Rock that is removed shall become the property of the Contractor and shall be removed from the site and/or buried as allowed by the specifications, and subject to GE approval.

F. Decomposed rock and similar material that can be removed by tractor drawn ripper or power machinery as previously mentioned will be classified as earth excavation.

G. When rock is encountered, clear away earth and notify Architect/Owner/Engineer. Architect/Engineer will inspect material and issue written instructions. No rock excavation shall be done without written instructions. No rock excavation shall be done prior to measurement.

E. Measurement for Rock Excavation shall be as follows:

1. Mass Rock:

a. Measurement for mass rock shall be made by taking cross sections or by other appropriate means identifying the contours of rock before and after removal. All rock measurements shall be made and certified by an independent licensed surveyor or engineer approved by the Architect.

b. Rock removed prior to measurement shall not receive compensation.

c. The quantity of rock shall be calculated using the following limits:

1. To top of rock
2. To 1.0 feet below finished grade of roadway
3. To vertical lines at back of curb
4. To 1.0 feet below foundations and footings
5. To vertical faces located 1.0 feet horizontal distance from each footing or foundation face
6. To 0.5 feet below slabs on grade
7. To finish grade in cut where rock is removed to finish grade. Where it is not so removed, to the finish rock surface.

2. Trench Rock:

a. Measurement for trench rock shall be made by taking level readings at reasonable intervals but not more than 10 feet along the exposed trench length before removal of rock. All rock measurements shall be made and certified by an independent licensed surveyor or engineer approved by the Owner/Architect.

b. Rock removed prior to measurement shall not receive compensation.

c. The quantity of rock shall be calculated using the following limits:

1. To top of rock

2. To vertical faces 1.0 feet beyond the outside of pipe barrel, each side
3. To 12 inches below pipe barrel for the full trench length having rock
4. To vertical faces located 1.0 feet horizontal distance beyond structures or manholes
6. To 6 inches below bottom of slab for structures

E. Blasting or explosives:

1. All blasting or use of explosives shall be done by a company with at least five years documented experience specializing in use of explosives for disintegration of rock.

2. All blasting or use of explosives shall be done in strict accordance with the local authority having jurisdiction. Obtain all necessary permits or approvals prior to use of explosives. The Contractor is responsible for all Federal, State, and local safety requirements, ordinances, or laws regarding the use of explosives.

3. The Contractor shall conduct a survey with photographs of to document existing conditions of buildings adjacent to or near the location of rock removal prior to blasting. The Contractor shall advise and coordinate with all affected adjacent or nearby property owners in writing of the proposed blasting schedule. Obtain a seismic survey prior to rock excavation to determine maximum charges which may be used without damaging adjacent property, buildings, or structures. Provide seismographic monitoring during all blasting operations.

4. All blasting shall be completed before footings or foundation construction begins.

5. Rock which is removed shall become the property of the Contractor and shall be removed from the site and disposed of in a legal manner.

6. When rock is encountered, the Contractor shall immediately notify the Engineer in writing. Classification of rock and volume calculations shall be done in accordance with the specifications and as directed by the Architect. The Engineer and/or the Architect will issue written instructions to the Contractor concerning rock work prior to any rock removal.

7. Payment will not be made for over excavated rock or for replacement materials.

2.06 BACKFILL AND FILL

A. Fill materials: Fill shall be clean inorganic natural soil. Structural fill shall contain no rock fragments larger than 3 inches in the longest dimension. Soils proposed for fill shall have a target maximum dry density of 100 pounds per cubic foot or greater in Standard Proctor Compaction Test ASTM D698 or as directed by the GE. All fill materials must be approved by the Soils Engineer prior to placement. In the absence of a Soils Engineer, the Contractor is fully responsible for material or soil selected for fill. Any fill containing large quantities of rock or weathered rock shall not be used as structural fill.

B. The Contractor shall coordinate testing as required by the Soils Engineer (GE) for all fill materials prior to their use.

C. Execution: Placed fill materials used in backfilling or filling in layers shall not exceed the following loose depths or as directed by the Soils Engineer (GE):

1. Heavy equipment compaction: 6-8 inches
2. Hand operated tampers: 4-6 inches

D. All areas of existing subgrade which require remediation, or are not capable of in-place compaction, shall be excavated and backfilled with structural fill material compacted to a density equal to or greater than requirements for subsequent fill material layers.

E. Place fill simultaneously on opposite sides of walls, small structures, utility lines, trenches, etc. to avoid displacement or over stressing.

F. In-place density requirements:
Compact soil to not less than the values given below, expressed as a percentage of maximum dry density at optimum moisture content per ASTM D698:

1. Structural fill: Paved areas, buildings, footings, structures, etc.: 95 percent minimum unless noted otherwise, or as recommended by the Geotechnical Engineer or the Geotechnical subsurface exploration analysis and evaluation, whichever is

greater.
2. Unpaved non-structural areas: 90 percent
3. Exterior steps, walks, ramps, etc.: 95 percent
4. Compacted fill behind walls: 95 percent

G. Moisture Control: During compaction, control moisture of subgrades and subsequent lifts to within optimum moisture content tolerances as recommended by the GE. Wet surface or aerate soil as required.

H. Backfilling:

1. Backfill areas to contours and elevations shown with approved unfrozen materials.
2. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, or spongy subgrade surfaces.
3. Maintain moisture content within optimum range as specified by the GE.
4. Compaction: See 2.06 (F) above.
5. Slope grades away from buildings or other structures which may be damaged by water a minimum of 2 inches in 10 feet, unless noted otherwise.
6. Tolerances: Plus or minus 1/10 foot.

I. Protection of finished work: Protect all finished work. Re-shape and re-compact fills subjected to vehicular traffic as necessary.

2.07 TRENCHING

A. Comply with all Federal, OSHA, State, County, City or local regulations regarding safety and construction. See Section 1.05 (4).

B. Maintain and protect all utilities above and below ground designated to remain. Contractor to coordinate with all utilities and authorities having jurisdiction regarding construction procedures such as utility service connections, maintenance of service(s), notification procedures, tapping or extension specifications, and other related items.

C. Cut trenches sufficiently wide to enable installation and inspection. The minimum bedding for all pipes is Class B as shown on the plans unless specified otherwise.

D. Backfill trenches to correct elevations with approved materials only. Do not backfill over porous, wet, or spongy subgrade surfaces.

E. Maintain maximum moisture content range to ensure required compaction density.

2.08 DISPOSAL

A. The contractor shall remove from the Owner's property all waste material, unsuitable excavated material, trash and debris, and dispose of it offsite in a legal manner.

2.09 GEOTECHNICAL SOILS STUDY

A. If a Geotechnical Soils Study has been performed, a copy of the Geotechnical Soils Study will be made available to the Contractor or included in the specifications following this Section. The Soils Study is for reference only. All conclusions, estimates, or decisions made regarding the contents of the Study are the sole responsibility of the person(s) reading the Study.

END OF SECTION 02200

SECTION 02230 ASPHALTIC CONCRETE PAVEMENT

PART 1 - GENERAL

1.01 SUMMARY

A. THIS SECTION INCLUDES:

1. Aggregate materials
2. Aggregate base course
3. Asphaltic concrete pavement

1.02 RELATED DOCUMENTS / SECTIONS

A. Contract documents and drawings, State of Georgia Department of Transportation Standards and Specifications (GA DOT), current edition. Refer to appropriate related sections as applicable.

1.03 REFERENCES

A. AASHTO - M147 - Materials for aggregate and soil aggregate.
B. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb. (4.45 kg) Rammer and an 18-in. (457 mm) drop.
C. ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Course Aggregates.
D. ANSI/ASTM D698 - Standard Proctor Test - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using a 5.5 lb. (2.49 kg) Rammer and 12 inch (304.8 mm) drop.
E. ANSI/ASTM D1557 - Modified Proctor Test - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.45 kg) Rammer and 18 inch (457 mm) Drop.
F. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
G. ASTM D2487 - Classification of Soils for Engineering Purposes.
H. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
I. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
J. ASTM D4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
K. ANSI/ASTM D1556 - Test Method for Density of Soil using the Sand-Cone Method.

When standards or specifications are indicated herein by reference, the referenced portion shall apply to the most recent edition of the publication and shall have the same force and effect as if they were included herein in their entirety.

1.04 PAYMENT ISSUE

A. Materials testing to be done at Contractor's expense. Testing firm to be approved by Architect/Engineer.

1.05 DESCRIPTION OF WORK

A. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, or specifications, the more stringent requirement shall apply as determined by the Engineer.

PART 2 - PRODUCTS

2.01 AGGREGATE MATERIALS

A. Coarse Aggregate Type A (Gravel): AASHTO M147, Grade A; passing the No. 40 sieve with a liquid limit of not more than 25; a plasticity index of not more than 5 in accordance with ASTM D4318.

B. Coarse Aggregate Type 2 (Gravel): Crushed: friable material and debris, graded in accordance with ANSI/ASTM C136, within the following limits:

Sieve Size	Percent Passing
2 inches	100
1 inch	95
3/4 inch	95 to 100
5/8 inch	75 to 100
3/8 inch	55 to 85
No. 4	35 to 60
No. 16	15 to 35
No. 40	10 to 25
No. 200	5 to 10

C. Aggregate Type A3 (Pea Gravel): Natural Stone; washed, free of shale, clay, organic matter; graded in accordance with ANSI/ASTM C136; to the following limits:

1. Minimum Size: 1/4 inch
2. Maximum Size: 5/8 inch

D. Fine Aggregate Type A4 (Sand): Natural river or bank sand; washed,

free of silt, clay, loam, friable or soluble materials, and organic matter, graded in accordance with ANSI/ASTM C136; within the following limits:

Sieve Size	Percent Passing
No. 4	100
No. 14	50 to 85
No. 50	10 to 30
No. 100	2 to 10
No. 200	0

2.02 SOURCE QUALITY CONTROL

A. Tests and analysis of aggregate materials will be performed in accordance with ANSI/ASTM D698.

B. If tests indicate materials do not meet specified requirements, change material and re-test.

PART 3 - PREPARATION

3.01 STOCKPILING

A. Stockpile materials in sufficient quantities to meet construction schedules and requirements.

B. Separate differing materials with dividers or stockpile apart to prevent mixing.

C. Direct surface water away from stockpile site so as to prevent erosion.

PART 4 - EXECUTION

4.01 AGGREGATE BASE COURSE

A. Coarse Aggregate Fill Type A: As specified in 2.01.

B. Fine Aggregate (Sand) Fill Type A4: As specified in 2.01.

4.02 EXAMINATION

A. Verify substrate has been inspected, gradients and elevations are correct, and dry.

4.03 AGGREGATE PLACEMENT

A. Spread aggregate over prepared substrate to an equivalent compacted thickness as shown on the plans.

B. Place aggregate in maximum 6 inch layers and roller compact.

C. Level and contour aggregate surfaces to elevations and gradients indicated on the approved plans.

D. Add small quantities of fine aggregate to course aggregate as appropriate to assist compaction.

E. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

4.04 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straightedge. Positive drainage must be maintained, no ponding or depressed areas, sharp transitions, or other objectionable areas will be allowed.

B. Compacted thickness for each asphaltic concrete course: Within 1/8 inch, tolerance is not cumulative. Maximum deviation for total asphaltic concrete thickness: Within 1/4 inch regardless of number of courses. Positive drainage must be maintained, no ponding or depressed areas, sharp transitions, or other objectionable areas will be allowed.

C. Variation from true elevation: Within 1/4 inch. Positive drainage must be maintained, no ponding or depressed areas, sharp transitions, or other objectionable areas will be allowed.

4.05 FIELD QUALITY CONTROL

A. Compaction testing, locations, number and frequency of tests shall be as recommended by the GE. Compaction testing shall be in accordance with ANSI/ASTM D1556.

B. If tests indicate Work does not meet specified requirements, remove Work, replace, and re-test.

4.06 COMPACTION

A. Under paved areas:

1. Compact placed aggregate materials to achieve minimum 95 percent ASTM D698 compaction or as shown on plans.

4.07 ASPHALTIC CONCRETE PAVING

A. RELATED DOCUMENTS / SECTIONS

1. Refer to related sections as applicable.

2. Aggregate Base Course and Aggregate Materials.

B. REFERENCES

1. MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot Mix Types - The Asphalt Institute (AI).

2. MS-3 - Asphalt Plant Manual - The Asphalt Institute (AI).
3. MS-8 - Asphalt Paving Manual - The Asphalt Institute (AI).

4. MS-17 - Asphalt Overlays for Highway and Street Rehabilitation - The Asphalt Institute (AI).

5. MS-19 Basic Asphalt Emulsion Manual, The Asphalt Institute (AI).

6. ASTM D946 - Penetration-Graded Asphalt Cement for Use in Pavement Construction.

C. PAYMENT ISSUE

1. Materials testing to be done at the contractor’s expense. Testing firm to be approved by Architect/Engineer/engineer.

D. QUALITY ASSURANCE

1. Perform Work in accordance with AI Manual MS-8 unless the GA DOT specifications conflict.

2. Mixing Plant: Conform to AI Manual MS-3.

3. Obtain materials from same source throughout.

E. SUBMITTALS

1. Material Certificates: Provide copies of materials certificates signed by material producer and Contractor, certifying that each material item complies with or exceeds, specified requirements.

F. SITE CONDITIONS

1. Weather Limitations: Apply prime and tack coats when ambient temperature is above 50 deg. F (10 deg.C), and when temperature has not been below 35 deg. F (1 deg. C) for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture. Construct asphalt concrete surface course when atmospheric temperature is above 40 deg. F (4 deg.C), and when base is dry. Base course may be placed when air temperature is above 30 deg. F (-1 deg. C) and rising.

2. Grade Control: Establish and maintain required lines and elevations.

G. DEFINITIONS

1. Asphalt Wearing Course: The top course of an asphalt pavement.

2. Asphalt Binder Course: The course located between a base course and the wearing course.

3. Base Course: The layer of material immediately beneath the binder course.

H. MATERIALS

1. Asphalt Cement: ASTM D946.

2. Aggregate for Binder Course Mix: (Heavy Duty asphaltic concrete type B) (Light Duty asphaltic concrete type B) in accordance with GA. DOT standards.

3. Aggregate for Wearing Course Mix: In accordance with GA DOT

standards.

4. Aggregate for Base Course: The base course shall be spread evenly upon the prepared subgrade in sufficient quantity to form a compacted depth as shown on the plans.

5. New topping for existing asphalt pavement as shown on the plans.

6. Fine Aggregate: In accordance with the GA DOT standards.

7. Mineral Filler: Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter.

I. ACCESSORIES

1. Primer: In accordance with the GA DOT standards.

2. Tack Coat: In accordance with the GA DOT standards.

J. ASPHALT PAVING MIX

1. Use dry material to avoid foaming. Mix uniformly.

2. Binder Course: Per GA DOT specifications.

3. Wearing Course: Per GA DOT specifications.

4. The contractor shall submit to the Engineer a design mix for each course specified a minimum of two weeks prior to commencing work.

K. SUBBASE

1. Aggregate Base Course forms the base construction for work of this Section.

L. PREPARATION - PRIMER

1. Apply primer on base or subbase over subgrade surface at uniform rate of 1/3 gal/sq yd.
2. Apply primer to contact surfaces of curbs, gutters.

3. Use clean sand to blot excess primer.

M. PREPARATION - TACK COAT

1. Apply tack coat on asphalt or concrete surfaces over subgrade at uniform rate of 1/3 gal/sq yd.
2. Apply tack coat to contact surfaces of curbs and gutters.

N. PLACING ASPHALT PAVEMENT

1. Install Work in accordance with GA DOT standards and specifications.

2. All areas where new asphalt adjoins existing asphalt or other pavement shall be sawcut for smooth edges and shall have expansion joints for entire adjoining length. All such expansion joints shall be completely and permanently sealed for entire length per standard details and GADOT standards and specifications. All such areas in right-of-way or other jurisdiction shall comply with the local authority specifications for material, depth, base, pavement thickness, finish, and specifications.

O. RESURFACING

1. Resurfacing and/or overlay topping of existing pavements shall be a minimum 1 1/2" type F asphalt surface course. Spot repairs, cleaning, and sealing of existing pavements shall be in accordance with "Asphalt Overlays for Highway and Street Rehabilitation" (MS-17), Asphalt Institute.

P. FIELD QUALITY CONTROL

1. General: Core Test in-place asphalt concrete courses for compliance with requirements for thickness and surface smoothness. Test locations shall be selected by Owner/Engineer. Coring(s) shall be repaired per referenced standards. Repair or remove and replace unacceptable paving as directed by Architect/Engineer.
2. Thickness: In-place compacted thickness will not be acceptable if exceeding following allowable variation from required thickness:

    A. Base Course: 1/4 inch
    B. Asphaltic concrete Binder and Surface Courses: 1/8 inch
    C. Surface Smoothness: Test finished surface of each

asphalt concrete course for smoothness, using 10' straightedge applied parallel with, and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness. All surfaces not acceptable shall be removed and replaced until acceptable.

1. Base Course Surface: 1/4"
2. Compacted thickness for each asphaltic concrete course: Within 1/8 inch, tolerance is not cumulative. Maximum deviation for total asphaltic concrete thickness: Within 1/4 inch regardless of number of courses. Positive drainage must be maintained, no ponding or depressed areas, sharp transitions, or other objectionable areas will be allowed.
3. Crowned Surfaces: Test with crowned template centered at right angle to crown. Maximum allowable variance from template 1/4". Positive drainage must be maintained, no ponding or depressed areas, sharp transitions, or other objectionable areas will be allowed.
4. Check surface areas at intervals as directed by Architect/Engineer/Engineer as necessary to insure conformance to the plans and specifications.

4.08 ASPHALTIC CONCRETE OVERLAY PAVING

A. RELATED DOCUMENTS / SECTIONS

1. Refer to related sections as applicable.

2. Aggregate Base Course and Aggregate Materials.

B. REFERENCES

1. MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot Mix Types - The Asphalt Institute (AI).

2. MS-3 - Asphalt Plant Manual - The Asphalt Institute (AI).

3. MS-8 - Asphalt Paving Manual - The Asphalt Institute (AI).

4. MS-17 - Asphalt Overlays for Highway and Street Rehabilitation - The Asphalt Institute (AI).

5. MS-19 Basic Asphalt Emulsion Manual, The Asphalt Institute (AI).

6. ASTM D946 - Penetration-Graded Asphalt Cement for Use in Pavement Construction.

When standards or specifications are indicated herein by reference, the referenced portion shall apply to the most recent edition of the publication and shall have the same force and effect as if they were included herein in their entirety.

C. PAYMENT ISSUE

1. Materials testing to be done at the contractor's expense. Testing firm to be approved by architect/engineer.

D. QUALITY ASSURANCE

1. Perform Work in accordance with AI Manual MS-8 and the GA DOT specifications. Where conflicts occur, use the more stringent specification.

2. Mixing Plant: Conform to AI Manual MS-3.

3. Obtain materials from same source throughout.

E. SUBMITTALS

1. Material Certificates: Provide copies of materials certificates signed by material producer and Contractor, certifying that each material item complies with or exceeds, specified requirements.

F. SITE CONDITIONS

1. Weather Limitations: Apply prime, seal, and tack coats per manufacturer's specifications, but not less than the following: when ambient temperature is above 50 deg. F (10 deg.C), and when temperature has not been below 35 deg. F (1 deg. C) for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture. Construct asphalt concrete surface course when atmospheric temperature is above 40 deg. F (4 deg.C), and when base is dry. Base course may be placed when air temperature is above 30 deg. F (-1 deg. C) and rising.

2. Grade Control: Establish and maintain required lines and elevations.

G. DEFINITIONS

1. Asphalt Wearing Course: The top course of an asphalt pavement.

2. Asphalt Binder Course: The course located between a base course and the wearing course.

3. Base Course: The layer of material immediately beneath the binder course.

4. Asphalt Overlay Course: Asphaltic concrete course directly on top of existing asphalt pavement top course. Asphalt overlay is allowed only where specifically shown on plans.

H. MATERIALS

1. Asphalt Cement: ASTM D946.

2. Aggregate for Binder Course Mix: In accordance with GA DOT standards.

3. Aggregate for Wearing Course Mix: In accordance with GA DOT standards.

4. Aggregate for Base Course: The base course shall be spread evenly upon the prepared subgrade in sufficient quantity to form a compacted depth as shown on the plans.

5. Overlay for existing asphalt pavement only as shown and specified on the plans.

6. Fine Aggregate: In accordance with the GA DOT standards.

7. Mineral Filler: Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter.

I. ACCESSORIES

1. Primer: In accordance with the GA DOT standards.

2. Tack Coat: In accordance with the GA DOT standards.

J. ASPHALT PAVING MIX

1. Use dry material to avoid foaming. Mix uniformly.

2. Binder Course: Per GA DOT specifications.

3. Wearing Course: Per GA DOT specifications.
4. Overlay Course: Per GA DOT specifications.

5. The contractor shall submit to the Engineer a design mix for each course specified a minimum of two weeks prior to commencing work.

K. ASPHALT OVERLAY PREPARATION - EXISTING PAVEMENT

1. The Contractor must perform a thorough inspection of all existing pavement areas designated for asphalt pavement overlay with the Architect/Engineer. Existing pavement areas which exhibit excessive wear, rutting, cracking, settling, or other defects must be repaired prior to installation of asphalt overlay. Repaired areas must meet project specifications for the entire pavement section including subgrade, base, and all asphalt pavement courses. Areas requiring repairs shall be determined by the Architect/Engineer.

2. CLEANING:
Existing asphalt pavement shall be cleaned thoroughly. Saw cut pavement edges where pavement is to be removed. Clean all loose and objectionable material. Surface must be dry prior to asphalt overlay pavement. Primer, sealer, reinforcement fabric, and tack coat are required prior to placement of overlay pavement.

3. STRUCTURAL PATCHING:
Structural patching will be required where the following conditions occur: excessive wear of surface course, rutting, excessive cracking, local depressed areas, potholes, and similar defects in the existing pavement. All such areas in the existing pavement with defects shall be removed and repaired. Areas to be patched shall be cut out, trimmed to vertical sides, with all loose material or debris removed. Remove and replace subgrade and existing aggregate base material as required to provide a minimum pavement section equal to or greater than the pavement section specified for the project.

4. LEVELING:
Leveling consists of asphalt wedges used to level existing pavement surfaces prior to asphalt overlay pavement installation. Leveling may be done ONLY in those areas where the existing base course and underlying subgrade meet the minimum pavement specifications for the project as determined by the Architect/Engineer. Leveling shall be done in at least two layers, maximum depth of 2 inches per layer, for up to 6 inches total depth. All layers shall be level with smooth transitions to existing pavement. Crowned areas shall be leveled all the way to the top of the crown, depressed areas shall be leveled to meet the existing edge of pavement adjacent to the depression.

Leveling construction and materials shall conform to GA DOT specifications.

5. CRACK SEALING:
All cracks in the existing pavement greater than 0.375 inches (3/8") shall be sealed with an appropriate crack filler prior to asphalt overlay pavement installation. After proper installation of crack filler material, all cracks in existing pavement shall be reinforced with Type II pavement reinforcement fabric per GA DOT standards and specifications. Crack filler and sealer material and construction shall conform to GA DOT specifications.

6. TAPERING:
Asphalt pavement overlay adjacent to curbs, gutters, raised pavement edges, structures, drainage grates, manhole covers, or similar areas shall be constructed to provide a finished asphalt surface at the joint where the asphalt meets the existing structure no higher or lower than the existing or proposed structure elevation to provide a smooth even surface at all structures in or adjacent to the pavement. The asphalt overlay minimum thickness as specified shall be maintained. Existing pavement shall be removed as required to provide a finished surface at the edge of pavement adjacent to existing or proposed structures equal to the existing structure surface elevation. Do not feather or taper the asphalt overlay. Maintain the minimum pavement thickness throughout.

7. STRUCTURE ADJUSTMENTS:
All structures in the pavement or touching pavement shall be adjusted, relocated, repaired, raised or lowered, and set into new pavement to ensure proper function for the structure. All joints and edges with existing pavement, curb, gutters, drainage structures, manholes, cleanouts, valves, and all other structures in the pavement overlay area, shall be even with the finished pavement surface including the overlay and uniform for the proper function of the structure. Removal of existing asphalt pavement will be required. Do not raise with the asphalt overlay any finished grades adjacent to buildings or structures which may be damaged by water intrusion. Maximum finished pavement grade adjacent to buildings or structures which may be damaged by water intrusion is 0.50 feet lower than the finished floor level of the building or structure. Existing grades adjacent to buildings which are less than 0.50 feet lower than the finished floor may be maintained at the existing elevation with Owner’s approval under the following conditions: 1.) no water intrusion is present, with no history of water intrusion (Contractor must verify); 2.) Positive slope and drainage away from the building or structure must be maintained.

L. ASPHALT OVERLAY PREPARATION - PRIMER

1. Apply primer on base or subbase over surface at uniform rate per GA DOT specifications.
2. Apply primer to contact surfaces of curbs, gutters.
3. Use clean sand to blot excess primer.

M. ASPHALT OVERLAY PREPARATION - TACK COAT

1. Apply tack coat on asphalt or concrete surfaces over subgrade at uniform rate per GA DOT specifications.
2. Apply tack coat to contact surfaces of curbs and gutters. Install Type II pavement reinforcement fabric per GA DOT standards and specifications.

N. PLACING ASPHALT OVERLAY PAVEMENT

1. Install all Work in accordance with asphaltic concrete pavement specifications, and GA DOT standards and specifications.

O. RESERVED

P. FIELD QUALITY CONTROL

1. General: Test in-place asphalt concrete courses for compliance with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable paving as directed by Architect.

2. Thickness: In-place compacted thickness will not be acceptable if exceeding following allowable variation from required thickness:

   A. Base Course: 1/2", plus or minus
   B. Surface Course: 1/4", plus or minus
   C. Overlay Course: 1/4", plus or minus

   D. Surface Smoothness: Test finished surface of each asphalt concrete course for smoothness, using 10' straightedge applied parallel with, and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness. All surfaces not acceptable shall be removed and replaced until acceptable.

      1. Base Course Surface: 1/4"
      2. Wearing Course Surface: 1/8"

3. Crowned Surfaces: Test with crowned template centered at right angle to crown. Maximum allowable variance from template, 1/4".
4. Check surface areas at intervals as directed by Architect or as necessary to insure conformance to the plans and specifications.

END OF SECTION 02230

SECTION 02361 - TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following for termite control:

1. Soil treatment.

1.3 DEFINITIONS

A. EPA: Environmental Protection Agency.

B. PCO: Pest control operator.

1.4 SUBMITTALS

A. Product Data: Treatments and application instructions, including EPA-Registered Label.

B. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements.

C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following as applicable:

1. Date and time of application.
2. Moisture content of soil before application.
3. Brand name and manufacturer of termiticide.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes, and rates of application used.
6. Areas of application.
7. Water source for application.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A PCO who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located and who is experienced and has completed termite control treatment similar to that indicated for this Project and whose work has a record of successful in-service performance.

B. Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

1.7 COORDINATION

A. Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

1.8 CLOSEOUTS

A. Provide signed treatment letter from Applicator noting exact products provided and date products were applied.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation. Use only soil treatment solutions that are not harmful to plants. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

B. 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:

1. Manufacturers: Subject to compliance with requirements of the authority having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer.

C. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction, for locations all locations, and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute the treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Adjacent soil including soil along entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers, piers, and chimney bases; and along entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
3. Crawlspaces: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
4. Masonry: Treat voids.
5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 02361

SECTION 02510 - PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Concrete Curbs
B. Concrete Sidewalks, pads & steps
C. Concrete Paving, footings, foundations, slabs

1.02 RELATED SECTIONS

A. Refer to appropriate related sections as applicable

1.03 REFERENCES

A. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
B. ACI 305R - Hot Weather Concreting.
C. ACI 306R - Cold Weather Concreting.
D. ACI 308 - Standard Practice for Curing Concrete.
E. ACI 318 - Building Code Requirements for Reinforced Concrete.
F. ANSI/ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous Type).
G. ANSI/ASTM D1190 - Concrete Joint Sealer, Hot-Poured Elastic Type.
H. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
I. ASTM C33 - Concrete Aggregates.
J. ASTM C94 - Ready-Mixed Concrete.
K. ASTM C150 - Portland Cement.
L. ASTM-C260 - Air Entraining Admixtures for Concrete.
M. ASTM C494 - Chemicals Admixtures for Concrete.
N. AC1 301 – Specifications for Structural Concrete

When standards or specifications are indicated herein by reference, the referenced portion shall apply to the most recent edition of the publication and shall have the same force and effect as if they were included herein in their entirety.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301.
B. Maintain one copy of each document on site.
C. Acquire cement and aggregate from same source for all work.
D. Conform to ACI 305R when concreting during hot weather.
E. Conform to ACI 306R when concreting during cold weather.

1.06 DESCRIPTION OF WORK

A. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, or specifications, the more stringent requirement shall apply as determined by the Engineer.

PART 2 - PRODUCTS

2.01 CONCRETE TYPES

A. Class A and B Concrete.

2.02 MATERIAL

A.

	CLASS A	CLASS B
Coarse Aggregate Size No.	56, 57, 67	56, 57, 67
Minimum Cement Factor (lbs / cu yd)	611	470
Maximum Water / Cement Ratio (lbs / cu yd)	0.490	0.660
Slump Acceptance Limits (in. lower - upper)	2 - 4	2 - 4
Entrained Air Acceptance Limits (% lower - upper)	2.5 - 6.0	0.0 - 6.0

	CLASS A	CLASS B
Minimum Compressive Strength 28 Days (psi)	3000	2500

B. Refer to GA DOT standards and specifications.

C. Minimum compressive strength shall be as stated on plans.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I - Normal.
B. Fine and Coarse Aggregate : ASTM C33.
C. Water: Clean and not detrimental to concrete.

2.04 CONCRETE MIX

A. Mix concrete in accordance with ACI 304. Deliver concrete in accordance with ASTM C94.
B. Select proportions for normal weight concrete in accordance with ACI 301 Method 1.
C. No mixing onsite will be allowed, no fly ash or other additives will be allowed, water shall not be added after initial mixing at plant. Concrete older than 90 minutes from initial mixing at plant shall not be used.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify all formwork is correctly installed and located.
B. Verify requirements for concrete cover over reinforcement.

3.02 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI 304. Fully comply with AC1 305R (Hot weather concreting) and ACI 306R (Cold weather concreting).
B. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints are not disturbed during concrete placement.
C. Install joint devices in accordance with manufacturer's instructions.

D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
E. Place concrete continuously between predetermined expansion, control, and construction joints.

3.04 RESERVED

3.05 CONCRETE FINISHING

A. Broom finish surfaces which are scheduled to be exposed or as directed by the Architect or shown on the plans. Verify required finish with Architect and Owner prior to construction.

3.06 CURBING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.07 FIELD QUALITY CONTROL

A. Field testing will be performed in accordance with ACI 301.

3.08 PATCHING

A. Allow Architect/Engineer to inspect concrete surfaces immediately upon removal of forms.
B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Architect/Engineer upon discovery.

3.09 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
B. Repair or replacement of defective concrete will be determined by the Architect/Engineer.
C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

3.10 SIDEWALKS

A. Walks shall be constructed of Class B concrete, and shall be minimum four (4") inches depth. Provide cross slope (perpendicular to travel path) of minimum 1/8 inch per foot (1.0%) to maximum ¼ inch per foot (2.0%). Cross slope shall direct flow to drainage channels, storm sewer, or free discharge. No ponding allowed. All sidewalks shall have minimum 6x6 10 Gauge welded wire fabric reinforcement placed at 1.5 inches from bottom of concrete, with subgrade compacted to minimum 95 percent maximum dry density. Transverse contraction joints shall be formed with tool designed for forming groove one-third of the depth of the sidewalk, and located as shown on the architectural drawings, or at a minimum of twice the sidewalk width, or 10 feet maximum. All edges shall be rounded with a 1-1/4" edger. Full depth expansion joints shall be located on not more than 20'-0" centers and at all intersections. All sidewalk surfaces should be broom finished or as directed by Architect/Engineer or as shown on plans. Verify finish prior to construction.

3.11 CURBS

A. Curbs shall be constructed of Class A concrete and all curbing shall be placed in compacted subsoil meeting specifications. Curbing shall be as shown on plans. Transverse contraction joints shall be formed with tool designed for forming groove, and on no more than 6'-0" centers. Expansion joints shall be located on not more than 20'-0" centers and at all intersections.

B. Gutter cross section slope shall be adjusted at low points and as required to meet design intent for drainage and flow direction. At upstream low point sections the gutter cross slope shall be sloped in the direction of flow and blended smooth with adjacent curb and gutter. No ponding will be allowed in any gutter section.

3.12 CONCRETE PADS & STEPS

A. Shall be constructed of Class A concrete. Concrete reinforcement according to construction details, minimum 6x6 10 gauge welded wire fabric. All concrete pads poured at entrance or exit doorways or access points shall be poured to the finish floor level at the interface with the building, and immediately sloping away from the building at a rate of 1/8 inch per foot or 1.0 percent minimum, 1/4 inch per foot maximum. Provide positive slope away from building or structure at all points, no ponding or depressed areas will be allowed.

3.13 CONCRETE PAVING

Shall be placed in full compliance with ACI Hot and Cold weather requirements. Concrete reinforcement minimum 6x6 10 gauge welded wire fabric or fiber reinforcement, as shown on construction details.
Install dowels at all connections to existing concrete, paving, curb and gutter, or any other existing concrete. Install dowels at all construction joints. Dowels shall be as shown on the plan details, installation and materials per GDOT standards and specifications as a minimum.
Install control joints at maximum 10’ x 10’ spacing. Install construction joints at pour terminations or other placement interruptions. All construction joints shall coincide with control joint(s).
Submit joint layout and details for approval prior to construction.

END OF SECTION 02510

SECTION 02580 - PAVEMENT MARKING AND TRAFFIC SIGNS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Parking striping and direction markings on asphalt concrete.
B. Signage for directing traffic on the site.

1.02 SUBMITTALS

A. Product data: Submit for marking paint to Architect. Indicate application rates and methods.
B. Proposed Sign Samples to Owner/Architect.

1.03 REFERENCES

A. Georgia Department of Transportation Standards and Specifications
B. Manual on Uniform Traffic Control Devices (MUTCD)

When standards or specifications are indicated herein by reference, the referenced portion shall apply to the most recent edition of the publication and shall have the same force and effect as if they were included herein in their entirety.

1.04 JOB CONDITIONS

A. Weather Limitations:

1. Apply pavement marking paint only when ambient temperature in the shade is at least 50 degrees F for 12 hours immediately prior to application.
2. Do not apply when surface is wet or contains moisture.
3. Do not apply paint when wind conditions would result in debris being deposited on painted surfaces.

1.05 DESCRIPTION OF WORK

A. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, or specifications, the more stringent requirement shall apply as determined by the Engineer.

PART 2 - PRODUCTS

2.01 PAVEMENT MARKING PAINT

A. Traffic lane, parking stall, handicap parking and direction arrow marking: Type meeting GA DOT Specification, current edition.
B. Qualities: Quick drying colors as specified by Architect.
C. Source:
1. Sherglide by Sherwin-Williams or equivalent.

2.02 DIRECTIONAL SIGNAGE

A. All signage used on the site to direct traffic shall conform to the Manual for Uniform Traffic Control Devices, and the GA. D.O.T. Standards and Specifications, current edition, and be approved by the Owner/Architect prior to installation. Contractor shall provide Owner/Architect with samples and shop drawings of these signs.

2.03 HANDICAP PARKING SIGNS

A. Contractor shall provide and erect all required handicap signage required for the site according to federal, state, county and city authorities standards and specifications whether shown on the plans or not.

PART 3 - EXECUTION

3.01 MARKING PAVEMENTS

A. All pavement markings used on the site to direct traffic shall conform to the Manual for Uniform Traffic Control Devices, and the GA. D.O.T. Standards and Specifications, current edition, as approved by the Owner/Architect. Contractor shall provide Owner/Architect with samples and shop drawings of all markings prior to construction, Paint lines as shown on approved drawings.

B. Cleaning: Sweep surface with power broom supplemented by hand brooms to remove loose material and dirt. Do not begin pavement marking until substrate has cured.

C. Apply paint with mechanical equipment to uniform straight line. All linework not otherwise indicated shall be 4" uniform thickness, color white. All directional markings shall be painted with spray equipment on stencils or templates of approved design to prevent overspray. Apply one coat in accordance with manufacturer’s recommended rates to achieve minimum 15 mils dry film thickness.

END OF SECTION 02580

SECTION 02700 - STORM SEWER

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Site storm sewer drainage piping, structures, fittings, accessories, and pipe bedding.

B. Catch basins, manholes at junctions, inlets, structures and appurtenances as shown on the plans.

1.02 RELATED DOCUMENTS/SECTIONS

A. Contract documents and drawings, construction details as shown on the plans, geotechnical engineering report, GA. D.O.T. Standards and Specifications. Refer to appropriate related sections as applicable.

1.03 REFERENCED STANDARDS

A. AASHTO M36 - Metallic (Zinc or Aluminum) Coated Corrugated Steel Culverts and Underdrains.

B. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop.

C. ANSI/ASTM A74 - Cast Iron Soil Pipe and Fittings.

D. ANSI/ASTM C12 - Practice for Installing Vitrified Clay Pipe Lines.

E. ANSI/ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.

F. ANSI/ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

G. ANSI/ASTM C425 - Compression Joints for Vitrified Clay Pipe and Fittings.

H. ANSI/ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

I ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

J. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

K. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb(4.54 Kg) Rammer and 18 inch (457 mm) Drop.

L. ANSI/ASTM D2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.

M. ANSI/ASTM D2729 - Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

N. ANSI/ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.

O. ANSI/ASTM D3033 - Type PSP Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

P ANSI/ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

Q. ASTM C700 - Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.

R. ASTM D2922 - Test Methods for Density of Soil and Soil- Aggregate in Place by Nuclear Methods (Shallow Depth).

S. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

When standards or specifications are indicated herein by reference, the referenced portion shall apply to the most recent edition of the publication and shall have the same force and effect as if they were included herein in their entirety.

1.04 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations. All bedding and trenching shall conform to the details shown on the construction plans. Any wet, spongy, or other unsuitable material shall be removed and/or

stabilized at the direction of the soils engineer.

1.05 SUBMITTALS

A. Provide data indicating pipe, pipe accessories, and manufacturer's warranties.

B. Manufacturer's Installation Instructions: Indicate special procedures required to install products specified.

C. Manufacturer's Certificate: Certify that products meet or exceed specifications and/or referenced standards.

D. Pre-manufactured catch basins, trench drains or other special drainage equipment: Submit to Engineer manufacturer’s shop drawings, specifications, and warranties for approval prior to purchase or installation.

1.06 PROJECT RECORD DOCUMENTS

A. Submit complete, detailed as built drawings to Owner, Engineer, and Architect upon completion of the work showing vertical and horizontal location. As built drawings shall be based on field run survey(s) and be sealed and signed by a registered surveyor in the State where the project is located. Provide three sets of original hard copies and one digital file in AutoCad or other acceptable digital format. Contractor is responsible for approval and verification of acceptable digital format. **As-built drawings will be required at a minimum 45 days prior to substantial completion.**

B. Accurately record actual locations of pipe runs, taps, connections, valves, tees, mechanical joints, connections, pipes, manholes, structures, sub-surface drain fields, septic tanks, lift stations, service taps or stubouts, type and size of material, and top and invert elevations of all pipes and structures.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities or other structures. All such uncharted utilities or structures shall be shown on as built drawings.

1.07 REGULATORY REQUIREMENTS

A. Conform to all applicable Federal, State, County, City, or local

jurisdiction requirements concerning storm sewer construction and safety.

B. **WARNING:**
CONTRACTOR SHALL: COMPLY WITH ALL OSHA, FEDERAL, STATE, LOCAL, AND INDUSTRY STANDARD SAFETY MEASUES, DEVICES, PROCEDURES, PRECAUTIONS, AND EQUIPMENT FOR ALL WORK OR OTHER ACTIVITIE(S). NO PERSON(S) SHALL ENTER MANHOLES, CONFINED SPACES, OR OTHER UNDERGROUND STRUCTURES, SPACES, TRENCHES, OR EXCAVATIONS WITHOUT PROTECTIVE BREATHING APPARATUS AND ALL OTHER REQUIRED SAFETY MEASURES, DEVICES, PROCEDURES, AND EQUIPMENT, AND AT LEAST ONE OTHER PERSON PRESENT ABOVE GROUND FOR SAFETY AND MONITORING AT ALL TIMES. CONTRACTOR SHALL PROVIDE AND ENSURE USE OF SAFETY KITS, HELMETS, GLOVES, EMERGENCY OXYGEN RESUSCITAOR KITS, AND AIR QUALITY AND GAS DETECTORS FOR VOLATILE, TOXIC, OR EXPLOSIVE GASES OR SUBSTANCES. VERIFY SAFE OXYGEN CONTENT PRIOR TO ENTERING MANHOLES, CONFINED SPACES, OR OTHER UNDERGROUND STRUCTURES.

1.08 FIELD MEASUREMENTS

A. Verify that field measurements and elevations are as indicated by the manufacturer.

1.09 COORDINATION

A. A. Coordinate the Work with plumbing contractor and MEP engineering plans for connection of storm sewer to foundation drainage system and roof drainage system outside building. Verify and confirm positive drainage and slope for all Roof drain stubs connection to storm sewer prior to construction (PTC).

1.10 DESCRIPTION OF WORK

A. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, or specifications, the more stringent requirement shall apply as determined by the Engineer.

PART 2 - PRODUCTS

2.01 STORM SEWER PIPE MATERIALS

A. All storm sewer structures, manholes, junctions, piping, joints, sealing, materials and installation shall conform, at a minimum, to the local authorities having jurisdiction standards and specifications and current Georgia Department of Transportation (GDOT) latest standards and specifications, and as specified herein, whichever is greater. The Contractor is responsible for verification of current applicable standards and specifications prior to construction. All manhole or other junction structures shall have with paved invert channels per current GDOT standards and specifications.

B. Storm Sewer Pipe:
All storm sewer pipe gauge shall conform at minimum to GDOT 1030D, 1030P, current revision, and pipe manufacturer's specifications, whichever is greater. All storm sewer pipe, materials, joints, and installation is subject to the approval of the local authority having jurisdiction approval. Contractor shall verify local authority specifications and requirements prior to purchase. All storm sewer (except concrete) carrying live streams or used for storm water detention shall have paved invert.

C. Reinforced Concrete Pipe: ANSI/ASTM C76, Class III, with Wall Type A, mesh reinforcement; bell and spigot end joints. Verify Class per GADOT 1030D.

D. Reinforced Concrete Pipe Joint Device: ANSI/ASTM C443, rubber compression gasket joint.

E. Corrugated Steel Pipe: AASHTO M36 Type I, helical lock seam, coated inside and out with 0.050 inch (1.3 mm) thick bituminous coating.

F. Coupling Bands: Galvanized steel, 0.052 inches (1.3 mm) thick x 10 (250 mm) inches wide; connected with two neoprene "O" ring gaskets and two galvanized steel bolts.

G. HDPE Pipe:
Shall conform to: ASTM D4101, ASTM F677, ASTM D3212, ASTM F477, ASTM D2321, AASHTO M294.
Contractor shall comply fully with all manufacturer's specifications and

as specified herein, whichever is greater, including but not limited to: subgrade, bedding, joints, backfill, installation and handling procedures.

Minimum HDPE requirements:

Smooth bore dual wall pipe is minimum requirement.

All HDPE pipe installation shall be monitored and certified by Geotechnical Engineer or other testing agency approved by Engineer / Architect.

Provide submittal to Engineer for approval prior to purchase.

Maintain minimum HS20 load rating at all times.

Watertight bell and spigot gasketed joints required.

Granular backfill conforming to ASTM D2321 Class I (AASHTO M43 Designation #5 or # 56 stone) shall be installed minimum 6 inches below pipe to top (crown) of pipe, minimum compaction 90% ASTM D698, or per manufacturer, or as shown on plans, whichever is greater. Contractor shall verify all bedding requirements prior to construction.

Backfill shall be distributed and placed with shovels or other light hand tools to completely fill all voids in and around the pipe and the backfill area at the required density for compaction specified. No heavy equipment shall be used adjacent to or near the pipe until minimum cover is established as noted below.

Geotextile fabric shall be installed at the interface between adjacent soil and the granular backfill below, on the sides, and at the top of the backfill trench. Verify type of geotextile with Geotechnical Engineer prior to construction.

Heavy equipment or vehicles are not allowed over HDPE pipe prior to minimum 24 inches compacted cover (or per manufacturer specifications, whichever is greater) over top of pipe is established per design and specifications.

Minimum and maximum cover depth shall be verified by Contractor with manufacturer based on design, site conditions, manufacturer specifications, and contract documents, plans, and specifications.

Contractor shall verify that site soil conditions meet manufacturer's specifications for pH and resistivity prior to purchase.

Contractor shall provide testing and certification of all HDPE pipe installation for deflection and structural integrity after finish grades are established and construction is complete by Geotechnical Engineer or other testing agency approved by Engineer / Architect.

H. Aluminum Coated Type 2 Corrugated Steel Pipe:

Shall conform to: AASHTO M36, AASHTO M274

Contractor shall comply fully with all manufacturer's specifications, including but not limited to: bedding, joints, backfill, and installation

and handling procedures.
Minimum pipe thickness is 12 gauge. Comply GADOT 1030D and manufacturer's specifications for pipe gauge, depths and design conditions.
Provide submittal to Engineer for approval prior to purchase.
Maintain minimum H20 load rating at all times.
Granular backfill of maximum 1 inch diameter to 1/2 pipe diameter required.
Contractor shall verify that site soil conditions meet manufacturer's specifications for pH and resistivity prior to purchase.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that trenches, excavations, dimensions, bedding, fill materials, and elevations conform to the plans and specifications and are ready to receive the work.

B. Contractor shall verify all existing storm sewer pipe, structures, and other utilities location, depth, invert, material, size, and condition **PRIOR TO CONSTRUCTION.** Contractor shall verify connection locations and inverts to existing storm sewer pipe or structures **PRIOR TO CONSTRUCTION.** Resolve any conflicts or problems prior to proceeding with the work.

3.02 PREPARATION

A. Hand trim excavations to required elevations. Correct over-excavation with fine aggregate or as directed by the contracting officer. Verify all fill material as suitable with the soils engineer prior to placement and compaction.

B. Remove large stones, debris, rock, roots, organic material, or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.03 BEDDING

A. Excavate pipe trench in accordance with Section 02200 for work of this section. Hand trim excavation for accurate placement of pipe to elevations indicated. Cut trenches sufficiently wide to enable

installation and inspection. The minimum bedding for all pipes is Class B unless specified otherwise.

B. Pipe bedding is required for all storm sewer. Where not specified on the plans, Class B Bedding will be required. Do not place aggregate or stone bedding for any storm sewer or storm structure in or within 20 linear feet of any dam, pond, or water impoundment area. Place bedding material at trench bottom, level materials in continuous layers not exceeding 6 inches compacted depth. Minimum compaction for pipe trenches is 95% of standard proctor or greater as directed by the soils engineer.

C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.04 INSTALLATION - STORM SEWER

A. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal joints watertight.

B. Lay pipe to slope gradients noted on drawings.

C. Install pipe bedding aggregate at bottom, sides and over top of pipe where required and as shown on the drawings. Do not place aggregate or stone bedding for any storm sewer or storm structure in or within 20 linear feet of any dam, pond, or water impoundment area. Provide top cover to minimum compacted thickness of 12 inches, compact to minimum 95% standard proctor.

D. Refer to Section 02200 for trenching requirements. Do not displace or damage pipe when compacting.

E. Refer to Section 02200 for field testing requirements for fill materials.

3.05 INSTALLATION – MANHOLES, JUNCTIONS, STRUCTURES

A. All manholes, junctions, or structures shall be precast reinforced concrete. Brick structures will not be allowed. Set all structures plumb. All structures shall have inverts to provide positive flow and prevent any ponding of water. Install per manufacturer’s specifications.

B. All grout shall be nonmetallic, non-shrink cementitious type flowable expansive grout with minimum 28 day compressive strength of 6500 psi, conforming to ASTM C 1107, verify Type for field conditions prior

to construction. Voids or gaps which exceed the maximum allowed for grout by the manufacturer specifications will require a structural repair or replacement as directed by the Engineer. Comply fully with grout manufacturer's specifications.

C. Manhole, junction, or structure riser sections shall be watertight and sealed per manufacturer's specifications and reference standards using preformed resilient gaskets. Joints between manholes or structures and base sections shall be grouted on the inside to provide a smooth surface. Manhole sections shall grouted to ring and covers on the inside.

D. All pipe or other penetrations into manholes, structures, or junctions shall be permanently sealed watertight. Fill all spaces between pipe or other connections and manholes, junctions, or structures completely with non-shrink cementitious concrete grout placed on inside and outside of manhole or structure, completely filling all voids. The exterior wall of the manhole or structure shall have a minimum 6 inch thick 2500 psi concrete collar poured tightly around the entire pipe perimeter and tight to the exterior wall, minimum extension past the pipe shall be 12 inches. Grout shall have minimum 28 day compressive strength of 6500 psi, installed in strict compliance with manufacturer's specifications.

3.06 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 02200.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest, until the work meets specified requirements.

C. Frequency of Tests: As directed by the soils engineer (GE).

3.07 PROTECTION

A. Protect finished Work from damage during construction. Damaged work shall be replaced at the expense of the contractor.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

C. All storm sewer structures, pipe, connections, and appurtenances shall be thoroughly cleaned and free of silt, sediment, soil, debris, trash, or

any unsuitable materials or obstructions. This is the sole responsibility of the Contractor.

END OF SECTION 02700

SECTION 02713 - WATER SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe and fittings for site water line including domestic water line and ductile iron pipe water line.

B. Valves, fire hydrants if required, and domestic water hydrants.

1.02 RELATED DOCUMENTS/SECTIONS

A. Contract documents and drawings, construction details as shown on the plans, geotechnical engineering report. Refer to appropriate related sections as applicable.

1.03 REFERENCE STANDARDS

A. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop.

B. ANSI/ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
ASME B1.20.1 - Pipe Threads, General Purpose (Inch)
ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings

C. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

D. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

E. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

F. ANSI/ASTM D2466 - Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

G. ANSI/AWS A5.8 - Brazing Filler Metal.

H. ANSI/AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

I. ANSI/AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and other liquids.

J. ANSI/AWWA C111- Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings.

K. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

K1. ASTM A536 – Ductile Iron MJ Fittings
ASTM A48 - Specification for Gray Iron Castings
ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped Zinc - Coated Welded and Seamless (Replaces A120)

K2. ANSI/AWWA C110, C153 – Ductile Iron MJ Fittings

AWWA C115 - Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges

AWWA C116 - Standard for Protective Fusion-Bonded Epoxy Coating for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service

L. ANSI/AWWA C500 - Gate Valves, 3 through 48 in NPS, for Water and Sewage Systems.

M. ANSI/AWWA C502 - Dry Barrel Fire Hydrants.

N. ANSI/AWWA C504 - Rubber Seated Butterfly Valves.

O. ANSI/AWWA C508 - Swing-Check Valves for Waterworks Service, 2 in through 24 in NPS.

P. ANSI/AWWA C509 - Resilient Seated Gate Valves 3 in through 12 in NPS, for Water and Sewage Systems.

AWWA C512 - Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service

AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service

AWWA C550 - Protective Epoxy Interior Coating for Valves and Hydrants

Q. ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances.

AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water

AWWA C651 - Disinfecting Water Mains

R. ANSI/AWWA C606 - Grooved and Shouldered Type Joints.

AWWA C800 - Underground Service Line Valves and Fittings

S. ANSI/AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water.

T. ASTM B88 - Seamless Copper Water Tube.

Copper Development Association (CDA)

Copper Tube Handbook International Conference of Building Officials (ICBO)

U. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

V. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Plastic Pipe(SDR-PR).

W. ASTM D2855 - Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

X. ASTM D2922 - Test Methods for Density of Soil and Soil- Aggregate in Place by Nuclear Methods (Shallow Depth).

Y. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

Z. ASTM D3139 - Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.

AA. ASTM D3035 - Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.

ASTM - D2774 Standard Practice for Underground Installation of Thermoplastic Pressure Piping

ASTM F477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

BB. AWWA C901 - Polyethylene (PE) Pressure Pipe, Tubing, and Fittings, 1/2 inch through 3 inch, for Water.

CC. UL 246 - Hydrants for Fire - Protection Service.

National Fire Protection Association (NFPA) 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances

DD. Local Authority Water and Sewer Department standards and specifications. All materials and construction shall conform, at a minimum, to Local Authority Having Jurisdiction (LAHJ) standards and specifications. Contractor is responsible for verification of LAHJ specifications prior to construction.

When standards or specifications are indicated herein by reference, the referenced portion shall apply to the most recent edition of the publication and shall have the same force and effect as if they were included herein in their entirety.

1.04 SUBMITTALS

A. Provide data indicating pipe, pipe accessories, and manufacturer's warranties.

B. Manufacturer's Installation Instructions: Indicate special procedures required to install products specified.

C. Manufacturer's Certificate: Certify that products meet or exceed specifications and/or referenced standards.

1.05 PROJECT RECORD DOCUMENTS

A. Submit complete, detailed as built drawings to Owner, Developer, and Architect upon completion of the work showing vertical and horizontal location. As built drawings shall be based on field run survey(s) and be sealed and signed by a registered surveyor in the State where the project is located. Provide three sets of original hard copies and one digital file in AutoCad or other acceptable digital format. Contractor is responsible for approval and verification of acceptable digital format. **As-built drawings will be required at a minimum 45 days prior to substantial completion.**

B. Accurately record actual locations of pipe runs, taps, connections, valves, tees, mechanical joints, connections, pipes, manholes, structures, sub-surface drain fields, septic tanks, lift stations, service taps or stubouts, type and size of material, and top and invert elevations of all structures.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities or other structures. All such uncharted utilities or structures shall be shown on as built drawings.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with local utility company providing water service standards and specifications. Contractor shall coordinate with utility concerning inspection, testing and applicable specifications. The minimum requirements of the referenced standards herein shall be maintained in the event of conflicts with the local utility requirements.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Follow manufacturer's installation requirements and recommendations.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site in a timely manner to facilitate the construction schedule. Protect materials and equipment from damage due to construction, weather, or other means.

B. Deliver and store valves in shipping containers with labeling in place.

1.08 DESCRIPTION OF WORK

A. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, or specifications, the more stringent requirement shall apply as determined by the Engineer.

B. **WARNING:**
CONTRACTOR SHALL: COMPLY WITH ALL OSHA, FEDERAL, STATE, LOCAL, AND INDUSTRY STANDARD SAFETY MEASUES, DEVICES, PROCEDURES, PRECAUTIONS, AND EQUIPMENT FOR ALL WORK OR OTHER ACTIVITIE(S). NO PERSON(S) SHALL ENTER MANHOLES, CONFINED SPACES, OR OTHER UNDERGROUND STRUCTURES, SPACES, TRENCHES, OR EXCAVATIONS WITHOUT PROTECTIVE BREATHING APPARATUS AND ALL OTHER REQUIRED SAFETY MEASURES, DEVICES, PROCEDURES, AND EQUIPMENT, AND AT LEAST ONE OTHER PERSON PRESENT ABOVE GROUND FOR SAFETY AND MONITORING AT ALL TIMES. CONTRACTOR SHALL PROVIDE AND ENSURE USE OF SAFETY KITS, HELMETS, GLOVES, EMERGENCY OXYGEN RESUSCITAOR KITS, AND AIR QUALITY AND GAS DETECTORS FOR VOLATILE, TOXIC, OR EXPLOSIVE GASES OR SUBSTANCES. VERIFY SAFE OXYGEN CONTENT PRIOR TO ENTERING MANHOLES, CONFINED SPACES, OR

OTHER UNDERGROUND STRUCTURES.

PART 2 - PRODUCTS

2.01 WATER PIPE

A. Lines 4" and larger shall be ductile iron pipe (DIP). All pipes shall be permanently marked to allow identification of type and class and Underwriters Laboratories (UL) listed or Factory Mutual (FM) approved if used for fire protection and shall conform to the following material requirements:

Ductile Iron Pipe (DIP) 4" and larger shall be as noted on the drawings but not less than pressure class 350, conforming to AWWA C151, with rubber-gasket joints conforming to AWWA C111, and cement-mortar lining conforming to AWWA C104. The pipe exterior shall have a bituminous outside coating conforming to AWWA C151.

Flanged Ductile Iron Pipe shall conform to AWWA C115.

B. Service Lines 3" and smaller shall conform to the applicable provisions of AWWA C800, and shall conform to the material requirements for the following piping materials:

Copper Tubing: Type K, hard drawn or annealed, conforming to ASTM B88. Joints shall be AWS A5.8, BCuP silver braze.

C. All materials and construction shall conform, at a minimum, to Local Authority Having Jurisdiction (LAHJ) standards and specifications. Contractor is responsible for verification of LAHJ specifications prior to construction.

2.02 GATE VALVES - Up to 3 Inches (75 mm):

A. Shall conform to local authority standards and specifications.

2.03 GATE VALVES - 3 Inches (75 mm) and Over

A. Shall conform to local authority standards and specifications.

2.04 BALL VALVES - Up to 2 Inches (50 mm)

A. Shall conform to local authority standards and specifications.

2.05 SWING CHECK VALVES - From 2 inches to 24 inches (50 mm to 600 mm)

A. Shall conform to local authority standards and specifications.

2.06 BUTTERFLY VALVES - From 2 inches to 24 inches (50 mm to 600 mm)

A. Shall conform to local authority standards and specifications.

2.07 BEDDING MATERIALS

A. Bedding: Fill materials must be approved by soils engineer prior to placement and compaction. Cut trenches sufficiently wide to enable installation and inspection. The minimum bedding for all pipes is Class B as shown on the plans unless specified otherwise.

2.08 REQUIRED ACCESSORIES

A. Concrete Thrust Blocks: Shall conform to local authority standards and specifications at a minimum.

B. Backflow Prevention (BFP), Fire Department Connection (FDC), Post Indicator Valve (PIV): Shall conform to local authority standards and specificatons.

C. Meter(s): Shall conform to local authority standards and specifications.

D. Manhole and Cover: Shall conform to local authority standards and specifications.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions, all existing utilities, verify and coordinate all existing and proposed service taps with Local authority standards and specifications. All existing service or water main taps or intersections shall be protected, maintained, and re-installed per Local Authority specifications when original taps or connections are relocated or moved to complete the proposed work.

B. Verify that building service connection, vault, meter, and municipal utility water main size, location and invert are as indicated on the drawings.

C. All construction which impacts fire lines or fire suppression system components in any way shall be done in strict accordance and with prior approval of the Fire Department having jurisdiction (FDHJ). Maintain fire protection service at all times as specified by the FDHJ.

3.02 PREPARATION

A. Ream pipe and tube ends and remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.03 BEDDING

A. Excavate pipe trench in accordance with Section 02200 (2.07) and Section 02700 (3.03) for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Place bedding material at trench bottom, level materials in continuous layers not exceeding 6 inches compacted depth. Minimum compaction for pipe trenches is 95% of standard proctor or as directed by the soils engineer.

C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.04 INSTALLATION - PIPE

A. Maintain separation of water main from other underground utilities, pipes, or obstructions of one foot minimum.

B. Install pipe to indicated elevation to within tolerance of 5/8 inches. Maintain minimum depth of cover over top of pipe of 48 inches or as specified Local authority standards and specifications, whichever is greater.

C. Install ductile iron piping and fittings to ANSI/AWWA C600.

D. Route pipe in straight line.

E. Install pipe to allow for expansion and contraction without stressing pipe or joints.

F. Install access fittings to permit disinfection of water system.

G. Slope water pipe and position drain at low points.

H. Form and place concrete for thrust blocks at each elbow or change of direction of pipe main and as specified by Local authority standards and specifications.

I. Establish elevations of buried piping to ensure not less than 48 inches of cover over top of pipe.

J. Install trace wire continuous over top of pipe.

K. Backfill trench in accordance with Section 02200 (2.06).

L. All materials and construction shall conform, at a minimum, to the manufacturer's standards and specifications.

3.05 INSTALLATION - VALVES

A. Set valves on solid bearing.

B. Center and plumb valve box over valve. Set box cover flush with finished grade.

3.06 DISINFECTION AND TESTING OF WATER PIPING SYSTEM

A. Clean, pressure test, flush and disinfect system in accordance with local authority standards and specifications, all applicable AWWA standards, and reference standards herein (1.03) constituting minimum requirements. Provide documentation for all disinfection and testing procedures and results. All water lines must comply with 3.06 Disinfection and Testing of Water Piping System requirements.

3.07 SERVICE CONNECTIONS

A. Provide water service tap per all utility authority requirements including but not limited to reduced pressure device(s), backflow prevention devices, vaults, valves, post indicator valve, fire department connection(s), and water meter(s) with by-pass valves as required by Local authority standards and specifications.

3.08 FIELD QUALITY CONTROL

A. Field inspection and testing of earthwork will be performed under provisions of Section 02200 (1.06).

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest, until the work meets specified requirements.

C. Frequency of Tests: As directed by the soils engineer.

END OF SECTION 02713

SECTION 02730 - SANITARY SEWERAGE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Sanitary sewerage drainage piping, structures, fittings, accessories and bedding.

B. Connection of building sanitary drainage system to existing municipal sewer system.

1.02 RELATED DOCUMENTS/SECTIONS

A. Contract documents and drawings, construction details as shown on the plans, geotechnical engineering report, and Referenced Standards are included herein by reference, latest revision shall apply. Refer to appropriate related sections as applicable.

1.03 REFERENCED STANDARDS

A. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop.

B. ANSI/ASTM A74 - Cast Iron Soil Pipe and Fittings.

C. ANSI/ASTM C12 - Practice for Installing Vitrified Clay Pipe Lines.

D. ANSI/ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.

E. ANSI/ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

F. ANSI/ASTM C425 - Compression Joints for Vitrified Clay Pipe And Fittings.

G. ANSI/ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

H. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

I. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of

Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

J. ANSI/ASTM D2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.

K. ANSI/ASTM D2729 - Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

L. ANSI/ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.

M. ANSI/ASTM D3033 - Type PSP Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

N. ANSI/ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

O. ASTM A746 - Ductile Iron Gravity Sewer Pipe.

P. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

Q. ASTM C700 - Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.

R. ASTM D1785 - Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.

S. ASTM D2922 - Test Methods for Density of Soil and Soil- Aggregate in Place by Nuclear Methods (Shallow Depth).

T. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

U. Shall conform to Local authority standards and specifications.

V. ASTM C478 – Specification for Precast Reinforced Concrete Manhole Sections

When standards or specifications are indicated herein by reference, the referenced portion shall apply to the most recent edition of the publication and shall have the same force and effect as if they were included herein in their entirety.

1.04 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations. Cut trenches sufficiently wide to enable installation and inspection. The minimum bedding for all pipes is Class B as shown on the plans unless specified otherwise.

1.05 SUBMITTALS

A. Provide data indicating pipe, pipe accessories, and manufacturer's warranties.

B. Manufacturer's Installation Instructions: Indicate special procedures required to install products specified.

C. Manufacturer's Certificate: Certify that products meet or exceed specifications and/or referenced standards.

1.06 PROJECT RECORD DOCUMENTS

A. Submit complete, detailed as built drawings to Owner, Developer, and Architect upon completion of the work showing vertical and horizontal location. As built drawings shall be based on field run survey(s) and be sealed and signed by a registered surveyor in the State where the project is located. Provide three sets of original hard copies and one digital file in AutoCad or other acceptable digital format. Contractor is responsible for approval and verification of acceptable digital format. **As-built drawings will be required at a minimum 45 days prior to substantial completion.**

B. Accurately record actual locations of pipe runs, taps, connections, valves, tees, mechanical joints, connections, pipes, manholes, structures, sub-surface drain fields, septic tanks, lift stations, service taps or stubouts, type and size of material, and top and invert elevations of all structures.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities or other structures. All such uncharted utilities or structures shall be shown on as built drawings.

1.07 REGULATORY REQUIREMENTS

A. Conform to all applicable Federal, State, County, City, or local jurisdiction requirements concerning sanitary sewer construction and

safety.

B. **WARNING:**
CONTRACTOR SHALL: COMPLY WITH ALL OSHA, FEDERAL, STATE, LOCAL, AND INDUSTRY STANDARD SAFETY MEASUES, DEVICES, PROCEDURES, PRECAUTIONS, AND EQUIPMENT FOR ALL WORK OR OTHER ACTIVITIE(S). NO PERSON(S) SHALL ENTER MANHOLES, CONFINED SPACES, OR OTHER UNDERGROUND STRUCTURES, SPACES, TRENCHES, OR EXCAVATIONS WITHOUT PROTECTIVE BREATHING APPARATUS AND ALL OTHER REQUIRED SAFETY MEASURES, DEVICES, PROCEDURES, AND EQUIPMENT, AND AT LEAST ONE OTHER PERSON PRESENT ABOVE GROUND FOR SAFETY AND MONITORING AT ALL TIMES. CONTRACTOR SHALL PROVIDE AND ENSURE USE OF SAFETY KITS, HELMETS, GLOVES, EMERGENCY OXYGEN RESUSCITAOR KITS, AND AIR QUALITY AND GAS DETECTORS FOR VOLATILE, TOXIC, OR EXPLOSIVE GASES OR SUBSTANCES. VERIFY SAFE OXYGEN CONTENT PRIOR TO ENTERING MANHOLES, CONFINED SPACES, OR OTHER UNDERGROUND STRUCTURES.

1.08 FIELD MEASUREMENTS

A. Verify that field measurements and elevations are as indicated by the manufacturer.

1.09 COORDINATION

A. Coordinate work with other underground utilities, both existing and proposed. Verify all existing utilities concerning type, size, location and depth prior to start of construction.

B. Coordinate the Work with termination of sanitary sewer connection outside building.

1.10 DESCRIPTION OF WORK

A. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, or specifications, the more stringent requirement shall apply as determined by the Engineer.

PART 2 - PRODUCTS

2.01 SANITARY SEWER PIPE MATERIALS

A. All sanitary sewer structures, piping, materials and installation shall conform to the local authorities having jurisdiction standards and specifications. In the absence of local authority standards and specifications, all materials and construction shall conform, at a minimum, to the current Georgia Department of Transportation (GDOT) standards and specifications, and as specified herein, whichever is greater. The Contractor is responsible for verification of current applicable standards and specifications prior to construction.

B. Ductile Iron Pipe: Shall conform to Local authority standards and specifications.

C. Ductile Iron Pipe Joint Device: Shall conform to Local authority standards and specifications.

D. Plastic Pipe: Shall conform to Local authority standards and specifications.

E. PVC Pipe: Shall conform to Local authority standards and specifications, minimum SDR 35.

2.02 PIPE ACCESSORIES

A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.

B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

C. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Sewer Service" in large letters shall be placed for underground piping.

D. All pipe joints shall provide a permanent, secure watertight seal.

2.03 BEDDING MATERIALS

A. Bedding: Fill materials must be approved by Soils Engineer prior to placement and compaction.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify all existing utility structures regarding location and elevation prior to construction. Verify that trench is graded and prepared according to plans and specifications prior to pipeline construction.

3.02 PREPARATION

A. Hand trim excavations to required elevations. Correct over-excavation with fine aggregate or as directed by the soils engineer. Verify all fill material as suitable with the soils engineer prior to placement and compaction.

B. Remove large stones, debris, rock, roots, organic material, or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.03 BEDDING

A. Excavate pipe trench in accordance with Section 02200 for work of this section. Hand trim excavation for accurate placement of pipe to elevations indicated. Cut trenches sufficiently wide to enable installation and inspection. The minimum bedding for all pipes is Class B as shown on the plans unless specified otherwise.

B. Place bedding material at trench bottom, level materials in continuous layers not exceeding 6 inches compacted depth. Minimum compaction for pipe trenches is 95% of standard proctor or as directed by the soils engineer.

C. Maintain optimum moisture content of bedding material to attain required compaction.

3.04 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. All joints shall be permanent, secure, and watertight.

B. Lay pipe to slope gradients noted on drawings, with maximum variation from true slope of 1/8 inch in 10 feet, non cumulative.

C. Install pipe bedding aggregate at bottom, sides and over top of pipe where required and as shown on the drawings. Provide top cover to minimum compacted thickness of 12 inches, compact to minimum 95% standard proctor.

D. Refer to Section 02200 for trenching requirements. Do not displace or damage pipe when compacting.

E. Refer to Section 02200 for field testing requirements for fill materials.

F. Install tracer wire on all pipe runs, drain field tiles, and underground piping.

3.05 INSTALLATION – MANHOLES, JUNCTIONS, STRUCTURES

A. All manholes, junctions, or structures shall be precast reinforced concrete, with paved invert channels per current GDOT standards and specifications. All grout shall be nonmetallic, non-shrink type conforming to ASTM C 1107, with minimum 28 day compressive strength of 6500 psi. Set all manholes plumb. Install per manufacturer's specifications.

B. Manhole, junction, or structure riser sections shall be watertight and sealed per manufacturer's specifications and reference standards using preformed resilient gaskets. Joints between manholes or structures and base sections shall be grouted on the inside to provide a smooth surface. Manhole sections shall grouted to ring and covers on the inside. Comply fully with ASTM C478.

C. All pipe or other penetrations into manholes, structures, or junctions shall be sealed watertight. Provide resilient connectors manufactured for use in contact with sanitary sewer conforming to ASTM C923 and the local authority having jurisdiction specifications. All penetrations shall be fully sealed, permanent, and watertight.

3.06 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 02200.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest, until the work meets specified

requirements.

C. Frequency of Tests: As directed by the soils engineer.

3.07 PROTECTION

A. Protect finished Work from damage during construction. Damaged work shall be replaced at the expense of the contractor.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 02730

SECTION 02831 - FENCING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fencing, fittings, accessories.

1.02 RELATED DOCUMENTS/SECTIONS

A. Contract documents and drawings, construction details as shown on the plans, geotechnical engineering report. Refer to appropriate related sections as applicable.

1.03 FENCING

A. All materials and construction shall conform to the Chain Link Fencing Manufacturers Institute (CLFMI) standards and specifications and the local authority having jurisdiction, and the plans and specifications. Provide all materials and accessories from a single source.

B. TEMPORARY CONSTRUCTION FENCING: Contractor shall provide temporary fencing as required for safety of all person(s) onsite for all phases of construction.
Temporary fence characteristics: Minimum 6 feet overall exposed height, minimum 12-1/2 gauge hog wire (no barbed wire) tied at 12 inches on center, with drive-in metal posts securely anchored, minimum driven post depth is 18 inches, or deeper as required for stability. Maximum post spacing is 8.0 feet. Provide concrete footings where necessary to stabilize fencing. Contractor to increase minimum fence criteria as required, per Code(s), and to suit his other needs for security and safety.
Gates required: As necessary, with padlocks. Provide warning and no access signage at 10 foot intervals along all temporary fencing.

TEMPORARY CONSTRUCTION FENCING LOCATIONS:
Temporary construction fencing locations shall be including but not limited to: around all construction work areas, along entire top edge perimeter of all shoring or sheet piling walls, storage areas, and construction staging/parking areas. At additions or renovations to existing buildings, all area(s) necessary to provide all person(s) safe access to all areas in use or required by Owner. Adjust temporary fencing location(s) and gate(s) as required for each phase of construction to provide protection and safety for all person(s) onsite

and for all areas, functions, or uses as required by Owner.
Provide safe access or pathways including but not limited to sidewalks, steps, and railing per standard details and Code(s) where designated by Owner/Engineer, with directional and warning signage for all pedestrian traffic.
Coordinate with Owner all required access and use areas prior to and throughout construction for each phase or required use.

1.04 DESCRIPTION OF WORK

A. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, or specifications, the more stringent requirement shall apply as determined by the Engineer.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials and construction shall conform to the Chain Link Fencing Manufacturers Institute (CLFMI) standards and specifications. Provide all materials and accessories from a single source. All fencing material shall be vinyl coated unless noted otherwise. Verify color with Architect/Owner prior to construction.

B. Fabric: 2-inch diamond mesh. Minimum 9 gauge galvanized steel wire. Knuckle selvage top and bottom.

C. Terminal and Gate Posts: 3-inch o.d., hot-dipped galvanized, schedule 40 steel pipe. Lengths = Exposure + 36" for embedment.

D. Line Posts: 2-inch o.d., hot-dipped galvanized, schedule 40 steel pipe. Lengths = Exposure + 30" for embedment.

E. Post Caps: Required for all posts. Size to suit posts, integral eye for passage of top rail or tension wire.

F. Top Rails: 1-5/8 inch o.d., hot-dipped galvanized, schedule 40 steel pipe. Fabricate for swedge-type joints.

G. Braces: Material same as rails.

H. Fabric Tension Bars: 3/16" x 3/4" hot-dipped galvanized, single piece

full height of fabric. Bands shall be 11 gauge x 7/8" wide.

I. Tension Wire: 7 gauge coated steel coil spring wire. Required at bottom of all fencing.

J. Fabric Ties: 11 gauge aluminum alloy.

K. Gates:
Framework and diagonal bracing: Same as top rail pipe, shop fabricated welded construction, all welds ground smooth, hot-dipped galvanized.
Hinges: Offset non-liftoff type to achieve 180-degree opening, minimum 1 for each 24" of gate height or fraction thereof.
Latch: Fork type or plunger bar type with integral padlock eye to permit operation and unlocking from either side of gate.
Keeper: 1 for each leaf, automatically engages gate leaf and holds leaf open until manually released.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Layout fencing per Contract drawings and/or actual site conditions. Temporary construction fencing shall be provided as required to protect all persons from work/construction areas, provide for the safety of the public, and provide safe access for Owner as necessary for normal operation.

B. Set all posts plumb. All permanent fencing posts shall be set in center of 3000 psi concrete footings in firm solid earth. Terminal and gate posts set in 12" diameter x 42" depth footings, line posts set in 10" diameter x 36" depth footings. Post lengths to achieve minimum 6" concrete coverage under post bottom and sides, posts shall not contact earth. Top of concrete finished smooth, set to finished grade, and sloped away from post to shed water. Exposed post height to achieve fabric height plus 2 inches of fabric clearance above finished grade.

C. Locate terminal posts at all corners and changes of direction. Install braces at each terminal post with pressed steel connectors.

D. Locate gate posts at both gate jambs of each gate. Install braces at each gate post with pressed steel connectors. Line posts evenly spaced at maximum 10.0 feet on center.

E. Tie fabric to posts at 15" o.c. maximum, tie fabric to top rails at 24" o.c. maximum.

F. Top rails shall be installed parallel to finish grade.

G. Adjust gates and gate hardware for smooth operation without binding or scraping.

H. Remove temporary construction fencing at completion of project.

3.02 PROTECTION

A. Protect finished Work from damage during construction. Damaged work shall be replaced at the expense of the contractor.

END OF SECTION 02831

SECTION 02900 - LAWNS, GRASSING, & LANDSCAPING

PART 1 - GENERAL

1.01 PERMANENT GRASSING REQUIREMENTS:

THE CONTRACTOR SHALL ESTABLISH PERMANENT GRASSING ON ALL DISTURBED AREAS PRIOR TO FINAL RELEASE WHETHER SHOWN ON THE PLANS OR NOT.

1.02 SECTION INCLUDES

A. Lawns, grassing, and landscaping materials and planting instructions.

1.03 RELATED DOCUMENTS/SECTIONS

A. Contract documents and drawings, construction details as shown on the plans, geotechnical engineering report. Refer to appropriate related sections as applicable.

1.04 WARRANTIES

A. Warranty commencement date will be date of final approval and release after all grassing and landscaping is complete, established and accepted by Owner or Architect.

B. Materials:
1. Sod and grasses:
One year following Owner acceptance.

2. Evergreen shrubs, bushes, & trees:
One year following Owner acceptance.

3. Deciduous Plants and trees:
90 days following Spring breakout of growth.

C. Replacement policies:
1. Materials which have either died or failed to show satisfactory vigorous growth shall be removed and replaced with equal as-specified materials.
2. Warranty periods for replaced materials shall commence on the Owner-acceptance dates for these materials, and warranty criteria shall be the same as outlined above.

3. If replaced materials become unsatisfactory within their new warranty periods, the Owner reserves the right to require continued replacements or obtain a credit from the Contractor for the value of the unsatisfactory materials.

1.05 REFERENCED STANDARDS

A. Standardized Plant Names, latest edition, by the American Joint Committee on Horticultural Nomenclature.

B. American Standard for Nursery Stock, latest edition, by the American Association of Nurserymen.

When standards or specifications are indicated herein by reference, the referenced portion shall apply to the most recent edition of the publication and shall have the same force and effect as if they were included herein in their entirety.

1.06 QUALITY CONTROL

A. Only tree or plant material grown in a recognized nursery in accordance with good horticultural practice will be accepted. Provide healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun-scald, injuries, abrasions or disfigurement.

B. All materials and construction required for completion of the work under this section are subject to the approval of the Owner/Architect. The Owner/Architect shall have the right to reject any and all materials and construction which, in their own opinion, does not meet the requirements of the Contract Documents. The Contractor shall remove all rejected work or material from the job site and replace promptly according to the Contract Documents at no expense to the Owner.

1.07 DESCRIPTION OF WORK

A. When any construction, materials, or specifications for the same or similar item(s) are shown in more than one place in the construction documents, plans, or specifications, the more stringent requirement shall apply as determined by the Engineer.

PART 2 - PRODUCTS

2.01 GENERAL

A. PERMANENT GRASSING: (Sodded, seeded, or sprigged):
VERIFY AREAS TO BE SODDED WITH OWNER PRIOR TO CONSTRUCTION.

Seed: Common Bermuda (Cyandon dactylon), 98% purity, 85% germination, with State Dept. of Agriculture tag, or as specified by Owner.

Sod and sprigs: Hybrid Bermuda, Tifway 419, or as specified by Owner.

B. TEMPORARY GRASSING:
As shown on plans, or Kentucky 31 Fescue and/or winter rye, allowed for Contractor's convenience to control erosion or other purposes. Temporary grass must be tilled under and soil prepared for permanent grassing per specifications.

C. LANDSCAPING MATERIALS:
Plants: True to species and variety, complying to ANSI Z60.1 "Standard for Nursery Stock".
Trees: Of height and caliper listed with branching configuration conforming to ANSI Z60.1 for type and species required. Provide only single stem trees.
Ground cover: Provide plants well established and well rooted in removable containers with not less than the minimum number and length of runners conforming to ANSI Z60.1 for the pot or container size listed.

D. FERTILIZER:
Commercial slow release type, 5% nitrogen, 10% phosphoric acid, 15% potash.

E. LIME: Ground dolomitic limestone.

F. WATER:
Contractor shall furnish all water as required for establishment and maintenance of all grassing (sod or seed), trees, shrubs, plants, and other landscape materials until final approval and acceptance by Owner and Architect. Contractor is responsible for water source, transportation, distribution, and necessary equipment.

G. MULCH:

Pine bark mini-nuggets or shredded hardwood mulch (color per Architect).

H. SOD:
Remove all netting, backing, or other packing or shipping attachments from Sod prior to installation.

PART 3 - EXECUTION

3.01 GENERAL

A. Contractor is solely and fully responsible for compliance with recommended and seasonal planting dates for all seeding, grassing, sod, trees and shrubs, and all other landscape materials to facilitate construction schedule and stabilize disturbed areas. Any planting or installation of any landscaping or grassing materials outside recommended planting dates will require additional warranties and delay final release and payment for all affected material and labor cost(s). Contractor shall review all drawings and specifications, and locate and protect from damage any and all existing or proposed utilities or site improvements prior to landscape excavation or work. Contractor shall restore any damaged improvements or utilities at no expense to Owner.

B. SOIL SAMPLES: Contractor shall take several soil samples from each area where landscaping will occur. Samples shall be taken to represent each different soil or site condition encountered in the required landscaping areas. Soil samples shall be sent for analysis to the Agricultural Extension Service (AES). Provide the A/E with the written report of AES recommendations for soil amendments and fertilizers to be used on the site. All recommendations from the AES will become minimum requirements. No adjustment in Contract Time or Contract Sum will be allowed for soil sampling and analysis.

C. TOP SOIL: Provide topsoil which is fertile, friable, natural loam surface soil, free of subsoil, clay lumps, brush, weeds and other debris, free of roots, stumps, stones larger than 1/2" diameter in any dimension, and any other extraneous or toxic material or debris harmful to plant growth. The Contractor is solely responsible for obtaining and distributing all required topsoil material for grassing, planting, and landscaping the project, regardless of the source. Minimum 5 inch depth of topsoil required for all grassed areas, minimum 9 inch depth of topsoil required for shrubbery, flower, or planting beds or areas.

D. FINISH GRADE REQUIREMENTS:

a. Within 0.10 feet of required grade provided positive drainage is maintained. No ponding or depressed areas allowed.

b. Smooth and uniform to accomplish mowing of grass to uniform heights without scalping. Remove all stones 1/2" and larger in diameter prior to grassing operations.

c. Sloped at minimum 1.0% grade for proper drainage away from buildings and into storm sewer system.

d. Sod shall be set in place with snug and staggered joints, and rolled to remove high or low or undulating areas.

e. **Contractor shall coordinate all landscaping to ensure that finished grades are provided as shown on plans, particularly along the interface with the building perimeter to ensure positive drainage away from building(s), structures, and all other improvements which may be damaged by water or runoff. Maintain minimum 6 inches below finish floor elevation (FFE) and top of finished grass, landscape, or mulch along entire building or structure perimeter. Verify FFE along entire building or structure perimeter PRIOR TO CONSTRUCTION. Adjust subgrade, topsoil, and mulch as required to allow for grass and landscape material thickness.**

E. PERMANENT GRASSING:

The Contractor is responsible for establishing final permanent grassing on all disturbed areas in accordance with the Contract Documents whether shown on the plans or not. All temporary grassing which does not comply with the required permanent grassing materials and were installed for erosion control measures or the convenience of the Contractor, shall be fully tilled under, then the soil shall be prepared for permanent grassing in accordance with Contract Documents.

F. ACCEPTABLE UNIFORM STAND OF GRASS:

An acceptable uniform stand of grass is defined as:

Establishment of the specified grass, properly watered, maintained, mowed, and free of weeds, with the grass having a minimum coverage of 97% over the required areas and only scattered bare spots, none of which is larger than one (1) square foot in area. Coverage is defined as mature healthy

grass with established root systems, thickness and density per normal species nursery standards for grass in good condition.

G. MOWING SCHEDULE:

A. All grass clippings shall be removed from property with EACH mowing.

B. When grass reaches a height of three (3) inches, mow to 2/3 height, leaving two (2) inches remaining.

C. Maintain a grass height between two (2) and two and one-half (2.5) inches until final acceptance.

D. Perform mowing approximately weekly, or as required to fulfill the criteria in this section, for a total of not less than four (4) mowings prior to final acceptance and release. Establish grass in timely manner to meet this requirement prior to final release and acceptance.

H. GRASS MAINTENANCE & ACCEPTANCE:

Contractor shall maintain grass until final release and acceptance but for not less than 60 calendar days after seeding/sodding or planting. Maintenance shall include watering per nursery/supplier standards, additional watering for initial period after planting per accepted nursery standards, and all other recommended measures to ensure root system establishment and healthy grass. Full grass coverage shall be required within 60 calendar days of planting. The Contractor is responsible for establishment of permanent grassing and landscaping, including mowing, watering, and maintenance requirements, prior to final release and acceptance.

I. TREE, SHRUB, LANDSCAPING MAINTENANCE & ACCEPTANCE:

Contractor shall install, establish, and maintain trees, shrubs, and landscaping until final release and acceptance but for not less than 60 calendar days after proper installation. Maintenance shall include watering per nursery/supplier standards, additional watering as required for initial period after planting per accepted nursery standards, and all other recommended measures to ensure root system establishment and healthy trees, shrubs, and landscape materials. The Contractor is responsible for installation of trees, shrubs, and landscaping including watering, mulching, and maintenance requirements, prior to final release and acceptance.

3.02 EXCAVATION & PREPARATION

A. TREES, SHRUBS, & OTHER PLANTED MATERIALS:

1. Excavate pits, beds, or trenches with vertical sides.

2. Loosen hardpan and moisture barrier to a depth of 2 feet minimum below bottom of tree pit or until hardpan has been broken and moisture drains freely. For shrub beds, loosen hardpan 6 inches minimum below bottom of excavation.

3. For balled & burlapped (B&B) trees and shrubs, make excavations at least 50% larger width than the ball diameter and equal to the ball depth, plus allowing for 6 inch minimum setting layer of planting soil mixture.

4. Mix all soil amendments thoroughly into topsoil as required by soil analysis and manufacturers recommendations prior to backfilling.

5. Plant trees and shrubs according to nursery specifications.

6. Provide minimum 3 inch depth mulch to cover all disturbed areas for tree planting and planting beds for shrubs, plants, or flowers. Verify with Owner/Architect extent of all areas to receive mulch prior to construction.

7. **The Contractor shall provide a professional landscape contractor with minimum two years experience in landscaping and tree, shrub, planted material installation. Landscape contractor must be engaged in landscaping full time as majority of his business. Landscaping contractor shall be submitted to and approved by Owner/Architect prior to start of landscaping work. Landscape contractor shall provide a minimum 12 month warranty for all lawns/grass/landscaping installed.**

B. TREE & SHRUB RELOCATION:

1. Contractor shall engage and provide a qualified arborist for review and recommendation regarding all trees and shrubs to be transplanted or relocated. Arborist shall be qualified according to standards referenced herein, and recognized industry standards for this work.

2. Contractor shall review requirements of Arborist with Owner/Architect regarding cost and chance for survival prior to proceeding with the work.

3. All materials and construction shall be in accordance with Arborist's recommendations and specifications.

4. Contractor shall provide a qualified subcontractor to complete this work (see 3.02 A (6) above) with experience and qualifications

acceptable to Owner/Architect.

5. Provide minimum 3 inch depth mulch to cover all disturbed areas for tree planting and planting beds for shrubs, plants, or flowers. Verify with Owner/Architect extent of all areas to receive mulch prior to construction.

C. PLANTING BEDS:

1. Loosen subgrade of planting bed areas to minimum 6 inch depth. Remove stones larger than 1" diameter, sticks, roots, or other debris.

2. Mix all soil amendments thoroughly into topsoil as required by soil analysis and manufacturers recommendations prior to backfilling.

3. Spread planting soil mixture to minimum depth to meet proposed grades, allow for natural settlement. Work into top of loosened subgrade to create transition layer, then place remainder of planting soil.

4. Plant according to nursery specifications.

5. Provide minimum 3 inch depth mulch to cover all disturbed areas for tree planting and planting beds for shrubs, plants, or flowers. Verify with Owner/Architect extent of all areas to receive mulch prior to construction.

D. GRASS AREAS:

1. Loosen subgrade of areas to be grassed to a minimum 6 inch depth. Remove stones larger than 1" diameter, sticks, roots, trash, or other debris.

2. Place 50% of required topsoil, work into loosened subgrade to create transition layer. Place remaining topsoil to meet proposed grades.

3. Allow for sod thickness in areas to be sodded to meet finish grades.

4. Grade areas to be grassed to smooth, even surface, with loose, uniformly fine texture. Roll, rake, and remove ridges and depressions to meet finish grades.

5. Apply all fertilizer, lime, and soil amendments required for grass type selected according to the soils sample analysis prior to installing grass. Work into top 6 inches of soil.

6. Moisten prepared grass areas if soil is dry. Water thoroughly and allow surface to dry before planting grass.

3.03 INSTALLING LAWNS AND GRASSING

A. SEEDING GRASSED AREAS:

1. Do not use wet seed. Day laborers or other unskilled workers shall not be used for lawn and grass installation. All grass areas shall be prepared in accordance with section 3.02 (D).

The Contractor shall provide a professional landscape contractor with minimum two years experience in landscaping and lawn/grass installation. Landscape contractor must be engaged in landscaping full time as majority of his business. Landscaping contractor shall be submitted to and approved by Owner/Architect prior to start of landscaping work. Landscape contractor shall provide a minimum 12 month warranty for all lawns/grass/landscaping installed.

2. Sow seed using a spreader or seeding machines. Grass seed shall be applied at a rate according to nursery specifications, not less than 40 pounds per acre. Do not seed when wind velocity exceeds 5 mph. Distribute seed evenly over entire area by sowing equal quantity in two directions at right angles to each other.

3. When Hydro-seeding, soil preparation and all other requirements of the Contract Documents and specifications must be fully implemented.

4. Rake seed lightly into top 1/8" of soil, roll lightly.

5. Water immediately after seeding with a fine spray, soaking to a minimum depth of four (4) inches. Keep grassed areas continuously moist until grass is established.

6. Protect seeded areas with mulch to a depth not less than 1.5 inches immediately after seeding is complete. Mulch material and application shall comply, at a minimum, with erosion control specifications.

7. Protect seeded areas from traffic or damage.

8. Scarify, re-seed and re-fertilize seeded areas that do not show satisfactory growth within fifteen days after sowing, until satisfactory stand of grass is established.

B. SODDING GRASSED AREAS:

1. Do not use day laborers or unskilled workers.

The Contractor shall provide a professional landscape contractor with minimum two years experience in landscaping and lawn/grass/sod installation. Landscape contractor must be engaged in landscaping full time as majority of his business. Landscaping contractor shall be submitted to and approved by Owner/Architect prior to start of landscaping work. Landscape contractor shall provide a minimum 12 month warranty for all lawns/grass/landscaping installed.

2. **Remove all netting, tags, pins, or other non organic packing or shipping materials prior to sod installation.** Install sod within 36 hours of harvesting. Lay sod with tight joints, overlaps or gaps will not be allowed. Stagger sod joints, lay sod with long edge perpendicular to slope. Trim sod with sharp bladed instrument for clean cut, jagged edges not allowed. All sod areas shall be prepared in accordance with section 3.02 (D).

3. On slopes steeper than 3H:1V, sod shall be anchored with pins or other approved methods.

4. Installed sod shall be rolled and tamped to provide solid contact between sod and soil.

5. Irrigate sod and soil to a depth of 6 inches immediately after installation. Irrigate sod daily after installation to maintain moisture at 6 inch depth for a minimum 30 days, and as needed thereafter for health and maintenance of grass.

6. Sod shall be certified by supplier as meeting all requirements of plans and specifications, and for grass type selected.

7. Sod delivery, storage, and installation shall conform to Turfgrass Producers International (1995) Guideline Specifications to turfgrass sodding (TPI GSS).

8. Comply with supplier's standards and recommendations for sod delivery, storage, and installation. Do not install sod on frozen or freezing soil.

9. Protect sodded areas from traffic or damage.

END OF SECTION 02900

SECTION 02990 – SOIL INVESTIGATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE OF WORK

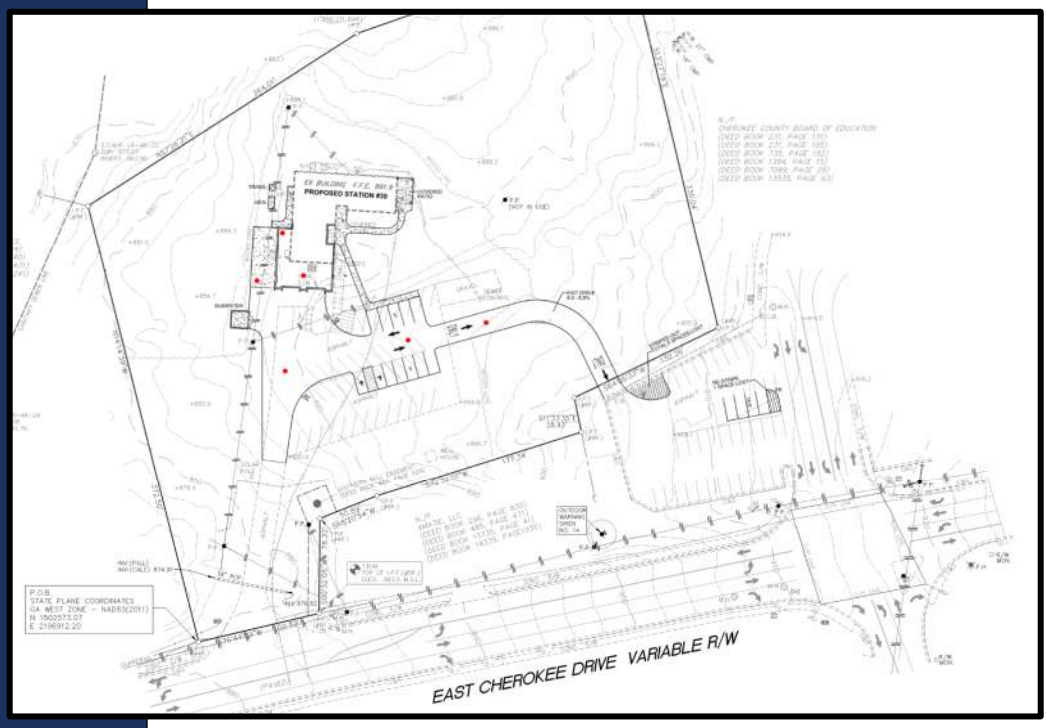
A. The following Geotechnical Study is included as prepared by NOVA Engineering.

B. The report is included for Contractor's convenience. The Owner and Architect assume no responsibility for the accuracy or completeness nor for any conclusions which may be drawn from the investigation.

C. The Contractor shall follow the recommendations made unless specifically noted otherwise on the drawings.

END OF SECTION 02990 (see attached)

REPORT OF SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING EVALUATION



EMS STATION NO. 30 ADDITIONS

Woodstock, Cherokee County, Georgia

PREPARED FOR:

Cherokee County Board of Commissioners
1130 Bluffs Parkway
Canton, Georgia 30114

NOVA Project Number: 10102-2023224

December 4, 2023

NOVA
PROFESSIONAL | PRACTICAL | PROVEN

December 4, 2023

CHEROKEE COUNTY BOARD OF COMMISSIONERS
1130 Bluffs Parkway
Canton, Georgia 30114

Attention: Mr. Jud Martin
Capital Projects Program Manager
Cherokee County

Subject: Report of Subsurface Exploration and Geotechnical Engineering Evaluation
EMS STATION NO. 30 ADDITIONS
Woodstock, Cherokee County, Georgia
NOVA Project Number 10102-2023224

Dear Mr. Martin:

NOVA Engineering and Environmental, LLC (NOVA) has completed the authorized Report of Subsurface Exploration and Geotechnical Engineering Evaluation for the EMS Station No. 30 Additions located in Woodstock, Cherokee County, Georgia. Our services were performed in general accordance with NOVA Proposal Number 10102-2023224, dated October 26, 2023. This report briefly discusses our understanding of the project at the time of the subsurface exploration, describes the geotechnical consulting services provided by NOVA, and presents our findings, conclusions, and recommendations.

We appreciate your selection of NOVA and the opportunity to be of service on this project. If you have any questions, or if we may be of further assistance, please do not hesitate to contact us.

Sincerely,
NOVA Engineering and Environmental, LLC
Georgia Engineering License No. PEF005170

Damon A. Noll, P.E.
Senior Geotechnical Engineer
GA P.E. License No. 50764

Wayne M. Shelburne, Ph.D., P.E.
Principal Geotechnical Engineer
GA P.E. License No. 31295

Copies Submitted: Addressee (electronic)

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 NAME AND LOCATION OF PROJECT

The Subject Property is located at 2017 East Cherokee Drive in Woodstock, Cherokee County, Georgia. The Cherokee County Tax Assessor's Office maps the site as a 4.01 acre parcel identified as 15-0739-0006.

A Site Location Map depicting the location of the Subject Property is included as Figure 1 in Appendix A. The approximate land coordinates near the center of the Subject Property are 34.1309° north and 84.4957° west.

1.2 AUTHORIZATION AND SCOPE OF STUDY

Our services on this project were as described in our Proposal Number 10102-2023224, dated October 26, 2023, authorized on November 3, 2023 by Cherokee County Board of Commissioners.

The primary objective of these services was to perform a geotechnical exploration within the areas of the proposed construction and to assess these findings as they relate to geotechnical aspects of the planned site development. The authorized geotechnical engineering services included a site reconnaissance, soil test borings (STBs) and sampling, engineering evaluation of the field data, and the preparation of this report.

The assessment of the presence of wetlands, floodplains, or water classified as state waters was beyond the scope of this exploration. Additionally, the assessment of site environmental conditions, including the detection of pollutants in the soil, rock, or groundwater, at the site was also beyond the scope of this geotechnical exploration and evaluation.

2.0 PROJECT INFORMATION

Our understanding of this project is based on email correspondence with Mr. Jud Martin of Cherokee County Department of Capital Projects on October 19, 2023, review of the provided documents, a site reconnaissance during boring layout, and our experience with similar projects.

2.1 SITE PLANS AND DOCUMENTS

We were furnished with a Preliminary Site Plan prepared by PWH Engineering dated October 10, 2023 denoting the requested locations of the STB locations, and a Topographic Map prepared by Martin Land Surveying, P.C. dated October 12, 2023 showing requested STB locations.

2.2 PROJECT SITE

The site is currently developed with a one-story building on the north side of the site with an associated asphalt parking area and driveway.

The site is bordered by the following:

DIRECTION	LAND USE DESCRIPTION/OBSERVATIONS
NORTH	Commercially undeveloped, wooded land
EAST	Elementary School
SOUTH	East Cherokee Drive
WEST	Badger Creek and commercially undeveloped, wooded land

A Topographic Map depicting the elevations of the Subject Property is included as Figure 2 in Appendix A. Based on the provided documents, elevations onsite slope downward from approximately 906 feet in the east portion of the site to approximately 874 feet in the southwest portion.

2.3 PROPOSED DEVELOPMENT

The proposed construction will consist of:

- A single-story addition to the southern portion of the existing building, including a covered patio on the east side and concrete walkways around the building.
- Asphalt driveway and parking addition.
- A dumpster, generator, and transformer pad.

We were not provided with proposed site grades or finished floor elevations. Based on the provided Topographic Map, the existing structure onsite has a finished floor elevation (FFE) of 891.9 feet. We have assumed the proposed building addition will match the FFE of the existing structure, and that maximum earthwork cuts and/or fills during site grading will not exceed 5 feet.

Structural loading information was not provided. We have therefore assumed that continuous wall and column loads will not exceed 3 kips per lineal foot (klf) and 100 kips, respectively. We also have assumed floor slab loads will not exceed 100 pounds per square foot (psf).

Traffic loading for the planned pavements was not provided. We have assumed the project's civil engineer will finalize the design of the pavements, incorporating the geotechnical recommendations from this exploration to ensure proper pavement design for the site based final design traffic loading. Below are the assumptions used to prepare this report:

- For Standard-Duty Pavements – assumed traffic loading conditions of 50 automobiles per day, 7 days per week with the occasional delivery van/panel truck (2 to 3 per day), for a 20-year pavement life.

- For Heavy-Duty Pavements – in addition to similar traffic as the standard-duty pavements, we have assumed additional traffic loading of 3 garbage, semi, or firetrucks 7 days per week for a 20-year pavement life.

If the above assumptions and/or project information are incorrect, NOVA should be afforded the opportunity to re-evaluate the conclusions and recommendations detailed in this report based on the correct information.

3.0 SUBSURFACE EXPLORATION

3.1 AREA GEOLOGY

The site is located in the Piedmont Geologic Region, a broad northeasterly trending province underlain by crystalline rocks more than 400 million years old. The Piedmont is bounded on the northwest by the Ridge and Valley Physiographic Province, on the north by the Blue Ridge Range of the Appalachian Mountains, and on the southeast by the leading edge of Coastal Plain sediments, commonly referred to as the "Fall Line". Numerous episodes of crystal deformation have produced varying degrees of metamorphism, folding and shearing in the underlying rock. The resulting metamorphic rock types in this area of the Piedmont are predominantly a series of Precambrian age schists and gneisses, with scattered granitic or quartzite intrusions.

According to the "Geologic of the Greater Atlanta Region" by McConnell and Abrams, 1984, the site is generally underlain by a member of the Laura Lake Mafic Complex which typically consists of garnet amphibolite (llu), shown in Figure 3 in Appendix A.

Residual soils in the region are primarily the product of in-situ chemical decomposition of the parent rock. The extent of the weathering is influenced by the mineral composition of the rock and defects such as fissures, faults and fractures. The residual profile can generally be divided into three zones:

- An upper zone near the ground surface consisting of red clays and clayey silts which have undergone the most advanced weathering,

- An intermediate zone of less weathered micaceous sandy silts and silty sands, frequently described as "saprolite", whose mineralogy, texture and banded appearance reflects the structure of the original rock, and

- A transitional zone between soil and rock, termed locally as partially weathered rock (PWR). Partially weathered rock is defined locally by standard penetration resistances exceeding 100 blows per foot.

The boundaries between zones of soil, partially weathered rock, and bedrock are erratic and poorly defined. Weathering is often more advanced next to fractures and joints that transmit water, and in mineral bands that are more susceptible to decomposition. Boulders and rock lenses are sometimes encountered within the overlying PWR or soil matrix. Consequently, significant fluctuations in depths to materials requiring difficult excavation techniques may occur over short horizontal distances.

3.2 FIELD EXPLORATION

Our field exploration was conducted on November 20, 2023 and included six STBs (B-1 through B-6) drilled to depths of 10 to 17 feet below the existing ground surface.

Test locations were established in the field by NOVA personnel using a handheld GPS device. Prior to initiating field testing, underground utilities were marked by Georgia 811 and a private utility locator. Utility related adjustments of boring location B-3 were made at the time of the field exploration. The approximate test locations are shown on Figure 4 in Appendix A. If increased accuracy is desired, test locations and elevations should be surveyed.

3.3 LABORATORY TESTING

Following completion of the field services, soil samples obtained in the field were returned to our office for visual classification. The purpose of the testing program was to classify the subsurface materials relative to the Unified Classification System and to determine their physical characteristics including strength and compressibility.

The soil samples will be discarded upon the submittal of this report, unless you request otherwise.

3.4 SUBSURFACE CONDITIONS

The following paragraphs provide generalized descriptions of the subsurface profiles and soil conditions encountered by the borings conducted during this exploration.

3.4.1 Surface Materials

Topsoil: Approximately 4 inches of topsoil was encountered in borings B-1 through B-3 and B-6. Topsoil thickness is frequently erratic, and thicker zones of topsoil should be anticipated.

Asphalt: Borings B-4 and B-5 were performed within existing parking lot areas and encountered 4 and 3 inches of asphalt, respectively. In boring B-5, 2 inches of graded aggregate base (GAB) was encountered beneath the asphalt.

3.4.2 Fill

Fill was encountered in four of the six borings to depths of up to 8 feet. The fill was described as silty sand and sandy lean clay with portions containing rock fragments. Standard penetration resistances in the fill varied from 4 to 9 blows

per foot (bpf). The resistances may have been amplified by the presence of rock fragments where encountered. The following table depicts the locations, depths, and approximate elevations of fill materials where encountered.

BORING NUMBER	APPROXIMATE DEPTH OF FILL BOTTOM (feet)	APPROXIMATE ELEVATION OF FILL BOTTOM (feet)
B-1	3	885
B-2	3	886
B-3	8	878
B-5	3	891

Elevations were interpolated from the provided Preliminary Site Plan prepared by PWH Engineering dated October 10, 2023 and should be considered approximate.

3.4.3 Residual Soils

Residual soils were encountered in the borings beneath the surface materials and/or fill. The residuum was described as silty sand, sandy silt, or clayey sand. Standard penetration resistance values ranged from 8 to 67 bpf, but more typically varied from 10 to 25 bpf.

3.4.4 Partially Weathered Rock

Partially weathered rock (PWR) is a transitional material between soil and the underlying parent rock that is defined locally as materials that exhibit a standard penetration resistance exceeding 100 bpf.

PWR was encountered in boring B-1 at a depth of 8 to 12 feet below the ground surface (approximate elevations of 880 to 876 feet). The PWR was observed immediately above auger refusal.

3.4.5 Auger Refusal Materials

Auger refusal materials are any very hard or very dense material, frequently boulders or the upper surface of bedrock, which cannot be penetrated by the drilling equipment.

Auger refusal was encountered in borings B-1 through B-3 at depths of 12 and 17 feet below the existing ground surface (approximate elevations ranging from 876 to 869 feet). The following table depicts the locations, depths, and approximate elevations where auger refusal materials were encountered.

BORING NUMBER	APPROXIMATE DEPTH TO AUGER REFUSAL (feet)	APPROXIMATE ELEVATION OF AUGER REFUSAL (feet)
B-1	12	876
B-2	17	872
B-3	17	869

Elevations were interpolated from the provided Preliminary Site Plan prepared by PWH Engineering dated October 10, 2023 and should be considered approximate.

Rock coring to determine the nature and continuity of refusal materials was beyond the scope of this exploration.

3.4.6 Groundwater Conditions

Groundwater was encountered in boring B-2 at the time of drilling at a depth of approximately 14 feet below the existing ground surface (approximate elevation of 875 feet). We also note that boring B-3 encountered a wet soil sample at a depth of approximately 13 feet below existing grade which could be indicative of groundwater.

Groundwater in the Piedmont geology typically occurs as an unconfined or semi-confined aquifer condition. Recharge is provided by the infiltration of rainfall and surface water through the soil overburden. More permeable zones in the soil matrix, as well as fractures, joints, and discontinuities in the underlying bedrock can affect groundwater conditions. The groundwater table is expected to be a subdued replica of the original surface topography.

Groundwater levels vary with changes in season and rainfall, construction activity, surface water runoff, and other site-specific factors. Groundwater levels in the Woodstock, Georgia area are generally lowest in the late summer-early fall and highest in the late winter-early spring, with annual groundwater fluctuations of 4 to 8 feet; consequently, the water table may be different than measured during this study at other times.

4.0 GEOTECHNICAL ASSESSMENT

The following assessment is based on our understanding of the proposed construction, site observations, our evaluation and interpretation of the field data obtained during this exploration, our experience with similar subsurface conditions, and generally accepted geotechnical engineering principles and practices.

Based on the encountered subgrade conditions, we anticipate that the proposed building addition may be supported by shallow foundations on soil. If settlements described in subsequent sections of this report are not acceptable to the structure engineer, a program of overexcavating foundations excavations and backfilling with GAB or #57 could be utilized to reduce total and differential settlements.

It should be noted that subsurface conditions in unexplored locations may be different from those encountered at the test locations considered and discussed herein. If such variations are noted during construction, or if project development plans are changed, we request the opportunity to review the changes and amend our recommendations, if necessary.

The following sections present our recommendations for site preparation and grading, and for the design of foundations, retaining walls, and pavements.

5.0 RECOMMENDATIONS

5.1 SITE PREPARATION

Prior to proceeding with construction, all slabs, foundations, pavements, vegetation, root systems, topsoil, and other deleterious non-soil materials should be stripped from proposed construction areas. Topsoil may be stockpiled and subsequently re-used in landscaped areas. Debris-laden materials, if present, should be excavated, transported, and disposed of off-site in accordance with appropriate solid waste rules and regulations. All existing utility locations should be reviewed to assess their impact on the proposed construction and relocated/grouted in-place as appropriate.

After clearing and stripping, areas that are at grade or which will receive fill should be carefully evaluated by a NOVA geotechnical engineer. This evaluation should initially include observation of the materials exposed below the stripped subgrade, The exposed materials should be proofrolled with multiple passes of a 20 to 30 ton loaded truck, or other vehicle of similar size and weight under the observation of the geotechnical engineer. The purpose of the proofrolling is to locate soft, weak, or excessively wet fill or residual soils present at the time of construction. Unstable materials observed during the evaluation and proofrolling operations should be undercut and replaced with structural fill or stabilized in-place by scarifying and re-densifying.

Should low consistency/relative density and/or debris laden fill materials be encountered during construction, it may need to be excavated and replaced or stabilized in place. Actual remedial recommendations can best be determined by the geotechnical engineer in the field at the time of construction.

Low-Lying Areas

Stabilization: Although not encountered in the borings, based on visual observations, alluvial soils could exist in the west portion of the site associated with Badger Creek. Upon stripping topsoil/root systems in this area, soft alluvial soils and/or shallow groundwater could be encountered. Prior to fill placement, a geotechnical engineer should carefully evaluate subgrade conditions in these areas. In the event that unstable soils are encountered, typical recommendations would include undercutting and replacing with structural fill/stone or stabilizing in-place with fabric and stone, as described below. A temporary dewatering system may be required in the event that groundwater exists at or near subgrade levels.

Stabilization of exposed groundwater-softened subgrade may consist of a woven geotextile overlain by 1 to 2 feet of surge stone capped with 6 to 12 inches of #57 stone and/or compacted graded aggregate base (GAB). The actual extent and nature of the required remedial measures can best be determined in the field at the time of construction.

5.2 FILL PLACEMENT

5.2.1 Fill Suitability

All materials to be used for backfill or compacted fill construction should be evaluated and, if necessary, tested by NOVA prior to placement to determine if they are suitable for the intended use. In general, based upon the exploration results, the soils encountered within the site can be used as structural fill as well as general subgrade fill and backfill, provided that the fill material is free of rubble, clay, rock, roots and organics. Any off-site materials used as fill should be approved by NOVA prior to acquisition.

Organic and/or debris-laden material is not suitable for re-use as structural fill. Topsoil, mulch, and similar organic materials can be wasted in architectural areas. Debris-laden materials should be excavated, transported, and disposed of off-site in accordance with appropriate solid waste rules and regulations.

5.2.2 Soil Compaction

Fill should be placed in thin, horizontal loose lifts (maximum 8-inch) and compacted to at least 95 percent of the standard Proctor maximum dry density (ASTM D 698). The upper 8 inches of soil beneath pavements and slab-on-grade should be compacted to at least 98 percent of the standard Proctor maximum dry density. In confined areas, such as utility trenches or behind retaining walls, portable compaction equipment and thinner fill lifts (3 to 4 inches) may be necessary. Fill materials used in structural areas should have a target maximum dry density of at least 95 pounds per cubic foot (pcf). If lighter weight fill materials are used, the NOVA geotechnical engineer should be consulted to assess the impact on design recommendations.

Soil moisture content should be maintained within 3 percent of the optimum moisture content. We recommend that the grading contractor have equipment on site during earthwork for both drying and wetting fill soils. Moisture control may be difficult during rainy weather.

Filling operations should be observed by a NOVA soils technician, who can confirm suitability of material used and uniformity and appropriateness of compaction efforts. The technician can also document compliance with the specifications by performing field density tests using the drive cylinder, nuclear, or sand cone testing methods (ASTM D2937, D6938, or D1556, respectively). One test per 400 cubic yards and every 2 feet of placed fill is recommended, with test locations well distributed throughout the fill mass. When filling in small areas, at least one test per day per area should be performed.

The site should be graded during construction to maintain positive drainage away from the construction areas, to prevent ponding of storm water on the site during and shortly following significant rain events. The construction areas should be sealed and crowned with a smooth roller to minimize ponding water from storm events at the end of each day of work.

5.3 FOUNDATIONS

5.3.1 Shallow Foundation Design

Design: After the recommended site and subgrade preparation and fill placement, we recommend that the proposed building addition be supported by conventional shallow foundations. Foundations for the proposed building addition should bear on undisturbed residual soils and/or compacted structural fill and be designed for a maximum allowable bearing pressure of 2,500 pounds per square foot (psf).

Previously placed fill materials were encountered on the site. In the event that low consistency/relative density or debris-laden fill materials are present in foundation excavations, undercutting and backfilling with crushed stone or structural fill may be required.

We recommend minimum foundation widths of 24 inches for ease of construction and to reduce the possibility of localized shear failures. Exterior foundation bottoms should be at least 18 inches below exterior grades for protection against frost damage.

Settlement Estimates: Settlements for spread foundations were assessed using SPT values to estimate elastic moduli, based on published correlations and our experience with similar subsurface conditions. Generalized profiles deemed representative of the subsurface conditions encountered were developed for the settlement analyses herein.

Based on the previously stated assumed column loadings, the recommended soil bearing capacity and the presumed foundation elevations as discussed above, we expect primary, post-construction total settlement beneath individual foundations for the proposed building addition to be on the order of 1 inch.

The amount of differential settlement is difficult to predict because the subsurface and foundation loading conditions can vary considerably across the site. However, we anticipate differential settlement between adjacent foundations within the new addition to be half of the primary, post-construction total settlement. The final deflected shape of the structure will be dependent on actual foundation locations and loading.

If the proposed building addition is structurally connected to the existing building, the differential settlement between the new and existing foundations could be up to the entirety of the estimated primary, post-construction total settlement (1 inch) and could cause additional settlement of the existing foundations. Therefore, we recommend the additions not be structurally connected to the existing building and be separated by expansion or construction joints.

Installing new foundations adjacent to the existing structure could induce additional settlement of the existing foundations near the new foundations. It is the responsibility of the contractor to take the necessary measures to protect the existing structure.

5.3.2 Subgrade Improvement – Undercutting and Replacing with #57 Stone or GAB (Proposed Building Addition)

If the estimated total and differential settlements previously stated are deemed unacceptable for the proposed building addition, a program of undercutting and replacing with graded aggregate base (GAB) or #57 stone could be utilized to bring total settlements to ½ inch. For preliminary purposes, we recommend that foundation excavations for the proposed addition be undercut 3 feet and replaced with #57 stone or GAB. Once design plans are finalized, final loads and locations should be provided to NOVA so a more detailed plan can be created.

5.4 SLAB-ON-GRADE

5.4.1 General

The conditions exposed at subgrade levels will vary across the site and may include residual soils and/or structural fill. Slabs-on-grade may be adequately supported on these subgrade conditions subject to the recommendations in this report. Slabs-on-grade should be jointed around columns and along walls to reduce cracking due to differential movement.

An underdrain system is not required. However, we recommend a minimum of 6 inches of graded aggregate base (GAB) beneath the slabs to:

- Reduce non-uniform support conditions
- Provide a stable base to support construction traffic
- Provide a base material that can be fine graded to design tolerances.

GAB should be compacted to 98 percent of the maximum dry density as determined by the modified Proctor compaction test (ASTM D 1557) and overlain by a conventional plastic vapor barrier.

Once grading is completed, the subgrade is usually exposed to adverse construction activities and weather conditions during the period of sub-slab utility installation. The subgrade should be well-drained to prevent the accumulation of water. If the exposed subgrade becomes saturated or frozen, the geotechnical engineer should be consulted.

After utilities have been installed and backfilled, a final subgrade evaluation should be performed by the geotechnical engineer immediately prior to slab-on-grade placement. If practical, proofrolling may be used to redensify the surface and to detect any soil that has become excessively wet or otherwise loosened.

5.4.2 Subgrade Modulus

A coefficient of subgrade reaction (***k***) of 125 pci may be used for conventional slab design where slabs bear upon subgrades prepared in accordance with previous recommendations.

Please note that this magnitude of ***k*** is intended to reflect the elastic response of soil beneath a typical floor slab under light loads with a small load contact area often measured in square inches, such as loads from forklifts,

automobile/truck traffic or lightly loaded storage racks. The recommended coefficient of subgrade reaction (***k***) is not applicable for heavy slab loads caused by bulk storage or tall storage racks, or for mat foundation design.

Several design methods are applicable for conventional slab design. We have assumed that the slab designer will utilize the methods discussed in the American Concrete Institute (ACI) Committee 360 report, *"Guide to Design of Slabs-on-Ground, (ACI 360R-10)*.

5.5 PAVEMENT SECTIONS

5.5.1 General

As previously stated, traffic loading for the planned pavements was not provided. We have assumed the project's civil engineer will finalize the design of the asphalt and concrete pavements, incorporating the geotechnical recommendations from this exploration to ensure proper pavement design for the site-based final design traffic loading. Below are the assumptions used to prepare this report:

- For Standard-Duty Pavements – assumed traffic loading conditions of 50 automobiles per day, 7 days per week with the occasional delivery van/panel truck (2 to 3 per day), for a 20-year pavement life.

- For Heavy-Duty Pavements – in addition to similar traffic as the standard-duty pavements, we have assumed additional traffic loading of 3 garbage, semi, or firetrucks 7 days per week for a 20-year pavement life.

If the planned pavements are to be constructed and utilized by construction traffic, the below pavement sections will likely prove insufficient for heavy truck traffic, such as concrete trucks or tractor-trailers used for construction delivery. Unexpected distress, reduced pavement life, and /or pre-mature failure of the pavement section could result if subjected to heavy construction traffic and the owner should be made aware of this risk. If the assumed traffic loading stated herein is not correct, NOVA should review actual pavement loading conditions to determine if revisions to these recommendations are warranted.

5.5.2 Flexible Pavement Sections

Based on the subsurface conditions encountered at this site, the recommended site preparation, and an estimated CBR of 4, our recommended flexible pavement design is shown in the following table:

Pavement Section	Standard Duty	Heavy Duty
Asphaltic Surface Course (9.5 mm or 12.5 mm SuperPave, GDOT approved mix)	2½ inches	3 inches
Asphaltic Base Course (19 mm of 12.5 mm SuperPave, GDOT approved mix)	N/A	1 inch
Graded Aggregate Base (GAB) or Recycled Concrete Base Course from an approved GDOT source	8 inches	8 inches
Stabilized Subgrade (compacted to a minimum 98% of the standard Proctor maximum dry density)	12 inches	12 inches

We recommend a minimum compaction of 98 percent of the maximum dry density for the Graded Aggregate Base (GAB) as determined by the modified Proctor compaction test (ASTM D 1557). The crushed stone should conform to applicable sections of the current GDOT Standard Specifications. All asphalt material and paving operations should meet applicable specifications of the Asphalt Institute and GDOT. A NOVA technician should observe placement and perform density testing of the base course material and asphalt.

5.5.3 Rigid Pavement Sections

A rigid pavement section is recommended in areas where heavy truck traffic, excessive braking, sharp wheel turning and/or point loads, like dumpsters and loading docks are planned. Based on the subsurface conditions at the site, the recommended site preparation, assumed low volume traffic loads and an estimated subgrade modulus (k) of 125 psi/inch for traffic or wheel loading, our recommended rigid pavement design is as follows:

Pavement Section	Standard Duty	Heavy Duty
GDOT approved air-entrained concrete mix	3½ inches	5 inches
Graded Aggregate Base (GAB) Course from an approved GDOT source	4 inches	6 inches
Control Joint Spacing (maximum)	8 feet X 8 feet	10 feet X 10 feet
Stabilized Subgrade (compacted to a minimum 98% of the standard Proctor maximum dry density)	12 inches	12 inches

All concrete materials and placement should conform to applicable GDOT specifications. We recommend that a non-woven geotextile (about 3 feet wide) be placed beneath the construction joints to prevent upward "pumping" movement of soil fines through the joints.

We recommend using concrete with a minimum compressive strength of 4,000 psi and a minimum 28-day flexural strength (modulus of rupture) of at least 600 pounds per square inch, based on 3rd point loading of concrete beam test samples. Layout of the saw-cut control joints should form square panels, and the depth of saw-cut joint should be approximately ¼ of the concrete slab thickness. The joints should be sawed within 6 hours of concrete placement or as soon as the concrete has developed sufficient strength to support workers and equipment.

We recommend allowing NOVA to review and comment on the final concrete pavement design, including section and joint details (type of joints, joint spacing, etc.), prior to the start of construction. For further details on concrete pavement construction, please reference the "Building Quality Concrete Parking Areas", published by the Portland Cement Association.

5.6 SEISMIC SOIL SITE CLASS

In accordance with Section 1613.2.2 of the 2018 International Building Code (IBC), the seismic Site Class was estimated using the standard penetration resistance values obtained from the soil test borings performed during this exploration. Based upon this analysis, and our knowledge of general subsurface conditions in the area, we are of the opinion that the soil profiles associated with a Site Class “C” are generally appropriate for this site.

6.0 LIMITATIONS

The findings, conclusions and recommendations presented in this report represent our professional opinions concerning subsurface conditions at the site. The opinions presented are relative to the dates of our site services and should not be relied on to represent conditions at significantly later dates or at locations not explored. The opinions included herein are based on information provided to us, the data obtained at specific locations during the study and our experience. If additional information becomes available that might impact our geotechnical opinions, it will be necessary for NOVA to review the information, reassess the potential concerns, and re-evaluate our conclusions and recommendations.

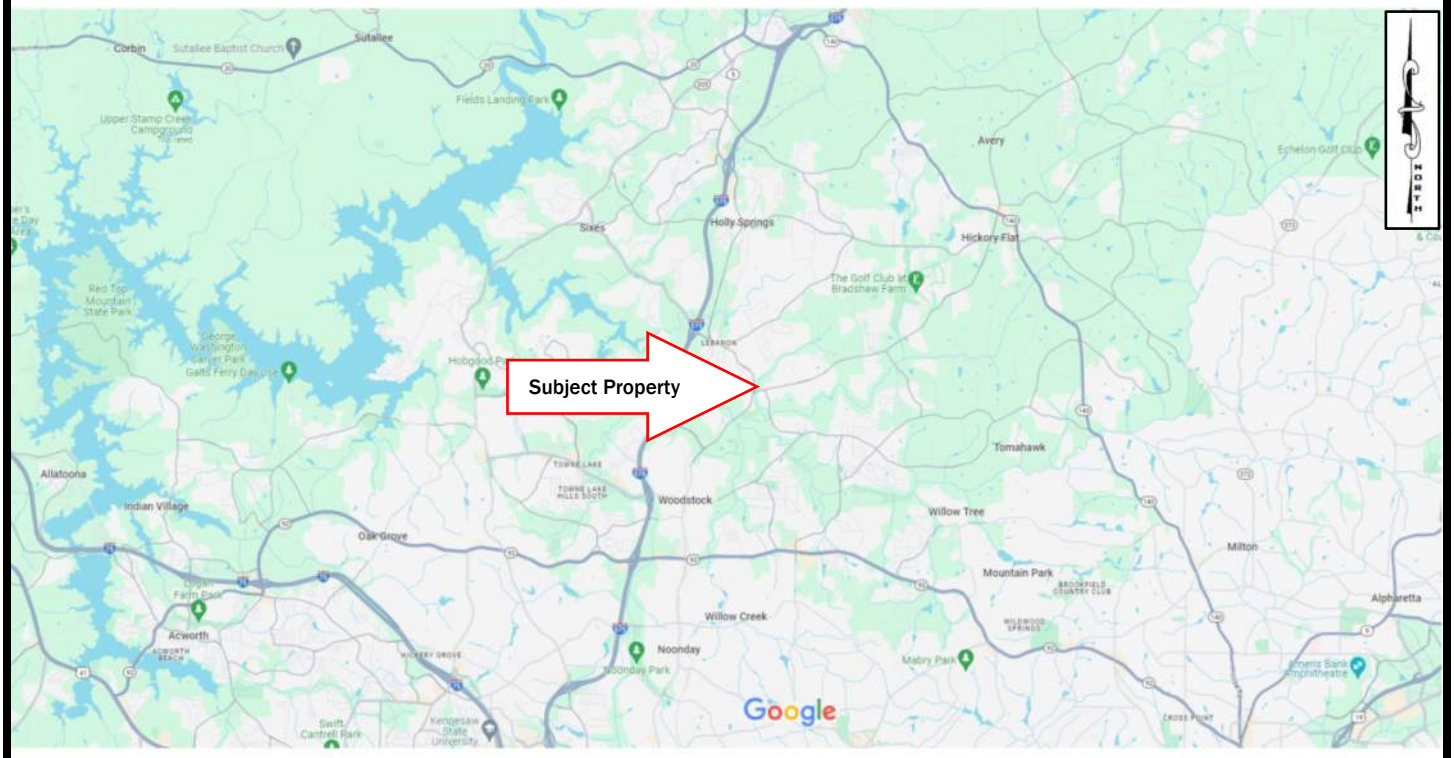
Regardless of the thoroughness of a geotechnical exploration, there is the possibility that conditions between test locations will differ from those encountered at specific test locations, that conditions are not as anticipated by the designers and/or the contractors, or that either natural events or the construction process have altered the subsurface conditions. These variations are an inherent risk associated with subsurface conditions in this region and the approximate methods used to obtain the data. These variations may not be apparent until construction.

This report is intended for the sole use of Cherokee County Board of Commissioners for the above noted project. The scope of services performed during this study may not satisfy other user's requirements. Use of this report or the findings, conclusions or recommendations by others will be at the sole risk of the user. NOVA is not responsible or liable for the interpretation by others of the data in this report, nor their conclusions, recommendations or opinions.

Our professional services have been performed, our findings obtained, our conclusions derived and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices in the State of Georgia. This warranty is in lieu of all other statements or warranties, either expressed or implied.

APPENDIX A

FIGURES AND MAPS



Approximate Subject Property Boundary

FIGURE 1
SITE LOCATION MAP
SOURCE: Google Maps
DATE: Accessed 11/29/2023
SCALES: As Shown

NOVA
PROFESSIONAL | PRACTICAL | PROVEN

CHEROKEE COUNTY BOARD OF COMMISSIONERS
EMS Station No. 30 Additions
Woodstock, Cherokee County, Georgia
NOVA Project Number 10102-2023224

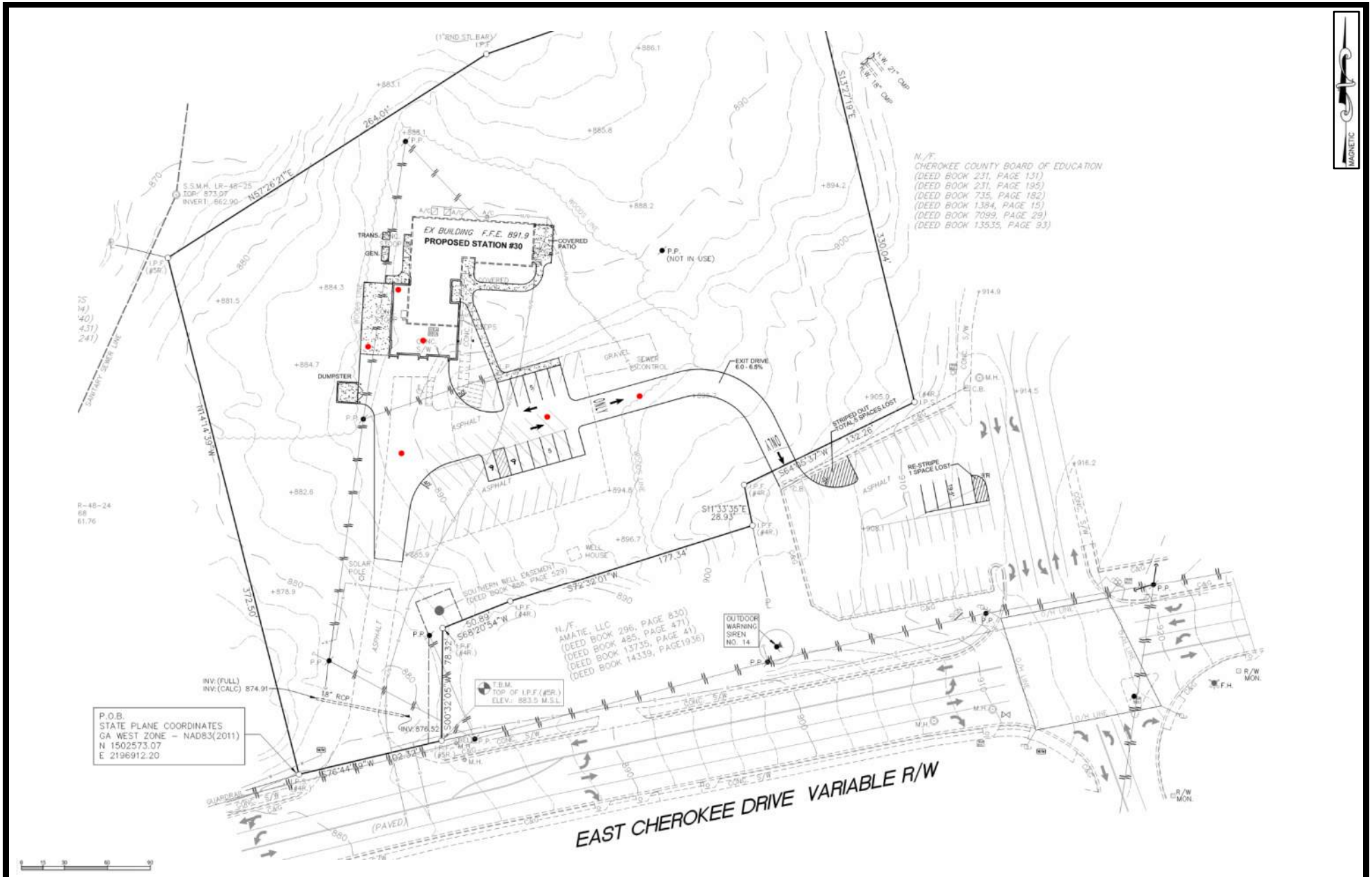


FIGURE 2
TOPOGRAPHIC MAP
SCALE: As Shown
SOURCE: Preliminary Site Plan prepared by PWH Engineering dated October 10, 2023

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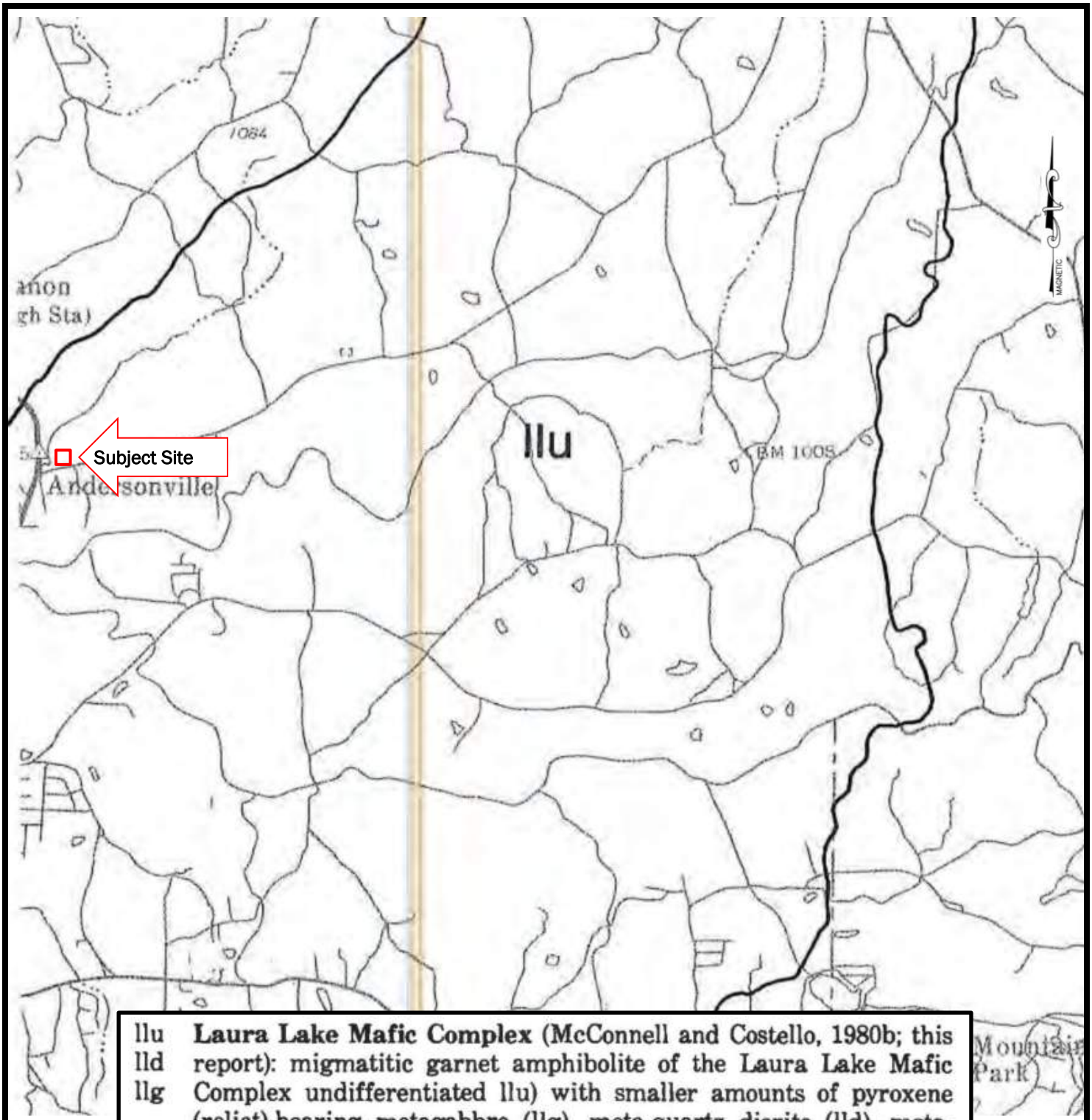
CHEROKEE COUNTY BOARD OF COMMISSIONERS
EMS Station No. 30 Additions
Woodstock, Cherokee County, Georgia
NOVA Project Number 10102-2023224



llu **Laura Lake Mafic Complex** (McConnell and Costello, 1980b; this
lld report): migmatitic garnet amphibolite of the Laura Lake Mafic
llg Complex undifferentiated llu) with smaller amounts of pyroxene (relict)-bearing metagabbro (llg), meta-quartz diorite (lld), meta-ultramafic rock and banded iron formation. Magnetite occurs as common porphyroblasts in amphibolite and coarse-grained amphibole-quartz-plagioclase rock is common neosome.

FIGURE 3
REGIONAL GEOLOGY
SOURCE: McConnell and Abrams, 1984

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NOVA Project Number 10102-2023224

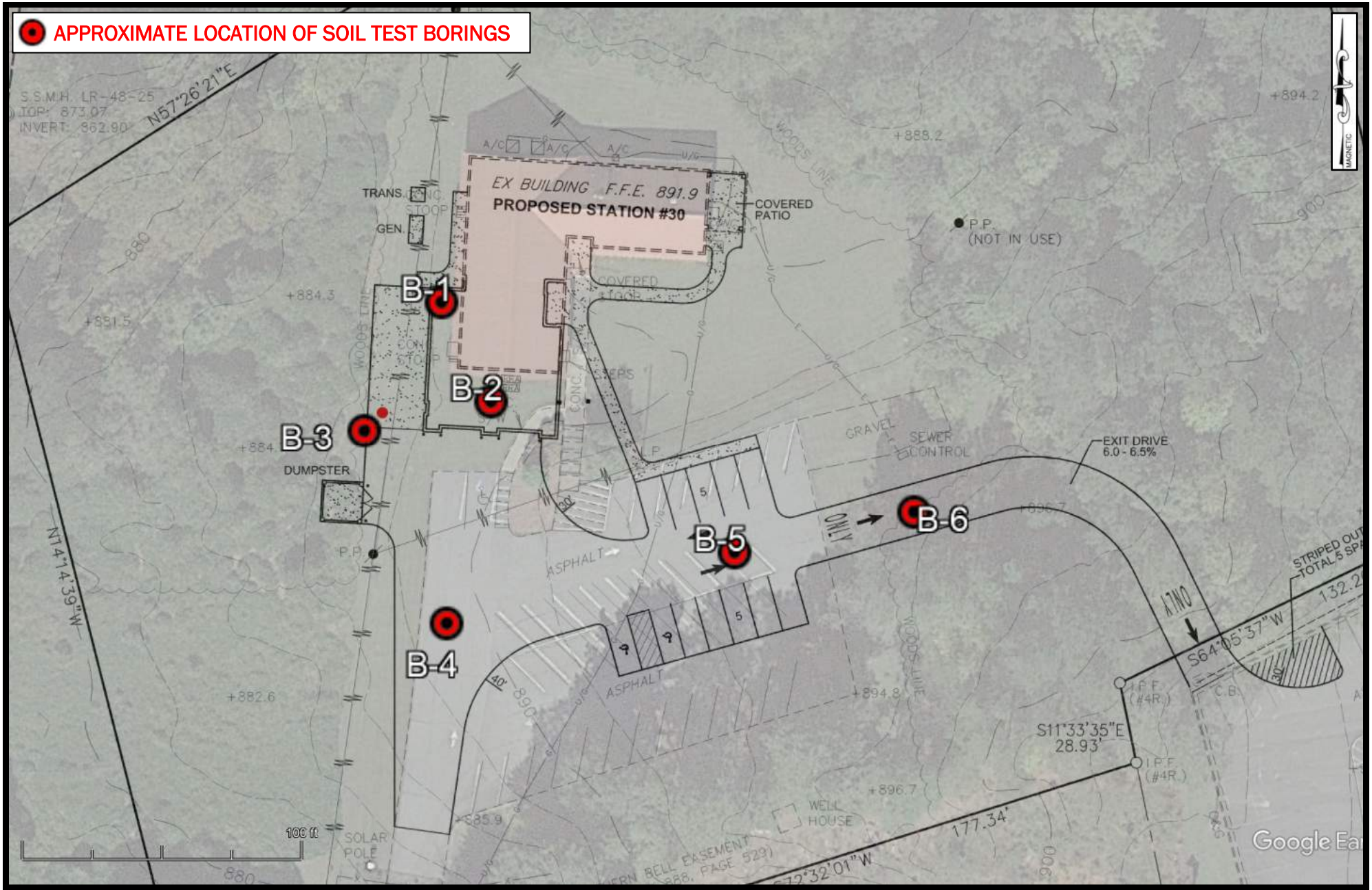

FIGURE 4
BORING LOCATION PLAN
SCALE: As Shown (Approximate)
SOURCES: Preliminary Site Plan prepared by PWH Engineering dated October 10, 2023 and Google Earth

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EMS Station No. 30 Additions
Woodstock, Cherokee County, Georgia
NOVA Project Number 10102-2023224

APPENDIX B

SUBSURFACE DATA

FIELD PROCEDURES

Soil Test Borings: The STBs were performed in general accordance with the guidelines of ASTM Designation D-1586, "Penetration Test and Split-Barrel Sampling of Soils". Hollow-stem augers were used to advance the borings. At regular intervals, soil samples were obtained with a standard 1.4-inch I.D., 2.0-inch O.D., split-tube sampler. The sampler was first seated six inches and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is designated the "Penetration Resistance". The penetration resistance is an index to the soil strength and density. Representative portions of the soil samples were transported to our laboratory for further evaluation and testing.

Test Boring Records in Appendix B show the standard penetration test (SPT) resistances, or “N-values”, and present the soil conditions encountered in the borings. These records represent our interpretation of the subsurface conditions based on the field exploration data, visual examination of the split-barrel samples, and generally accepted geotechnical engineering practices. The stratification lines and depth designations represent approximate boundaries between various subsurface strata. Actual transitions between materials may be gradual.

The groundwater levels reported on the Test Boring Records represent measurements made at the completion of the soil test boring. Subsequent to completion of the groundwater measurements, boreholes were backfilled with soil cuttings from the drilling process.

KEY TO SYMBOLS AND CLASSIFICATIONS

DRILLING SYMBOLS

	Split Spoon Sample
	Undisturbed Sample (UD)
	Standard Penetration Resistance (ASTM D1586-67)
	Water Table at least 24 Hours after Drilling
	Water Table 1 Hour or less after Drilling
100/2”	Number of Blows (100) to Drive the Spoon a Number of Inches (2)
NX, NQ	Core Barrel Sizes: 2⅛- and 2-Inch Diameter Rock Core, Respectively
REC	Percentage of Rock Core Recovered
RQD	Rock Quality Designation – Percentage of Recovered Core Segments 4 or more Inches Long
	Loss of Drilling Water
MC	Moisture Content Test Performed
N/E	Not Encountered
N/M	Not Measured
C	Caving

CORRELATION OF PENETRATION RESISTANCE WITH RELATIVE DENSITY AND CONSISTENCY

	Number of Blows, “N”	Approximate Relative Density
	0 – 4	Very Loose
	5 – 10	Loose
SANDS	11 – 30	Medium Dense
	31 – 50	Dense
	Over 50	Very Dense

	Number of Blows, “N”	Approximate Consistency
	0 – 2	Very Soft
	3 – 4	Soft
SILTS	5 – 8	Firm
and	9 – 15	Stiff
CLAYS	16 – 30	Very Stiff
	31 – 50	Hard
	Over 50	Very Hard

DRILLING PROCEDURES

Soil sampling and standard penetration testing performed in accordance with ASTM D1586-67. The standard penetration resistance is the number of blows of a 140 pound hammer falling 30 inches to drive a 2-inch O.D., 1⅜-inch I.D. split spoon sampler one foot. Core drilling performed in accordance with ASTM D2113-08. The undisturbed sampling procedure is described by ASTM D1587-08 (2012). Unless other arrangements are made, NOVA will dispose of all soil and rock samples remaining at the time of report submission.

NOVA

SOIL CLASSIFICATION CHART

COARSE GRAINED SOILS	**GRAVELS**	Clean Gravel less than 5% fines	GW	Well graded gravel
			GP	Poorly graded gravel
		Gravels with Fines more than 12% fines	GM	Silty gravel
			GC	Clayey gravel
	SANDS	Clean Sand less than 5% fines	SW	Well graded sand
			SP	Poorly graded sand
		Sands with Fines more than 12% fines	SM	Silty sand
			SC	Clayey sand
FINE GRAINED SOILS	**SILTS AND CLAYS** Liquid Limit less than 50	Inorganic	CL	Lean clay
			ML	Silt
		Organic	OL	Organic clay and silt
	SILTS AND CLAYS Liquid Limit 50 or more	Inorganic	CH	Fat clay
			MH	Elastic silt
		Organic	OH	Organic clay and silt
HIGHLY ORGANIC SOILS		Organic matter, dark color, organic odor	PT	Peat

PARTICLE SIZE IDENTIFICATION

GRAVELS	Coarse	¾ inch to 3 inches
	Fine	No. 4 to ¾ inch
SANDS	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40
SILTS AND CLAYS		Passing No. 200

STRATA SYMBOLS

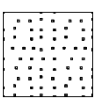

Paving


Gravel / Graded Aggregate Base


Fill


Topsoil


Alluvium


Poorly Graded Sand - SP


Well Graded Sand - SW


Silty Sand - SM


Clayey Sand - SC


Poorly graded silty, clayey sand - SM/SC


Clayey Sand and Gravel - SC/GC


Silty Sand and Gravel - SM/GM


Silt - ML


Elastic Silt - MH


Low Plasticity Clay - CL


High Plasticity Clay - CH


Partially Weathered Rock (PWR)


Rock

NOVA

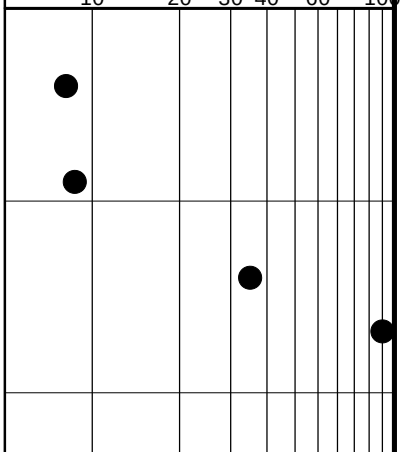
NOVA

TEST BORING RECORD B-1

PROJECT: EMS Station No. 30 Additions | PROJECT NO.: 10102-2023224
CLIENT: Cherokee County Board of Commissioners
PROJECT LOCATION: Woodstock, Cherokee County, Georgia
LOCATION: Proposed Addition | ELEVATION: 888 feet
DRILLER: Dodd Drilling | LOGGED BY: D. Noll
DRILLING METHOD: Hollow Stem Auger | DATE: 11/20/2023
DEPTH TO - WATER> INITIAL: N/E AFTER 24 HOURS: N/M CAVING> C

Depth (feet)	Elevation (ft-MSL)	Description	Graphic	Groundwater	Sample Type	N-Value
0		TOPSOIL: 4 inches				
		FILL: Loose gray brown red silty medium to fine SAND with rock fragments				7
	885	RESIDUUM: Loose red orange clayey medium to fine SAND				
5						8
		Dense brown gray silty medium to fine SAND				
						35
	880	PARTIALLY WEATHERED ROCK: Sampled as very dense brown gray silty medium to fine SAND				100/6"
10		Hard drilling at 9 feet				
		Auger Refusal at 12 ft.				
	875					
15						
	870					
20						
	865					
25						
	860					
30						
	855					
35						

Graphic Depiction



This information pertains only to this boring and should not be interpreted as being indicative of the site.

Elevations were interpolated from the provided Preliminary Site Plan prepared by PWH Engineering dated October 10, 2023 and should be considered approximate.
SPT values may have been amplified by the presence of rock fragments where encountered.

NOVA

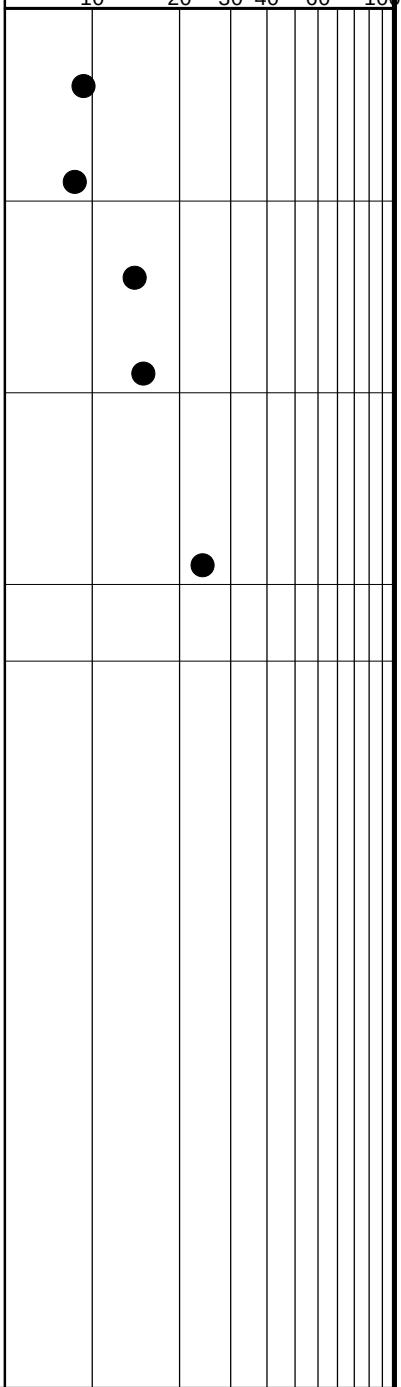
TEST BORING RECORD B-2

PROJECT: EMS Station No. 30 Additions | PROJECT NO.: 10102-2023224
CLIENT: Cherokee County Board of Commissioners
PROJECT LOCATION: Woodstock, Cherokee County, Georgia
LOCATION: Proposed Addition | ELEVATION: 889 feet
DRILLER: Dodd Drilling | LOGGED BY: D. Noll
DRILLING METHOD: Hollow Stem Auger | DATE: 11/20/2023
DEPTH TO - WATER> INITIAL: ▽ 14' | AFTER 24 HOURS: ▼ N/M | CAVING> C

Depth (feet)	Elevation (ft-MSL)	Description	Graphic	Groundwater	Sample Type	N-Value
0						
		TOPSOIL: 4 inches				
		FILL: Stiff red brown medium to fine sandy lean CLAY				9
	885	RESIDUUM: Loose to medium dense brown white silty medium to fine SAND				8
5						14
	880					15
10						
	875			▽		24
15		Hard drilling at 16 feet				
		Auger Refusal at 17 ft.				
	870					
20						
	865					
25						
	860					
30						
	855					
35						

Graphic Depiction

● BLOW COUNT
▲ NATURAL MOISTURE
PLASTIC LIMIT ⊢——⊣ LIQUID LIMIT
10 20 30 40 60 100



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Elevations were interpolated from the provided Preliminary Site Plan prepared by PWH Engineering dated October 10, 2023 and should be considered approximate.

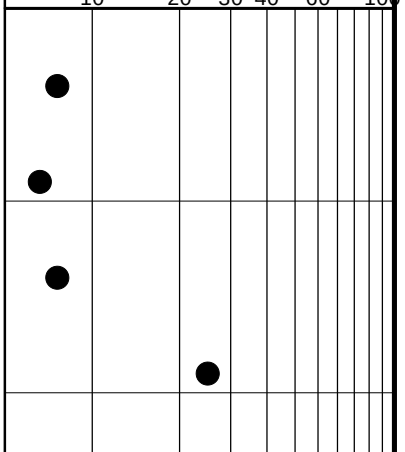
NOVA

TEST BORING RECORD B-3

PROJECT: EMS Station No. 30 Additions | PROJECT NO.: 10102-2023224
CLIENT: Cherokee County Board of Commissioners
PROJECT LOCATION: Woodstock, Cherokee County, Georgia
LOCATION: Proposed Addition | ELEVATION: 886 feet
DRILLER: Dodd Drilling | LOGGED BY: D. Noll
DRILLING METHOD: Hollow Stem Auger | DATE: 11/20/2023
DEPTH TO - WATER> INITIAL: N/E | AFTER 24 HOURS: N/M | CAVING> C

Depth (feet)	Elevation (ft-MSL)	Description	Graphic	Groundwater	Sample Type	N-Value
0						
		TOPSOIL: 4 inches				
	885	FILL: Loose gray brown silty medium to fine SAND with rock fragments				6
		Very loose to loose brown red silty medium to fine SAND				4
5						
	880					6
		RESIDUUM: Medium dense gray red silty medium to fine SAND				25
10						
	875					
		Stiff red brown medium to fine sandy SILT; wet				9
15						
	870	Hard drilling at 16 feet				
		Auger Refusal at 17 ft.				
20						
	865					
25						
	860					
30						
	855					
35						

Graphic Depiction



This information pertains only to this boring and should not be interpreted as being indicative of the site.

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SPT values may have been amplified by the presence of rock fragments where encountered.

NOVA

TEST BORING RECORD B-4

PROJECT: EMS Station No. 30 Additions | PROJECT NO.: 10102-2023224
CLIENT: Cherokee County Board of Commissioners
PROJECT LOCATION: Woodstock, Cherokee County, Georgia
LOCATION: Proposed Pavement | ELEVATION: 889 feet
DRILLER: Dodd Drilling | LOGGED BY: D. Noll
DRILLING METHOD: Hollow Stem Auger | DATE: 11/20/2023
DEPTH TO - WATER> INITIAL: N/E | AFTER 24 HOURS: N/M | CAVING> C

Depth (feet)	Elevation (ft-MSL)	Description	Graphic	Groundwater	Sample Type	N-Value
0						
		ASPHALT: 4 inches				
		RESIDUUM: Loose orange brown silty coarse to fine SAND				9
	885					
5						8
		Stiff orange brown fine sandy SILT				
						13
	880					
10						14
		Boring Terminated at 10 ft.				
	875					
15						
	870					
20						
	865					
25						
	860					
30						
	855					
35						

Graphic Depiction

BLOW COUNT
NATURAL MOISTURE
PLASTIC LIMIT ⊢——⊣ LIQUID LIMIT
10 20 30 40 60 100

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Elevations were interpolated from the provided Preliminary Site Plan prepared by PWH Engineering dated October 10, 2023 and should be considered approximate.

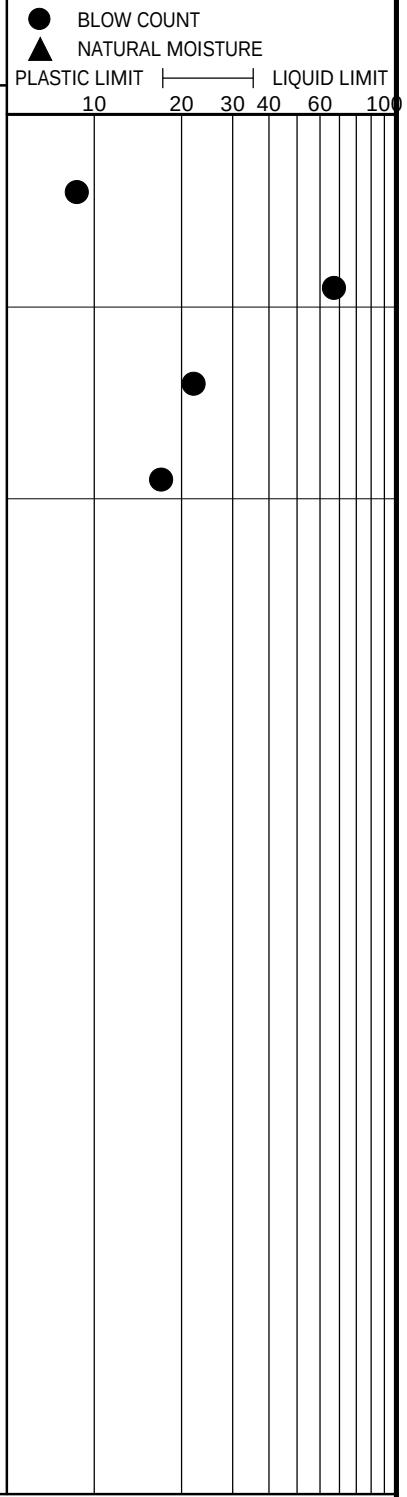
NOVA

TEST BORING RECORD B-5

PROJECT: EMS Station No. 30 Additions | PROJECT NO.: 10102-2023224
CLIENT: Cherokee County Board of Commissioners
PROJECT LOCATION: Woodstock, Cherokee County, Georgia
LOCATION: Proposed Pavement | ELEVATION: 894 feet
DRILLER: Dodd Drilling | LOGGED BY: D. Noll
DRILLING METHOD: Hollow Stem Auger | DATE: 11/20/2023
DEPTH TO - WATER> INITIAL: N/E | AFTER 24 HOURS: N/M | CAVING> C

Depth (feet)	Elevation (ft-MSL)	Description	Graphic	Groundwater	Sample Type	N-Value
0		ASPHALT: 3 inches				
		GRADED AGGREGATE BASE: 2 inches				
		FILL: Firm brown red fine sandy lean CLAY				8
	890	RESIDUUM: Very dense gray brown silty medium to fine SAND				
5						67
		Medium dense red gray silty medium to fine SAND				
						22
	885					
10						17
		Boring Terminated at 10 ft.				
	880					
15						
	875					
20						
	870					
25						
	865					
30						
	860					
35						

Graphic Depiction



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Elevations were interpolated from the provided Preliminary Site Plan prepared by PWH Engineering dated October 10, 2023 and should be considered approximate.

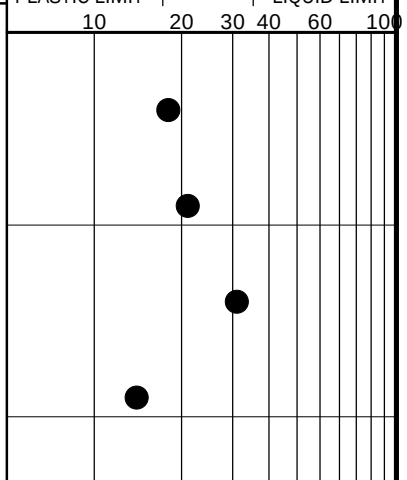
NOVA

TEST BORING RECORD B-6

PROJECT: EMS Station No. 30 Additions | PROJECT NO.: 10102-2023224
CLIENT: Cherokee County Board of Commissioners
PROJECT LOCATION: Woodstock, Cherokee County, Georgia
LOCATION: Proposed Pavement | ELEVATION: 896 feet
DRILLER: Dodd Drilling | LOGGED BY: D. Noll
DRILLING METHOD: Hollow Stem Auger | DATE: 11/20/2023
DEPTH TO - WATER> INITIAL: N/E | AFTER 24 HOURS: N/M | CAVING> C

Depth (feet)	Elevation (ft-MSL)	Description	Graphic	Groundwater	Sample Type	N-Value
0						
		TOPSOIL: 4 inches				
	895	RESIDUUM: Medium dense to dense gray brown silty medium to fine SAND				18
5						21
	890					31
10						14
	885	Boring Terminated at 10 ft.				
15						
	880					
20						
	875					
25						
	870					
30						
	865					
35						

Graphic Depiction



This information pertains only to this boring and should not be interpreted as being indicative of the site.

Elevations were interpolated from the provided Preliminary Site Plan prepared by PWH Engineering dated October 10, 2023 and should be considered approximate.

Important Information about This

Geotechnical-Engineering Report

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

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

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

SECTION 03300 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Slabs-on-grade.

1.2 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.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Samples: For waterstops and vapor retarder.

E. 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. Waterstops.
6. Curing compounds.
7. Floor and slab treatments.
8. Bonding agents.
9. Adhesives.
10. Vapor retarders.
11. Semirigid joint filler.
12. Joint-filler strips.

F. Floor surface flatness and levelness measurements at ground floor slabs to determine compliance with specified tolerances.

G. Minutes of pre-installation conference.

H. Slab-on-grade joint layout drawings: Dimensioned plan drawings indicating location and frequency of control construction joints in slab-on-grade pursuant to the guidelines in the structural contract drawings.

1.3 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, 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.
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 one source, and obtain admixtures through one source from a single manufacturer.

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5 and Section 7, "Lightweight Concrete".
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
3. ACI 318, "Building Code Requirements for Structural Concrete."

F. Concrete Testing Service: Owner shall engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

G. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1.

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.

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, shoring and re-shoring procedures, vapor-retarder installation, steel reinforcement installation, and concrete protection.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

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

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. 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.

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. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

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

F. 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.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

G. 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.

2.2 STEEL REINFORCEMENT

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

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

2.3 REINFORCEMENT ACCESSORIES

A. 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. Precast concrete supports are acceptable for on-ground applications.

B. Mechanical Terminators and Splices: Mechanical terminators and splices shall meet building code requirements. Terminators and splices shall be a positive locking, taper threading type anchor

manufactured from high quality steel. The ends of reinforcing shall be tapered using the manufacturer's threading equipment to ensure proper taper and thread engagement. Reinforcing, terminators, and splices shall be installed pursuant to manufacturer's requirements.

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.

a. No other cementitious materials are permitted.

B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded.

1. Maximum Coarse-Aggregate Size: 1 ½ inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94 and potable.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

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.

2.6 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

B. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch.

2.7 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E 1745, Class B. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.8 FLOOR AND SLAB TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.

2.9 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

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. Colored, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315.
1. To be used where concrete is indicated as the exposed floor finish.
2. Products:
   a. Euclid Chemical Company (The); Super Floor Coat Colored.
   b. PROSOCO, Inc.; ColorSeal ChemMasters, Colored Polyseal.
   c. TK Products; TK TRI-SEAL 1315 CCS.
   d. Vexcon Chemicals, Inc.; Starseal 1315 Concrete Stain.

F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
1. Curing compound must be compatible with glue agent utilized for VCT.

2.10 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
1. All exterior expansion joint material shall be “zip strip” type with caulked joints.

B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.11 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Concrete Slab at Equipment Bays: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: 4 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
5. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.

B. Exterior Concrete Slabs: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: 4 inches, plus or minus 1 inch.

4. Air Content: 4 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
5. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.

C. All Building Elements Except those Otherwise Noted: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.55.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: 4 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
5. Air Content: Do not allow air content of troweled finished floors to exceed 3 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. Chamfer exterior corners and edges of permanently exposed concrete.

D. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

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."
2. Install dovetail anchor slots in concrete structures as indicated.

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, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are 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 70 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. 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. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

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.

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.

F. Use of chairs or bolster is required for placement of welded wire fabric. Fabric laid on grade or bottom of form to be “pulled up” after concrete is in place will not be permitted.

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. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
2. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

3.7 WATERSTOPS

A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, 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. Do not add water to concrete during delivery, at Project site, or during placement.

C. 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.

D. 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.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.

5. 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.

E. 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 average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

F. Hot-Weather Placement: Comply with ACI 301 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.

3.9 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.

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 to receive a rubbed finish.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

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-Floated 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.

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 1 direction.

1. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes.

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 to receive trowel finish.

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 to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:

a. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 25; for slabs-on-grade.

3. Measurements of F(F) and F(L) shall be made as soon as possible, preferably within 24 hours, but not later than 72 hours after placement of slabs-on-grade, and prior to removal of formwork and shoring for suspended slabs.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. 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, and ramps, and elsewhere as indicated.

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, unless otherwise indicated, after work of other trades is in place. 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 Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. All slab areas where epoxy floor systems are specified shall be flood tested prior to the installation of epoxy coating.

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.

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 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. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.

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.

3. 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. Recoat 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 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than 28 days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.14 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.

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. 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 in solid concrete, but not less than 1 inch in depth. 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.

C. 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.

D. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

E. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.

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 50 cu. yd. or fraction thereof of each concrete mixture 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; 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; ASTM C 173, volumetric method, for structural lightweight 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.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31.

    a. Cast and laboratory cure four cylinder specimens for each composite sample.

    b. Cast and laboratory cure two additional cylinder specimens as necessary for determining early strength for formwork or shoring considerations or for reserve usage.

7. Compressive-Strength Tests: ASTM C 39; test one laboratory-cured specimen at 7 days and a minimum of one set of two specimens at 28 days.
    a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. 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.
9. 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.
10. 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.

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 dos not comply with the Contract Documents.

END OF SECTION 03300

SECTION 04200 - UNIT MASONRY

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. Concrete masonry units.
2. Building (common) brick.
3. Mortar and grout.
4. Embedded flashing.
5. Cavity-wall insulation.
6. CMU Dampproofing

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

A. Provide **structural** unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection:

1. Decorative CMUs, in the form of small-scale units.
2. Brick.
3. Colored mortar.
4. Weep holes/vents.
5. Cavity wall insulation
6. Flashing and drainage system.

C. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include material test reports substantiating compliance with requirements.
b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
c. For exposed brick, include test report for efflorescence according to ASTM C 67.
d. For masonry units, include data and calculations establishing average net-area compressive strength of units.

D. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical wall section as shown on Drawings.
2. Build mockups for each type of exposed unit masonry construction 72 inches long by 60 inches high by full thickness, including CMU, brick, flashing, drainage material and accessories.

a. Include a full height sealant-filled joint in mockup.
b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
c. Include through-wall flashing installed along entire length of wall, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).

d. Include veneer anchors, flashing**,** cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.

3. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
4. Protect accepted mockups from the elements with weather-resistant membrane.
5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

    a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
    b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

6. Approved mockups may not become part of the completed Work and shall remain until substantial completion.
    a. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide **bullnose** units for outside corners, door and window jambs and other openings unless otherwise indicated. The first course immediately adjacent to the finished floor shall not have a bullnose corner.

B. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi**.**
2. Density Classification: Lightweight.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.3 MASONRY LINTELS

A. Masonry Lintels: Built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units: Facing brick complying with ASTM C 216 as amended herein

1. Size: Modular

2. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
3. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
4. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
5. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

6. Include in the Base Bid an allowance of $1,200.00 per 1000 bricks. This allowance is for the purchase of brick only. All other labor, accessories and materials shall be included in the work. The Contractor shall determine the quantity of bricks required to complete the work included in the Contract Documents and use this to determine the required allowance. Upon selection of the brick, any unused funds shall be refunded to the Owner based on a calculation of the difference in price per 1000 bricks and the quantities determined by the contractor in his Base Bid as indicated on the Proposal Form. The Contractor's quantities shall include all calculations for waste, cull and etc. needed to complete the work. No increase in quantities will be allowed after receipt of proposals.

2.5 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C 91.

E. Mortar Cement: ASTM C 1329.

F. Colored Cement Product: Packaged blend made from masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Masonry Cement:

a. Products:

1) Mortamix Color Masonry Cement.
2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.
3) Lafarge North America Inc.; U.S. Cement Custom Color Masonry Cement.
4) Argos Custom Color Masonry Cement.
5) National Cement Company, Inc.; Coosa Masonry Cement.

G. Water: Potable.

2.6 REINFORCEMENT

A. Masonry Joint Reinforcement, General: See the Structural documents for all masonry reinforcement.

2.7 EMBEDDED FLASHING MATERIALS

A. Flexible Flashing:

1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch.

a. Products:
1) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
2) Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier Thru-Wall Flashing.
3) Grace Construction Products, W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
4) W. R. Meadows, Inc.; Air-Shield Thru-Wall Flashing.

b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

B. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt (No. 30 asphalt felt).

D. Weep/Vent Products: Use the following unless otherwise indicated:
1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.

a. Products:

1) Advanced Building Products Inc.; Mortar Maze weep vent.
2) Blok-Lok Limited; Cell-Vent.
3) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
4) Heckmann Building Products Inc.; No. 85 Cell Vent.
5) Hohmann & Barnard, Inc.; Quadro-Vent.
6) Wire-Bond; Cell Vent.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Provide the following configuration:

a. Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.

1) Basis-of-Design Product: Subject to compliance with requirements, provide Keene Building Products; KeeneStone Cut or comparable product by one of the following:

a) Mortar Net USA, Ltd.

2.9 MASONRY-CELL INSULATION

A. Foam Insulation: Two-component consisting of amino-plast resin and a catalyst foaming agent surfactant. All exterior CMU wall cells to be filled.

1. Products:

a. Core-Fill 500.

2.10 CAVITY-WALL INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV closed-cell product extruded with an integral skin.

B. Extruded-Polystyrene Board Insulation with Increased R-Value: ASTM C 578, Type IV, 1.5” thick, closed-cell product with an integral skin.

C. Adhesive: Type recommended by insulation board manufacturer for application indicated.

2.11 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers:

a. Diedrich Technologies, Inc.
b. EaCo Chem, Inc.
c. ProSoCo, Inc.

2.12 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Limit cementitious materials in mortar to Portland cement and lime.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry. Substitutions must be approved prior to use.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type S.
3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type M or Type S. For brick use type N.

D. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Mix to match Architect's sample.
3. Application: Use pigmented mortar for exposed mortar joints with the following units:
   a. Concrete facing brick.
   b. Face brick.

E. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated on structural documents.
2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of **8 to 11 inches** as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Cull oddly colored or textured units. Absolutely no staining of masonry will be allowed.

1. Mix units from several pallets or cubes as they are placed.

F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For location of elements in plan do not vary from that indicated by more than plus or minus 1/4 inch.
2. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels: Comply with ACI 530.1/ASCE 6/TMS 602 and with the following.

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/8 inch in 10 feet, or 1/4 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet or 1/2 inch (12 mm) maximum.
3. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet or 1/2 inch maximum.
4. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2 inch maximum.
5. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch .

2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/16 inch .
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/16 inch.]
4. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

D. Cracks and Chips. This requirement shall apply to all masonry construction

1. For the allowable percentage of exposed brick and block allowed in the wall, chips shall be limited to that size able to be completely covered by a $.10 U.S. Dime in CMU and limited to 1/4" by 1/4" square in all brick. No other chips are allowed
2. For the allowable percentage of exposed brick and block allowed in the wall, surface cracks shall be limited to 1.5" in length and no wider than 1/16" in CMU and 1/2" in length and no wider than 1/16" in brick. Any cracks extending through the brick or block shall not be acceptable. No other cracks are allowed

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Masonry: Unless otherwise indicated, lay exposed concrete masonry in, **running bond, lay exposed brick masonry in one-third running bond**. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar.

F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, in the joint below and rod mortar or grout into core.

G. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

H. Build non-load-bearing interior partitions to heights indicated on drawings.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above as required by structural documents.
3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with referenced UL design assembly.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow brick and CMUs as follows:

1. With face shells fully bedded in mortar and with head joints fully bedded.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
1. Do not wet CMU's before laying.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated. Do not leave finger joints.
1. Maintain joint widths shown, except for minor variations required to maintain bond alignment. If not shown, lay walls with 3/8" joints.

3.6 CAVITY WALLS

A. Bond wythes of cavity walls together.

a. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Dampproofing: Apply asphalt emulsion dampproofing to exterior side of C.M.U. surfaces as recommended by manufacturer. Product shall be equal to Karnak 220 AF. Products of equal quality will be acceptable with prior approval. Remove all excess mortar from block face and from reinforcement prior to application of dampproofing.

D. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.7 MASONRY-CELL INSULATION

A. Fill all exterior CMU wall cells with the specified foam insulation product. Inject foam into block cells from holes drilled in concealed spaces above the ceiling. Patch all holes once cells are completely filled. Follow all manufacturers instructions to ensure that all cells are filled.

3.8 MASONRY JOINT REINFORCEMENT

A. General: Install as indicated on structural documents.

3.9 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:

1. Provide an open space not less than 1 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally with not less than 1 anchor for each 2 of wall area.

3.10 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed tie sections in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches (o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 8 inches, around perimeter.

B. Anchor masonry veneers to masonry backup with 2- piece (hook and eye) masonry-veneer anchors to comply with the following requirements:

1. Embed tie sections in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.
2. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
3. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches around perimeter.
4. Care shall be taken not to bend or otherwise deform any component of the masonry anchors.

3.11 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:
1. Install preformed control-joint gaskets designed to fit standard sash block.

C. Form expansion joints in brick as follows:

1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches (100 mm) in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
2. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod.

D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.12 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.13 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, door & window openings, other openings, other obstructions to downward flow of water in wall, and where indicated. Install vents at all areas to receive flashing.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of **6 inches above cavity drainage material**, and through inner wythe for a distance of 3".
3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 6 inches above cavity drainage material with upper edge firmly secured to sheathing with termination bar. Ensure that moisture barrier completely covers the joint between the flashing and sheathing.
4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep/vent products to form weep holes.
2. Space weep holes 24 inches o.c. unless otherwise indicated.

E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material.

3.14 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.15 FIELD 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 comply with specified requirements shall be done at Contractor's expense.

3.16 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

3.17 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

END OF SECTION 04200

SECTION 05120 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Structural steel.
2. Grout.

1.2 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges (2016)", that support design loads.

B. Architecturally Exposed Structural Steel: Structural steel designated as architecturally exposed structural steel in the Contract Documents.

1.3 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand ASD-service loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details and procedures indicated in AISC's "Steel Construction Manual," Parts 9 through 15.

    a. Details shown on the drawings are typical, similar details apply to similar conditions unless otherwise indicated.
    b. Connections shown on the structural drawings are schematic and are only intended to show the relationship of members connected. Connection details indicated on the drawings shall be incorporated into Fabricator's connection design.

2. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections.
3. Connections for a beam which cannot conform to AISC typical connection details shall be designed and detailed in accordance with the following.

    a. Where beam reactions are not shown on the drawings, connections shall be designed for one-half the maximum uniform load which the beam will support (as simple span) for the span shown on the drawings for non-composite beams or three-quarters of the maximum uniform load which the beam will support (as simple span) for the span shown on the drawings for composite beams.
    b. Where connections support beams which are subject to concentrated loads, such concentrated loads shall be taken into account when designing the connections.
    c. Where connections are subject to eccentricity, such eccentricity shall be taken into account when designing the connections.
    d. End connections of floor members shall accommodate end rotations of simple, unrestrained beams. For this purpose, inelastic action in the connection is permitted.
    e. Coped or cut ends of members shall be reinforced where required to sustain the specified reactions.

B. Design Responsibility: The Fabricator shall be responsible for all errors of detailing on the shop drawings, errors in fabrication, and for the correct fitting of the structural steel members.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. For structural-steel connections indicated to comply with design loads, include structural analysis data prepared by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Shear stud connectors.
4. Shop primers.
5. Nonshrink grout.

E. Source quality-control test reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer with not less than 5 years' experience in the erection of structural steel who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance, and who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

D. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Code of Standard Practice for Steel Buildings and Bridges (AISC 303-16)".

a. Paragraph 4.4.1 (b) of the above Code is hereby modified by the revision: "Confirmation that the Owner's Designated Representative for Design has reviewed the Connection details shown on the Shop and Erection Drawings and submitted in accordance with Section 3.1.1, if applicable; and,"

b. Paragraph 4.4 of the above is hereby modified by the revision: "These drawings shall be returned to the Fabricator within 23 calendar days."

2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
3. AISC's Specification for Structural Steel Buildings—AISC 15th edition (2016).
4. AISC's "Specification for Structural Joints Using High-Strength Bolts (2009)."

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1.

1.6 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 erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. 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.

1.7 COORDINATION

A. Furnish 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

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992.

B. Channels, Angles**,** M, S-Shapes: ASTM A 36.

C. Plate and Bar: ASTM A 36.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade C, structural tubing.

E. Steel Pipe: ASTM A 53, Type E or S, Grade B.

F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Plain
2. Direct-Tension Indicators: ASTM F 959, Type 325 compressible-washer type.

a. Finish: Plain

B. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.

1. Direct-Tension Indicators: ASTM F 959, Type 490, compressible-washer type, plain.

C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy hex head steel structural bolts with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Plain.

D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

E. Headed Anchor Rods: ASTM F 1554, Grade 55, straight.

1. Nuts: ASTM A 563 heavy hex carbon steel.
2. Plate Washers: ASTM A 36 carbon steel.
3. Washers: ASTM F 436 hardened carbon steel.
4. Finish: Plain.

F. Threaded Rods: ASTM A 36

1. Nuts: ASTM A 563 heavy hex carbon steel.
2. Washers: ASTM F 436 hardened ASTM A 36 carbon steel.
3. Finish: Plain

G. Clevises and Turnbuckles: ASTM A 108, Grade 1035, cold-finished carbon steel.

H. Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.

2.3 PRIMER:

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.4 GROUT:

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 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's Specification for Structural Steel Buildings—AISC 15th edition (2016).

1. Camber structural-steel members where indicated.
2. Identify high-strength structural steel according to ASTM A6 and maintain markings until structural steel has been erected.
3. Mark and match-mark materials for field assembly.
4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning".

C. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened unless otherwise indicated on the drawings or where pretensioned or slip-critical joints are recommended or required by RCSC or AISC.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. For architecturally exposed structural steel, remove backing bars or runoff tabs, back gouge, and grind steel smooth.
2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

a. Grind butt welds flush.
b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.7 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.
5. Galvanized surfaces.

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 2, "Hand Tool Cleaning."
2. 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 dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

D. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.8 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of concrete and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

3.2 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.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings (AISC 360-16)."

B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

C. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

E. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

G. No burning or welding of steel shall be performed unless shown on the drawings and specifications or directed by the Structural Engineer of Record. Any burning performed to elongate hole openings or to otherwise facilitate erection shall not be permitted and all affected steel members shall be removed and replaced.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened unless otherwise indicated on the drawings or where pretensioned or slip-critical joints are recommended or required by RCSC or AISC.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings—AISC 15th edition (2016) for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

a. Grind butt welds flush.
b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

3. Contractor shall clean and prime all joints and bolts within 72 hours of installation.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using High-Strength Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

1. In addition to visual inspection, field welds will be tested 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.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

F. Contractor shall not request engineer approval or acceptance of any determined deficiency with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories and abutting structural steel.

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.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION 05120

SECTION 05310 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Roof deck.
2. Composite floor deck.

1.2 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

C. Product Certificates.

D. Welding certificates.

E. Field quality-control test and inspection reports.

1.3 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

B. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage.

1.5 COORDINATION

A. Coordinate installation of sound-absorbing insulation strips in topside ribs of acoustical deck with roofing installation to ensure protection of insulation strips against damage from effects of weather and other causes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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:

a. Canam Steel Corp.; The Canam Manac Group.
b. Consolidated Systems, Inc.
c. Nucor Corp.; Vulcraft Division.

d. Roof Deck, Inc.
e. United Steel Deck, Inc.
f. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

2.2 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:

1. Prime-Painted Steel Sheet: ASTM A 1008, Structural Steel (SS), Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.

a. Color: Manufacturer's standard.

2. Deck Profile: As indicated.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 COMPOSITE FLOOR DECK

A. Composite Steel Floor Deck: Fabtricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with “SDI Specifications and Commentary for Composite Steel Floor Deck” in SDI Publication No. 30, with the minimum section properties indicated, and with the following:

1. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33 G60 zinc coating.
2. Profile Depth: As Indicated
3. Design Uncoated-Steel Thickness: As Indicated.
4. Span Condition: Triple span or more.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 30 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

H. Rolled-in Hanger Tabs: Provide for use with floor deck as indicated on plans.

I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

J. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section, and as indicated on the structural contract documents.

B. Locate deck bundles to prevent overloading of supporting members.

C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.2 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to light gage supporting members by #12 self-drilling screws at spacing indicated.

B. Side-Lap and Perimeter Edge Fastening: As indicated on drawings, and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum or butted at Contractor's option.

D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.3 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to stell supporting memebers by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 5/8 inch, nominal.
2. Weld Spacing: Space and locate welds as indicated.

B. Side-Lap and Perimeter Edge Fastening: As indicated on drawings, and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Butted.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

E. Floor-Deck Closures: Weld steel column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05310

SECTION 05400 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Exterior load-bearing wall framing.
2. Roof trusses.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated**.**
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

    a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of the wall height.
    b. Roof Trusses: Vertical deflection of 1/240 of the span under total roof load.

3. Design framing systems to provide for movement of framing members 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. Upward and downward movement of 1/2 inch, or primary building framing element span divided by 240 (whichever is greater).

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
3. Roof Trusses: Design according to AISI's "Standard for Cold-Formed Steel Framing - Truss Design."

1.3 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal 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. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification Data

E. Product Test Reports

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this project and whose work has resulted in construction with a record successful in service performance.

B. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

C. 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 metal framing that are similar to those indicated for this Project in material, design, and extent.

D. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements.

E. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

F. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal 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. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:

1. Clark Steel Framing
2. Craco Metals Manufacturing, LLC.
3. Custom Stud, Inc.
4. Dale/Incor.
5. Design Shapes in Steel.
6. Dietrich Metal Framing, a Worthington Industries Company.

7. MarinoWare; a division of Ware Industries
8. United Metal Products, Inc.

2.2 MATERIALS

A. Steel Sheet: ASTM A 1003, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance
2. Coating: G90 or equivalent

2.3 EXTERIOR LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch
2. Flange Width: 1-5/8 inches

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch
2. Section Properties: As indicated on drawings.

2.4 ROOF TRUSSES

A. Roof Truss Members: Manufacturer’s standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges.

1. Minimum Base-Metal Thickness of truss top chord: 0.0538 inch.
2. Minimum Base-Metal Thickness of other than Top Chord: 0.0329 inch, unless noted otherwise on structural drawings.
3. Flange Width: 1-5/8 inches, minimum.

2.5 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.

8. Stud kickers, knee braces, and girts.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36, zinc coated by hot-dip process according to ASTM A 123.

B. Anchor Rods: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent 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.

2.7 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, nonleaching.

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.

2.8 FABRICATION

A. Fabricate cold-formed metal 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 metal framing members by welding, screw fastening, clinch 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 not less than three exposed screw threads.

4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

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 metal 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.

1. 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 wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

B. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

C. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

D. 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.

E. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

F. Install insulation, specified in Division 07 Section "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.

G. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

H. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) 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 LOAD-BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

1. Anchor Spacing: As indicated on drawings.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:

1. Stud Spacing: As indicated.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Anchor studs abutting structural columns to supporting structure as indicated.

F. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

G. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

H. Install horizontal bridging in stud system, spaced as indicated on drawings. Fasten at each stud intersection.

1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of 2 screws into each flange of the clip angle for framing members up to 6 inches deep.

I. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

J. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 TRUSS INSTALLATION

A. Install, bridge, and brace trusses according to Shop Drawings and requirements in this Section.

B. Truss Spacing: As indicated.

C. Do not alter, cut, or remove framing members or connections of trusses.

D. Erect trusses with plane of truss webs plumb and parallel to each other, align, and accurately position at spacings indicated.

E. Erect trusses without damaging framing members or connections.

F. Align webs of bottom chords and load-bearing studs or continuously reinforce tack to transfer loads to structure. Anchor trusses securely at all bearing points.

G. Install continuous bridging and permanently brace trusses as indicated on Shop Drawings and designed according to LGSEA’s Technical Note 551e, “Design Guide for Permanent Bracing of Cold-Formed Steel Trusses.”

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal 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 metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05400

SECTION 05500 - METAL FABRICATIONS

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. Steel framing and supports for ceiling-hung toilet compartments.
2. Steel framing and supports for countertops.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Shelf angles.
6. Loose bearing and leveling plates.
7. Steel weld plates and angles for casting into concrete not specified in other Sections.
8. Structural-steel door frames.
9. Miscellaneous steel trim including steel angle corner guards and steel edgings.
10. Metal bollards.
11. Pipe guards.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Paint products.
3. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Verification: For each type and finish of extruded nosing and tread.

D. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

E. Welding certificates.

F. Qualification Data: For professional engineer.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Provide allowance for trimming and fitting at site.

1.6 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.3 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

D. Rolled-Steel Floor Plate: ASTM A 786, rolled from plate complying with ASTM A 36 or ASTM A 283, Grade C or D.

E. Rolled-Stainless-Steel Floor Plate: ASTM A 793.

F. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface.

1. Available Products:

a. IKG Industries, a Harsco company; Mebac.
b. W. S. Molnar Company; SlipNOT.

G. Steel Tubing: ASTM A 500, cold-formed steel tubing.

H. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

I. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3.

1. Size of Channels: As indicated.
2. Material: Galvanized steel complying with ASTM A 653, structural steel, Grade 33, with G90 coating; nominal thickness.

J. Cast Iron: ASTM A 48, Class 30, unless another class is indicated or required by structural loads.

2.4 NONFERROUS METALS

A. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.

B. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.

C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632, Alloy 6061-T6.

D. Aluminum Castings: ASTM B 26, Alloy 443.0-F.

E. Bronze Plate, Sheet, Strip, and Bars: ASTM B 36, Alloy UNS No. C28000 (muntz metal, 60 percent copper).

F. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).

G. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).

H. Nickel Silver Extrusions: ASTM B 151, Alloy UNS No. C74500.

I. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.5 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.

D. Anchor Rods: ASTM F 1554, Grade 36.

1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

E. Eyebolts: ASTM A 489.

F. Machine Screws: ASME B18.6.3.

G. Lag Bolts: ASME B18.2.1.

H. Wood Screws: Flat head, ASME B18.6.1.

I. Plain Washers: Round, ASME B18.22.1.

J. Lock Washers: Helical, spring type, ASME B18.21.1.

2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 09 painting Sections**.**

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.7 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.8 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

C. Galvanize miscellaneous framing and supports where exposed to the exterior or otherwise indicated.

D. Prime miscellaneous framing and supports with zinc-rich primer where not galvanized.

2.9 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

2.10 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.11 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Prime plates with zinc-rich primer.

2.12 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.13 STRUCTURAL-STEEL DOOR FRAMES

A. Fabricate structural-steel door frames from steel shapes, plates, and bars of size and to dimensions indicated, fully welded together, with 5/8-by-1-1/2-inch steel channel stops, unless otherwise indicated. Plug-weld built-up members and continuously weld exposed joints. Secure removable stops to frame with countersunk machine screws, uniformly spaced at not more than 10 inches o.c. Reinforce frames and drill and tap as necessary to accept finish hardware.

1. Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.

B. Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.

C. Prime exterior steel frames and interior steel frames, where indicated with zinc-rich primer.

2.14 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Prime exterior miscellaneous steel trim and interior miscellaneous steel trim, where indicated with zinc-rich primer.

2.15 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe.

1. Cap bollards with 1/4-inch- thick steel plate.
2. Where bollards are indicated to receive push-button controls for door operators, provide necessary cutouts for push-button controls and hole for wire.

B. Fabricate bollards with 3/8-inch- thick steel base plates for bolting to concrete slab. Drill base plates at all 4 corners for 3/4-inch anchor bolts.

1. Where bollards are to be anchored to sloping concrete slabs, angle base plates for plumb alignment of bollards.

C. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch- thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.

2.16 ABRASIVE METAL THRESHOLDS

A. Cast-Metal Units: Cast gray iron, Class 20, with an integral abrasive finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.

1. Manufacturers:

a. American Safety Tread Co., Inc.
b. Balco Inc.
c. Barry Pattern & Foundry Co., Inc.
d. Granite State Casting Co.
e. Safe-T-Metal Co.
f. Wooster Products Inc.

2. Nosings: Cross-hatched units, 4 inches wide with 1-inch lip, for casting into concrete steps.
3. Nosings: Cross-hatched units, 1-1/2 by 1-1/2 inches, for casting into concrete curbs.
4. Treads: Cross-hatched units, full depth of tread with 3/4-by-3/4-inch nosing, for application over bent plate treads or existing stairs.
5. Thresholds: Fluted-saddle-type units, 5 inches wide by 1/2 inch high, with tapered edges.
6. Thresholds: Fluted-interlocking- (hook-strip-) type units, 5 inches wide by 5/8 inch high, with tapered edge.
7. Thresholds: Plain-stepped- (stop-) type units, 5 inches wide by 1/2 inch high, with 1/2-inch step.

2.17 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.18 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123, for galvanizing steel and iron products.
2. ASTM A 153, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

2.19 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Bright, Directional Satin Finish: No. 4.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.

1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 INSTALLING METAL BOLLARDS

A. Anchor bollards to existing construction with expansion anchors. Provide four 3/4-inch bolts at each bollard, unless otherwise indicated.

1. Embed anchor bolts at least 4 inches in concrete.

B. Fill bollards solidly with concrete, mounding top surface to shed water.

1. Do not fill removable bollards with concrete.

3.5 INSTALLING THRESHOLDS

A. Seal thresholds exposed to exterior with elastomeric sealant complying with Division 07 Section "Joint Sealants" to provide a watertight installation.

3.6 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500

SECTION 06100 - ROUGH CARPENTRY

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. Rooftop equipment bases and support curbs.
2. Wood furring, grounds, nailers, and blocking.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials:

1. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
2. For fire-retardant-treated wood products, include certification by treating plant that treated materials comply with specified standard and other requirements as well as data relative to bending strength, stiffness, and fastener-holding capacities of treated materials.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.
1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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:
1. Wood-Preservative-Treated Materials:

a. Baxter: J. H. Baxter Co.
b. Chemical Specialties, Inc.
c. Continental Wood Preservers, Inc.
d. Hickson Corp.
e. Hoover Treated Wood Products, Inc.
f. Osmose Wood Preserving, Inc.

2.2 LUMBER, GENERAL

A. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.

1. NELMA - Northeastern Lumber Manufacturers Association.
2. SPIB - Southern Pine Inspection Bureau.
3. WWPA - Western Wood Products Association.

B. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

C. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
1. Provide lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

A. General: Where lumber or plywood is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWPA C2 (lumber) and AWPA C9 (plywood). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.
1. For exposed items indicated to receive stained finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

B. Pressure treat aboveground items with waterborne preservatives to a minimum retention of 0.25 lb/cu. ft. (4.0 kg/cu. m). After treatment, kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively. Treat indicated items and the following:
1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing members less than 18 inches (460 mm) above grade.
4. Wood floor plates installed over concrete slabs directly in contact with earth.

C. Complete fabrication of treated items before treatment, where possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

2.4 DIMENSION LUMBER

A. General: Provide dimension lumber of grades indicated according to the ALSC National Grading Rule (NGR) provisions of the inspection agency indicated.

B. Non-Load-Bearing Interior Partitions: Provide framing of the following grade and species:

1. Grade: Standard, Stud, or No. 3.
2. Species: Southern pine; SPIB.

C. Framing Other than Non-Load-Bearing Partitions: Provide framing of the following grade and species:

1. Grade: No. 2.
2. Species: Southern pine; SPIB.

2.5 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.

B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.

C. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.

D. Grade: For dimension lumber sizes, provide No. 3 or Standard grade lumber per ALSC's NGRs of any species. For board-size lumber, provide No. 3 Common grade per NELMA, NLGA, or WWPA; No. 2 grade per SPIB; or Standard grade per NLGA, WCLIB or WWPA of any species.

2.7 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of Type 304 stainless steel.

B. Nails, Wire, Brads, and Staples: FS FF-N-105.

C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M)

F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Discard units of material with defects that impair quality of rough carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.

B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.

C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.

D. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with Georgia State minimum building codes.

F. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.

G. Use hot-dip galvanized or stainless-steel nails where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity.

H. Countersink nail heads on exposed carpentry work and fill holes with wood filler.

3.2 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

A. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attaching other work. Form to shapes shown and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

3.3 WOOD FURRING

A. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

END OF SECTION 06100

SECTION 07210 - BUILDING INSULATION

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. Concealed building insulation.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of insulation product specified.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products complying with requirements indicated without delaying the Work.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated on Drawings or specified elsewhere in this Section 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.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering insulation products that may be incorporated in the work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide insulation products by one of the following:

1. Glass-Fiber Insulation:

a. CertainTeed Corporation.
b. Knauf Fiber Glass GmbH.
c. Owens-Corning Fiberglas Corporation.

d. Schuller International, Inc.
e. Johns-Manville.

2.2 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

B. Faced Mineral-Fiber Blanket Insulation: Thermal insulation combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665, Type III, Class A (blankets with reflective vapor-retarder membrane facing and flame spread of 25 or less);

C. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics. Provide with maximum recycled content available.

2.3 AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

B. Protection Board: Pre-molded, semirigid asphalt/fiber composition board, 1/4 inch (6 mm) thick, formed under heat and pressure, standard sizes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or that interfere with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, unsoiled, and has not been exposed at any time to ice and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Seal joints between closed-cell (nonbreathing) insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.

1. Tape joints and ruptures in vapor retarder and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

D. Set reflective, foil-faced units with not less than 0.75-inch (19-mm) air space in front of foil as indicated.

1. Use blanket widths and lengths that fill cavities formed by framing members. Where more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

3.5 PROTECTION

A. General: Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07210

SECTION 07221 - METAL ROOF INSULATION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide all labor, equipment, and materials to install roof insulation over the properly prepared deck substrate.

1.2 RELATED SECTIONS

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

B. Related work specified elsewhere:

1. Division 7 Section "Standing seam roof panels."
2. Division 7 Section "Flashing and Sheet Metal."
3. Division 7 Section “Roof Specialty and Accessory Items."

1.3 REFERENCES

ASTM A-167-94a	Specification for Stainless and Heat-Resisting Chromium Nickel Steel Plate, Sheet and Strip
ASTM A-653	Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process
ASTM B-29	Pig Lead
ASTM B-32	Solder Metal
ASTM C-165-95	Test Method for Measuring Compressive Properties of Thermal Insulation
ASTM C-208-95	Specifications for Cellulosic Fiber Insulating Board
ASTM C-209-92	Test Method for Cellulosic Fiber Insulating Board
ASTM C-272-91	Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
ASTM C-36	Specification for Gypsum Wallboard
ASTM C-518-91	Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C-578-92	Specification for Rigid, Cellular, Polystyrene Thermal Insulation
ASTM C-728-91	Specification for Perlite Thermal Insulation Board
ASTM D-5	Test Method for Penetration of Bituminous Materials
ASTM D-36	Test Method for Softening Point of Bitumen (Ring and Ball Apparatus)
ASTM D-312	Specification for Asphalt Used in Roofing
ASTM D-412-92	Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension
ASTM D-1621-94	Test Method for Compressive Properties of Rigid Cellular Plastics
ASTM D-1622	Test Method for Apparent Density of Rigid Cellular Plastics
ASTM D-1863	Specification for Mineral Aggregate Used on Built-Up Roofs
ASTM D-2126-94	Test Method for Response off Rigid Cellular Plastics to Thermal Humid Aging
ASTM D-2178	Standard Specification for Asphalt Glass Felts used in Roofing and Waterproofing
ASTM D-4601-94	Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing
ASTM D-5147	Sampling and Testing Modified Bituminous Sheet Material
CISPI	Cast Iron Soil Pipe Institute, Washington, D.C.
FM	Factory Mutual System, Norwood, Massachusetts

NRCA	National Roofing Contractors Association, Chicago, IL
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SDI	Steel Deck Institute, St. Louis, Missouri
SPIB	Southern Pine Inspection Bureau, Pensacola, Florida
UL	Underwriter's Laboratories, Inc., Northbrook, Illinois
FS HH-I-1972	Insulation Board, Polyisocyanurate
FS LLL-1-535B	Insulation Board, Thermal (Fiberboard)
WH	Warnock Hersey International, Inc., Middletown, Wisconsin

1.4 SUBMITTALS

A. Submit under provisions of Section 01300 - Submittals.

B. Product Data: Provide manufacturer's specification data sheets for each product.

C. Provide approval letters from insulation manufacturer for use of their insulation within this particular roofing system type.

D. Provide a sample of each insulation type.

E. Shop Drawings

1. Submit manufacturer's shop drawings indicating complete installation details of insulation system, including identification of each insulation block, sequence of installation, layout, roof slopes, thicknesses, crickets and saddles.
2. Shop drawing shall include: Outline of roof, Roof slope, complete board layout of insulation components, thickness and the average "R" value for the completed insulation system.

F. Certification

1. Submit roof manufacturer's certification that insulation fasteners furnished are acceptable to roof manufacturer.
2. Submit roof manufacturer's certification that insulation furnished is acceptable to roofing manufacturer as a component of roofing system and is eligible for roof manufacturer's system warranty.
3. Submit certification that insulation and fastening system furnished is Tested and Approved by Factory Mutual for 1-90 Wind Up-Lift Requirements.

1.5 QUALITY ASSURANCE

A. Fire Classification, ASTM E-108

B. Submit certification that the roof system furnished is approved by Factory Mutual, Underwriters Laboratories or Warnock Hersey for external Fire E-108 Class 1A and that the roof system is adhered properly to meet or exceed 1-90.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site with seals and labels intact, in manufacturer's original containers, dry and undamaged.

B. Store all insulation materials in a manner to protect them from the wind, sun and moisture damage prior to and during installation. Any insulation that has been exposed to any moisture shall be removed from the project site.

C. Keep materials enclosed in a watertight, ventilated enclosure (i.e. tarpaulins).

D. Store materials off the ground. Any warped, broken or wet insulation boards shall be removed from the site.

PART 2 - PRODUCTS

2.1 APPROVED EQUIVALENT

A. Contractor must submit any product not specified a minimum five days before the bid date to Architect in order for product to be considered for approval. The Architect will notify Contractor in writing of decision to accept or reject request.

2.2 INSULATION MATERIALS

A. Provide thicknesses of insulation as indicated, provide combination of types and thicknesses to provide a complete system.

1. RIGID POLYISOCYANURATE ROOF INSULATION

a. Metal Roof Insulation Qualites: Rigid, closed cell Polyisocyanurate foam core with radiant barrier quality reinforced aluminum foil facers on both sides. Tape all seams with foil tape by same manufacturer.

1. Thickness: 4.25 in.
2. R-Value: Minimum 25.0

b. Source

1. Johns Manville ENRGY 3
2. Ultra Gard Gold II by Schuller Roofing Systems
3. GAFTEMP Isotherm R by GAF
4. Atlas Roofing Corp. – AC Foam Supreme
5. R-Max – Multimax FA
6. Dow – Tuff-R

2. Insulation board shall meet the following requirements

1. UL, WH or FM listed under Roofing Systems
2. Federal Specification HH-I-1972, Class 1

3. Physical Properties

Dimensional Stability	ASTM D-2126	2% max.
Compressive Strength	ASTM D-1621	25 psi min.
Vapor Permeability	ASTM E-96	1 perm max.
Foam Core Density	ASTM D-1622	2.0 pcf min.
Water Absorption	ASTM C-209	<1%

2.3 RELATED MATERIALS- where applicable

A. Fiber Cant and Tapered Edge Strips: Performed rigid insulation units of sizes/shapes indicated, matching insulation board or of perlite or organic fiberboard, as per the approved manufacturer.

1. Acceptable Manufacturers
   a. Celotex
   b. Johns Manville
   c. International Permalite, Inc.

d. Approved Equivalent

B. Protection Board: Premolded semi-rigid asphalt composition board ½ in.

C. Roof Board Joint Tape: 6" wide glass fiber mat with adhesive compatible with insulation board facers.

D. Asphalt: ASTM D-312, Type III Steep Asphalt.

E. Metal Deck Foam Adhesive: Type recommended by insulation manufacturer and approved by FM and UL for indicated ratings.

F. Fasteners

1. Corrosion resistant screw fastener as recommended by roof membrane manufacturer.
2. Factory Mutual Tested and Approved with 3 in. coated disc for 1-90 rating, length required to penetrate metal deck one inch.
3. Minimum pull out resistance of 800 lbs.

PART 3 - EXECUTION

3.1 INSPECTION OF SURFACES

A. Roofing contractor shall be responsible for preparing an adequate substrate to receive insulation.

1. Verify that work which penetrates roof deck has been completed.
2. Verify that wood nailers are properly and securely installed.
3. Examine surfaces for defects, rough spots, ridges, depressions, foreign material, moisture, and unevenness.
4. Do not proceed until defects are corrected.
5. Do not apply insulation until substrate is sufficiently dry.
6. Broom clean substrate immediately prior to application.
7. Use additional insulation to fill depressions and low spots that would otherwise cause ponding water.
8. Verify that temporary roof has been completed.

3.2 INSTALLATION

A. Attachment with Mechanical Fasteners.

1. This is for the areas of that have slope metal decking. Approved polyisocyanurate insulation board shall be fully attached to the deck with an approved mechanical fastening system. As a minimum, the amount of fasteners shall be in accordance with manufacturer's recommendation for FM 1-90 approved system.
2. Filler pieces of insulation require at least two fasteners per piece if size of insulation is less than four square feet.
3. Spacing pattern of fasteners shall be as per manufacturer's recommendations to meet the FM requirements. Placement of any fastener from edge of insulation board shall be a minimum of three inches, and a maximum of six inches.
4. Minimum penetration into deck shall be as recommended by the fastener manufacturer. There is a one inch (1") minimum for metal, wood and structural concrete decks where not specified by the manufacturer.

3.3 CLEANING

A. Remove debris and cartons from roof deck. Leave insulation clean and dry, ready to receive roofing membrane.

END OF SECTION

SECTION 07240 DAMP-PROOFING FOR EXTERIOR SHEATHING

PART I – GENERAL

1.01 SUMMARY

This document contains all the manufacturer's requirements for the proper design, use, and installation of the dryvit backstop nt - smooth or texture air/water-resistive barrier. This document is intended to be used in conjunction with:

A. Ds300 - backstop nt application instructions for use beneath claddings other than dryvit eifs
B. Ds806 - backstop nt product data sheet for use beneath claddings other than dryvit eifs

1.02 REFERENCES

1. Astm c 297 standard test method for flatwise tensile strength of sandwich constructions
2. Astm c 1177 standard specification for glass mat gypsum substrate for use as sheathing
3. Astm c 1396 (formerly c 79) standard specification for gypsum board
4. Astm d 522 standard test methods for mandrel bend test of attached organic coatings
5. Astm d 2370 standard test method for tensile properties of organic coatings
6. Astm d 2247 (federal test standard 141a method 6201) standard practice for testing water resistance of coatings in 100% relative humidity
7. Astm e 72 standard methods for conducting strength tests of panels for building construction
8. Astm e 84 standard test method for surface burning characteristics of building materials
9. Astm e 96 standard test methods for water vapor transmission of materials
8. Astm e 283 standard test method for determining rate of air leakage through exterior windows, curtain walls and doors under specified pressure differences across the specimen
10. Astm e 331 test method for water penetration of exterior windows, skylights, doors and curtain walls by uniform static air pressure difference
11. Astm e 1233 standard test method for structural performance of exterior windows, curtain walls and doors by cyclic air pressure differential
12. Astm e 2178 standard test method for air permeance of building materials
13. Astm e 2357 standard test method for determining air leakage of air barrier assemblies
14. Astm e 2134 test method for evaluating the tensile-adhesion performance of exterior insulation and finish systems (eifs)
15. Astm e 2485 (formerly eima std. 101.01) standard test method for freeze-thaw resistance of exterior insulation and finish systems (eifs) and water-resistive barrier coatings
16. Astm e 2570 standard test methods for evaluating water-resistive barrier (wrb) coatings used under exterior insulation and finish systems (eifs) or eifs with drainage
17. Aatcc test method 127-2008 water resistance: hydrostatic pressure test
18. Federal specification tt-c-555b resistance to wind-driven rain

1.03 DEFINITIONS

B. Sheathing: a substrate in sheet form.
C. Substrate: the material to which the backstop nt smooth or texture is applied.
D. Substrate system: the total wall assembly including the attached substrate to which the backstop nt – smooth or texture is applied.
E. Air/water-resistive barrier materials: a combination of backstop nt smooth or texture and dryvit grid tape with aquaflash® liquid and aquaflash® mesh or dryvit flashing tape™ and flashing tape conditioner™.

1.04 DESCRIPTION

A. General: dryvit backstop nt is available in smooth and texture and is a flexible polymer based, noncementitious, protective coating used as an air/water-resistive barrier when applied over acceptable exterior substrates.
B. Design requirements
   1. Apply at all exterior sheathing
   2. Backstop nt shall not be exposed to weather for longer than 30 days prior to being covered.
   3. Deflections of the substrate systems shall not exceed 1/240 times the span.

1.05 SUBMITTALS

A. Product data – the contractor shall submit to the owner/architect manufacturer's product data sheets describing products that will be used on this project.
B. Samples – as required for the specific cladding specified.

1.06 QUALITY ASSURANCE

A. Qualifications
   1. Product manufacturer: shall be dryvit systems, inc. All materials shall be manufactured or sold by dryvit and shall be purchased from dryvit or its authorized distributor.
      A. Materials shall be manufactured at a facility covered by a current iso 9001:2008 and iso 14001:2004 certification. Certification of the facility shall be done by a registrar accredited by the american national standards institute, registrar accreditation board (ansi-rab).
   2. Contractor: shall be experienced and competent in the waterproofing trade.
B. Certification
   1. Backstop nt shall be recognized for the intended use by the applicable building code(s).

1.07 DELIVERY, STORAGE, AND HANDLING

A. All dryvit materials shall be delivered to the job site in the original, unopened packages with labels intact.
B. Upon arrival, materials shall be inspected for physical damage, freezing, or overheating. Questionable materials shall not be used.
C. Materials shall be stored at the job site in a cool, dry location, out of direct sunlight, protected from inclement weather and other sources of damage. Minimum storage temperature shall be 4 °c (40 °f).

1.08 PROJECT CONDITIONS

A. Environmental requirements
   1. Application of wet materials shall not take place during inclement weather unless appropriate protection is provided. Protect materials from inclement weather until they are completely dry.
   2. At the time of application of backstop nt, the minimum air and wall surface temperatures shall be 4 °c (40 °f) and rising. These temperatures shall be maintained, with adequate air ventilation and circulation, for a minimum of 12 hours thereafter, or until the products are dry.
B. Existing conditions – the contractor shall have access to electric power, clean water, and a clean work area at the location where the dryvit backstop nt materials are to be applied.

1.09 SEQUENCING AND SCHEDULING

A. Installation of the dryvit backstop nt shall be coordinated with other construction trades.

1.10 LIMITED MATERIALS WARRANTY

A. Manufacturer's standard warranty.

PART II PRODUCT

2.01 MANUFACTURER

A. Damproofing for Exiterior Sheathing system: Dryvit Backstop NT or prior approved equal. Prior approval is required per Supplementary General Conditions, and alternate manufacturers must be approved per written and issued addendum a minimum of fifteen (14) days prior to the bid date. Approved Manufacturers, meeting the requirements of this specification, are as follows.

1. StoGuard by Sto Corp.
2. Prosoco R-Guard

2.02 COMPONENTS

A. Air/water-resistive barrier components:
   1. Dryvit backstop nt: a flexible, polymer-based, noncementitious, water-resistive coating available in smooth and texture.
   2. Dryvit grid tape™: an open weave fiberglass mesh tape with pressure sensitive adhesive available in rolls 102 mm (4 in) wide by 91 m (100 yds) long.

B. Flashing materials: used to protect substrate edges at terminations.
   1. Liquid applied: an extremely flexible water-based polymer material, ready for use.
      A. Shall be aquaflash® liquid and aquaflash mesh
   2. Sheet type:
      A. Shall be flashing tape and surface conditioner
         1) dryvit flashing tape™: a high density polyethylene film backed with a rubberized asphalt adhesive available in rolls 102 mm (4 in), 152 mm (6 in) and 229 mm (9 in) wide by 23 m (75 ft) long.
         2) dryvit flashing tape surface conditioner™: a water-based surface conditioner and adhesion promoter for the dryvit flashing tape.

PART III EXECUTION
3.01 EXAMINATION

A. Prior to application of backstop nt the contractor shall verify that the substrate:
   1. Is of a type listed in section 1.04.b.1.
   2. Is flat within 6.4 mm (1/4 in) in a 1.2 m (4 ft) radius.
   3. Gaps do not exceed 6.4 mm (1/4 in). Larger gaps shall be corrected by replacing sheathing material.
   4. Is sound, dry, connections are tight; has no surface voids, projections, or other conditions that may interfere with the application of backstop nt.

B. Ambient and surface temperatures are minimum 4 °c (40 °f) and rising.

C. The contractor shall notify the general contractor and/or architect and/or owner of all discrepancies. Work shall not proceed until discrepancies have been corrected.

D. All roof/wall intersections, decks, balconies and other attachments, as well as eves, chimneys, mechanical equipment, signage etc. Are properly flashed to divert water to the outside of the cladding.

E. All openings and penetrations are properly flashed and wrapped with the air/water-resistive barrier to prevent water intrusion damage.

3.02 SURFACE PREPARATION

A. The backstop nt materials shall be protected by permanent or temporary means from inclement weather and other sources of damage prior to, during, and following application until completely dry.
B. Protect adjoining work and property during application of backstop nt.
C. The substrate shall be prepared as to be free of foreign materials such as oil, dust, dirt, paint, wax, water repellents, moisture, frost and any other materials that inhibit adhesion.

3.03 INSTALLATION

A. Backstop nt – smooth
   1. General: backstop nt – smooth is used in conjunction with dryvit backstop nt - texture joint treatment and shall be applied in accordance with current, published dryvit backstop nt application instructions for use beneath claddings other than dryvit eifs, ds300.
   2. Backstop nt – smooth is ready to use after an initial spin-up using a "twister" paddle or equivalent mixing blade, powered by a 12.7 mm (1/2 in) drill, at 450 – 500 rpm. Do not add cement or any other additive.
   3. Prior to backstop nt – smooth application, sheathing joints, including inside and outside corners, shall be treated with backstop nt – texture and dryvit grid tape. All fastener heads shall also be spotted with backstop nt – texture. Refer to backstop nt application instructions for use beneath claddings other than dryvit eifs, ds300, for complete details. Allow to dry a minimum of 2 hours or until dry to the touch. Cool humid conditions will require longer drying time.
   4. Apply backstop nt smooth over the entire wall surface, including previously treated fasteners and sheathing joints. Refer to the chart on the backstop nt product data sheet for use beneath claddings other than dryvit eifs, ds806, or application instructions for use beneath claddings other than dryvit eifs, ds300, for proper tools and respective coverage.
   5. Allow to dry a minimum of 24 hours prior cladding installation. Cool damp weather will require longer drying times.
   6. Install the specified dryvit exterior insulation and finish system per published installation instructions for the specific system being used. Application shall not exceed 400 square feet per pail. Min 12 DFT

3.04 FIELD QUALITY CONTROL

A. The contractor shall be responsible for the proper application of the dryvit materials.
B. The contractor and general contractor shall review and follow the backstop nt application instructions for use beneath claddings other than dryvit eifs, ds300.

3.05 CLEANING

A. All excess dryvit materials shall be removed from the job site by the contractor in accordance with contract provisions.
B. All surrounding areas, where dryvit materials have been installed, shall be left free of debris and foreign substances resulting from the contractor’s work.

3.06 PROTECTION

A. The dryvit materials and the project shall be protected from damage and inclement weather until dry.
   1. The dryvit backstop nt – smooth or texture shall not be exposed for longer than 30 days prior to being covered with the specified building cladding.

End of Section 07240

SECTION 07411 - ARCHITECTURAL METAL ROOF PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Work Included: The contractor shall provide all material, labor, administration, and other items necessary to provide a complete architectural structural batten standing seam metal roof system complying with performance requirements indicated and capable of withstanding structural movement, thermally induced movement and exposure to weather without failure or infiltration of water into the building interior.
B. Coordinate architectural standing seam metal roof system with roofing substructure work.
C. Documents affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary General Conditions, and Sections in Division 1 of these Specifications.
D. One Manufacturer shall provide all work associated this section and section 07415 - Preformed Metal Wall panel system

1.2 SUMMARY

A. This Section includes the following:
1. Preformed and prefinished manufacturer's fully engineered architectural standing seam metal roof system with continuous interlocking seams, concealed clips and fastening devices.
2. Color coordinated ridge, hip, valley, gable, eave, corner, rake, headwall, counter flashings and miscellaneous flashings, attaching devices, gutters and downspouts.
3. Provide concealed clips, fasteners, metal closures, factory and field applied sealants as necessary to meet design criteria and ensure a weather tight installation.
4. Bituthane membrane underlayment.

B. Related Sections include the following:
1. Division 1 Section “Alternates” for description of alternates related to the metal roof system.
2. Division 5 Section "Steel Deck" for steel roof deck supporting metal roof panels.
3. Division 5 Section "Cold-Formed Metal Framing" for secondary support framing supporting metal roof panels.
4. Division 6 Section "Rough Carpentry" for nailers and miscellaneous blocking.
5. Division 7 Section "Metal Wall Panels" for factory-formed metal wall and soffit panels.
6. Division 7 Section “ Metal roof insulation
7. Division 7 Section "Sheet Metal Flashing and Trim" for copings, flashings and other sheet metal work not part of the architectural standing seam metal roof system.
8. Division 7 Section "Joint Sealants" for field-applied sealants not otherwise specified in this Section.

1.3 DEFINITIONS

A. Architectural Standing Seam Metal Roof System Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, thermal insulation, underlayment, gutters, downspouts and accessories necessary for a complete weather tight roofing system.

1.4 SYSTEM DESCRIPTION

A. DESIGN REQUIREMENTS:
1. The architectural standing seam metal roof system, including: panels, flashings, attachment clips and attachment screws shall be designed by the standing seam metal roof system manufacturer to meet the local building code. The design criteria shall include the following:
   a. Listing of applicable loads.
   b. Listing of the building importance factor (life safety factor).
   c. Design wind speed.

d. Building exposure factor.
e. Other necessary criteria.

2. The architectural standing seam metal roof manufacturer shall provide an engineered analysis of the roofing system assembly, sealed by a registered professional Engineer employed by the manufacturer, verifying that the product and attachment methods will resist wind pressures imposed upon it pursuant to the applicable building codes and that the standing seam metal roof system fully complies with all specified requirements.
3. The architectural standing seam metal roof system shall bear fully documented proof that it has been independent laboratory evaluated using the U.S. Army Corps of Engineers Guide Specification (CEGS) 07416.
   a. "Proof" shall be defined as both the manufacturer and the product being included in the document entitled, "List of Approved Standing Seam Metal Roof Systems" as published by the U.S. Corps of Engineers.
4. Provide UL-90 rated roofing panels that have been tested in accordance with UL 580 protocol.
5. Provide factory preformed architectural standing seam metal roofing system that has been pretested and certified by the manufacturer to comply with specified requirements under installed conditions.
6. Provide one-piece, single length roof panels without need for interior laps or splices.
7. Provide continuously interlocking architectural standing seam metal roofing panels that inherently increases load span capability, stiffness and flexural stress handling capacity.
8. Provide architectural standing seam metal roof panel capable of spanning 3'-0" spacing and maintaining a UL 90 wind uplift rating.
9. Provide continuous factory installed hot melt butyl sealant within the confines of the architectural standing seam metal roofing panel female rib. Loose gaskets and field applied panel sealants are unacceptable.
10. Provide factory preformed architectural standing seam roof panels that have been tested and approved for a Class 4 Impact (Hail) resistance rating per UL 2218. Listing shall be present on the Underwriters Laboratories website.
11. On-site, mechanically seamed or field roll formed panels are not acceptable.

D. Thermal Movement: Provide metal roof panel assemblies that allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss. Exposed fasteners in roofing panels are not permitted.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F at material surfaces.

E. Structural Requirements:
   1. Panel structural properties determined in accordance with latest edition of American Iron and Steel Institute's "Cold Formed Steel Design Manual" using "effective width" concepts.
   2. Wind uplift design for roof assemblies shall be calculated by the architectural standing seam metal roof system manufacturer per ASTM E 1592. Calculations shall include establishment of ultimate and allowable roof system uplift capacities for both the "field" and "areas of discontinuity".
   3. Provide confirmation of positive and negative buckling moments and uplift capacity determined by full-scale testing.

F. ENVIRONMENTAL REQUIREMENTS: Actual independent laboratory certified test results must be submitted.
   1. Resistance to air infiltration: Snapseam™ – .004 cfm per linear foot of joint when tested in accordance with ASTM E 1680 at static test pressure differential of 12.00 psf.
   2. Resistance to water infiltration: Snapseam™ – No leakage through panel joints when tested in accordance with ASTM E 1646 at static test pressure differential of 6.24 psf.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's specifications, engineered and sealed shop drawings, installation instructions and certified test reports.

B. Shop Drawings:
1. Submit three (3) sets of approval / design drawings produced by the architectural standing seam metal roofing system manufacturer indicating thickness and dimensions of parts, fastening, flashing conditions, gutters, downspouts, roof curbs, gutter baffles, snow guards and anchoring methods, details and locations of seams, transitions and other provisions necessary for thermal expansion and contraction and weathertightness.
2. Indicate roof terminations, clearly showing flashings and change of direction caps.
3. Clearly indicate locations and types of field and factory applied sealants.
4. Show locations, spacing patterns and types of hold-down clips and fasteners.
5. Provide full size 24"x36" blue line or AutoCAD produced drawings provided by the architectural standing seam metal roofing system manufacturer showing a complete roof plan, roof panel layout and cross section details of every individual flashing condition for the entire roofing system. Section cut details to be minimum 1-1/2" inches per 12 inch scale.
6. Architectural drawings indicate size, profiles and dimensional requirements of architectural standing seam metal roofing panels required and are based upon the Snapseam system as manufactured by AEP-Span. Do not modify intended aesthetic effects, as judged solely by the Architect, except with Architects' written approval. Refer to Division 1 Section "Product Requirements". If modifications are proposed, submit comprehensive explanatory data to Architect a minimum of fifteen (15) days prior to the bid date for review and prior written approval. Any modifications will be put forth in a written and issued addendum.

C. Engineered Design Calculations:
1. Submit panel system manufacturer's design calculations verifying the panel system meets the design criteria specified.
2. Design calculations shall be sealed by a professional Structural Engineer employed by the manufacturer of the panel system and licensed to practice in the jurisdiction where the Project is located.

D. Samples for Initial Selection: For each type of metal roof panel indicated with factory-applied color finishes.
1. Include similar Samples of trim and accessories involving color selection.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
1. Architectural Standing Seam Metal Roof Panels: 12 inches long by actual panel width. Include fasteners, clips, closures, and other metal roof panel accessories.
2. Trim and Closures: 12 inches long. Include fasteners and other accessories.
3. Accessories: 12-inch long Samples for each type of accessory.
4. A 12-by-12-inch square of roof insulation.
5. Six insulation fasteners of each type, length, and finish.
6. Submit color samples on minimum 12" x 12" metal chips for Architect's approval.

F. Certification:
1. Submit manufacturer's certification that materials and finishes meet specified requirements for air infiltration, water penetration, thermal movement, and structural performance.
2. Submit written verification of Panel Applicator's factory installation training performed by the architectural standing seam metal roofing system manufacturer and a copy of the Panel Applicator's "Authorized Applicator" certificate.

G. Maintenance Data: For metal roof panels to include in maintenance manuals.

H. Warranties: Special warranties specified in this Section.

1.06 QUALITY ASSURANCE:

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical roof area and eave including fascias shown on Drawings;, including attachments underlayment and accessories.
1. Build mockups for typical roof area only, including accessories.

a. Size: 6 feet long by 6 feet

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

B. Panel Applicator Qualifications:
1. Panel Applicator must have a minimum of five (5) years experience in the successful application of architectural structural batten standing seam metal roofing systems.
2. Panel Applicator must be factory trained and authorized by the architectural standing seam metal roofing system manufacturer prior to the bid date in order to obtain a contract for installation.
3. Use adequate members of skilled workers 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 in this Section.
4. Use equipment of adequate size, capacity and numbers to accomplish the Work of this Section in a timely manner.
5. Upon request, submit a minimum of five (5) successfully completed projects of similar size and scope. List project address, date of installation with Architect and Owners names and telephone numbers.
6. The Roofing System Manufacturer will provide weekly inspections of the roofing system throughout installation. Inspection shall be conducted by an employee of the manufacturer that is not in sales nor has sales responsibility. Inspector shall be a technical inspector of the company. Weekly reports shall be copied directly to the Architect.

C. Manufacturer's Qualifications:
1. Minimum twenty (20) years experience in the fabrication of architectural standing seam metal roofing systems on projects of similar size and scope. Upon request, submit a minimum of five (5) projects references for Architect's review. List project address, date of installation with Architect and Owners names and telephone numbers.
2. Products listed in this specification are as manufactured by AEP-Span.
3. No other manufacturer of architectural standing seam metal roofing systems will be accepted without prior written approval of the Architect based upon the manufacturer verifying the products can meet or exceed all specified performance criteria listed in these specifications.
4. Requests to be listed as an approved manufacturer must be submitted in writing a minimum of fifteen (15) days prior to bid date and be accompanied by product literature, technical information, sealed Engineer's calculations verifying conformance and a product sample. Approved manufacturers will only be set forth in a written and issued addendum.
5. No substitutions will be permitted after the bid date.

D. Single Source Responsibility: Provide all items of architectural standing seam metal roofing system work specified herein by a single roofing contractor to provide undivided responsibility.

E. Pre-installation Conference:
1. Convene a pre-installation conference prior to commencing Work of this Section.
2. Attendants: Panel Applicator, installers for each component of associated work, installers of deck or substrate construction to receive roofing system work, General Contractor, Architect, Owner or Own-

er's Representative and architectural standing seam metal roofing manufacturer's technical representative.

3. Record discussion, decisions and agreements reached and furnish a copy to each attendant.
4. Review installation procedures and coordination required with related Work.
5. Tour representative areas of roofing substrates, inspect and discuss condition of substrates, roof drains, curbs, penetrations, wood nailers and other preparatory Work performed by other trades.
6. Review structural loading limitations of roofing substrate and inspect substrate for loss of flatness and as required for mechanical fastening.
7. Review architectural standing seam metal roofing system requirements (approved manufacturer's shop drawings, specifications and other contract documents).
8. Review required submittals.
9. Review and finalize construction schedule related to architectural standing seam metal roofing system work and verify availability of material, Panel applicator's personnel, equipment and facilities needed to avoid delays.
10. Review weather and forecasted weather conditions and procedures for coping with unfavorable weather conditions, including possibility of temporary roofing.
11. Verify locations of roof framing and roof opening dimensions by field measurements before metal roof panel fabrication and indicate measurements on manufacturer's approved Shop Drawings.
12. General Contractor to document the meeting with written minutes and copy all in attendance.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
1. Delivery of material shall be made only after suitable facilities for its storage and protection are available at the Project site.
2. Protect products and accessories from damage and discoloration during transit and at project site.
3. Upon receipt of preformed and prefinished architectural standing seam metal roofing panels, flat sheets, flashings and panel accessories; Panel Applicator shall examine each container for damage during transit and completeness of the consignment.

B. Storage:
1. Store materials out of the weather in a clean, dry place. One end of each container should be slightly elevated and covered with a loose weatherproof covering to prevent condensation.
2. Panels and/or flashings with strippable film must not be stored in areas exposed to direct sunlight.
3. Care should be taken to prevent contact with any substance that may cause discoloration.
4. Store materials to provide ventilation and prevent bending, abrasion or twisting.
5. Do not overload roof structure with stored materials. Do not permit material storage or foot traffic on completed roof surfaces.

C. Handling:
1. Care should be taken to avoid gouging, scratching or denting.
2. Do not allow foot traffic on completed roof. If required, provide cushioned walk boards.
3. Protect installed products from damage caused by foreign objects and other trades until completion of the project.
4. Comply with pertinent provisions of Supplementary General Conditions.

1.08 WARRANTIES

A. Substrate Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of architectural standing seam metal roofing system that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Structural failures, including rupturing, cracking, or puncturing.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Period: Twenty (20) years from date of Substantial Completion.

B. Panel Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair, refinish or replace architectural standing seam metal roofing system panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Fluoropolymer (Kynar-500) Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading or color change in excess of 5 NBS units as measured per ASTM D 2244-68;
      b. Will not Chalk in excess of a Numerical rating of 7 when measured in accordance with standard procedures specified in ASTM D 659-74;
      c. Will not crack, peel or delaminate.
   2. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

C. Workmanship Warranty: Furnish a written warranty signed by the Panel Applicator guaranteeing materials and workmanship.
   1. Warranty Period: Two (2) years from date of Substantial Completion.

D. Special Weather Tightness Warranty: Furnish architectural standing seam metal roofing system manufacturer's full system, non-prorated, no dollar limit weather tightness warranty, jointly signed by the manufacturer and Panel Applicator, agreeing to repair or replace architectural standing seam metal roofing panels or flashings that fail to remain weather tight within the specified warranty period.
   1. Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 5 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Architectural standing seam metal roofing system: AEP-SPAN or prior approved equal. Prior approval is required per Supplementary General Conditions, and alternate manufacturers must be approved per written and issued addendum a minimum of fifteen (14) days prior to the bid date.
Approved Manufacturers, meeting the requirements of this specification, are as follows.

   1. Metal Sales Manufacturing Corp
   2. Firestone/UNA-CLAD
   3. MBCI - Lokseam
   4. McElroy Metal – Medallion-Lok
   5. Peterson Aluminum – Pac Clad
   6. Architectural Metal Systems
   7. Imetco

B. BITUTHANE MEMBRANE WATERPROOF UNDERLAYMENT:
   1. Grace “Ice and Water Shield – 40 mil.

2.02 MATERIALS:

A. PANELS:
   1. Panels shall be 24 gage with Fluoropolymer (Kynar 500) Finish.
   2. Factory fabricated panel with integral continuous overlapping seams suitable for continuous locking or crimping by mechanical means during installation. Onsite, mechanically seamed or field roll formed panel profiles will not be acceptable.
   3. Seam Size:
      a. Male leg: 1-3/8" high, on SN-16" (Snapseam™ System).
      b. Female leg: 1-3/4" high, on SN-16" (Snapseam™ System).
   4. Provide factory installed, high grade, hot-melt elastomeric sealant, within the confines of female seam flange, on bottom edge of female seam flange, designed to seal against adjacent male panel leg.
   5. Acceptable architectural standing seam metal roofing system: SN-16" (Snapseam™ System) as manufactured by AEP Span.

B. CLIP/FASTENER ASSEMBLIES:
1. Typical clip, UL 90 requirements:
a. UL-90 Fasteners: as per approved manufacturer's engineered shop drawings.
b. UL Rated Clip: 16 gage galvanized steel hook with structural base embossments to raise the panel slightly off the substrate to reduce condensation.
c. Bearing Plates: minimum 4"x6" by 22 gage flat notched and slotted bearing plates for use under the clip assembly to distribute point loads and prevent indentation into the insulation.
2. Standard Fasteners: Same as UL 90 fasteners specified above.

C. ACCESSORIES: To match roof in finish.
1. Provide manufacturer's standard accessories and other items essential to completeness of architectural standing seam roof installation.
2. Roof Jacks: Manufacturer's standard EPDM with an aluminum sealing base ring; for openings twelve (12) inches or smaller.
3. Roof Curbs: fabricated to the specifications of the architectural standing seam metal roof manufacturer, thereby assuring compatibility with the roof construction framing and covering. Roof curbs shall be of sufficient size and design to coordinate with requirements for support of heat and smoke vents specified in another Division 7 Section. Roof curb flashing and framing shall provide for the expected expansion and contraction of the architectural standing seam metal roofing system.
4. Gutters and downspouts will be fabricated, and supplied by the same manufacturer, to the same gage and specification as panel.

D. FIELD SEALANTS:
1. Color coordinated primerless silicone, urethane, or high-grade, nondrying butyl as recommended and engineered by panel manufacturer.
2. Do not use sealants containing asphalt.

E. BITUTHANE MEMBRANE WATERPROOF UNDERLAYMENT:
1. Flexible, self-adhering rubberized asphalt sheet membrane with a polymeric film on the surface and a removable silicone-treated release sheet on the adhesive side
2. Bituthane membrane underlayment shall be rated for a minimum temperature resistance of up to 260 degrees F.
3. Bituthane membrane shall have a maximum permeance rating of 0.05 perms.
4. Minimum thickness shall be 40 mils.
5. Granular surfaced membranes are not acceptable.

F. POLYISOCYANURATE RIGID INSULATION:

See section 07221 for full requirements of Metal Roof Insulation. Coordinate this section with requirements.

2.03 ACCESSORIES

A. Architectural standing seam metal roof system panel accessories: Provide components required for a complete architectural standing seam metal roofing system including, but not limited to: flashings, copings, fasciae, corner units, ridge vents and ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels, unless otherwise indicated.
1. Vents: Provide vents at ridges, fabricated of same metal as metal roof panels, with corrugated baffle insert to prevent insect infestation; equivalent to Cor-A-Vent Model V300/CS, plastic hollow core vented insert.
2. Closures: Provide metal closures at eaves and ridges, fabricated of same metal as metal roof panels.

B. Flashings and Trim: Formed from 0.030 thick (24 gage) thick Galvalume (tm) aluminum-zinc alloy coated steel sheet prefinished by coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed

openings, ridges, fasciae, and fillers. Flashings and Trims shall be the same finish, gage and color as the specified roofing system.

C. Gutters: Formed from 0.030" (22 gage) thick Galvalume (tm) aluminum-zinc alloy coated steel sheet prefinished by coil coating, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch long sections, sized according to SMACNA's "Architectural Sheet Metal Manual." Furnish flat stock gutter straps and brackets spaced 30 inches on center, fabricated from same metal as gutters 3/16" x 1 ½". Provide steel or aluminum wire ball strainers at outlets. Gutters shall be the same finish, gage and color as the specified roofing system.

D. Downspouts: Formed from 0.030" (22 gage) thick Galvalume (tm) aluminum-zinc alloy coated steel sheet prefinished by coil coating; in minimum10-foot long sections, complete with formed elbows and offsets. Downspouts shall be the same finish, gage and color as the specified roof system. Furnish with 3/16" x 1 ½" metal hangers to march gutters. Fabricate seams using flat stock seams meeting SMACNA.

E. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

2.04 FABRICATION

A. Panels:
1. Provide factory formed panel widths of 16", with a 1-3/4" high architectural standing seam panels.
2. On-site or field roll formed panels are not acceptable.
3. Provide panels in full length from ridge to eave.
4. Roof panels shall have flush horizontal and vertical surfaces to facilitate sealing at terminations. Panel configurations that create voids and require supplemental closure devices are acceptable.

B. Seams:
1. Panel seams shall interlock along entire length of seam.
2. Design seams to lock up and resist joint disengagement during design wind uplift conditions as calculated to comply with local building codes and design uplift criteria.
3. Provide factory sealant within confines on trailing edge of female seam leg to aid in resistance of leaks and provide panel-to-panel seal while allowing expansion and contraction movement, and the seams shall be continuously locked together during installation without the use of field seaming machinery.

C. Clips:
1. Provide UL listed clip designed to allow panels to thermally expand and contract and provide a minimum of ± 1 inch of thermal movement. Clip shall incorporate a self-centering feature to allow a minimum of 1" of movement in both directions along panel length.
2. Clip shall be designed to meet positive and negative pressures as calculated per local building code and as engineered by the roofing system manufacturer.

D. Expansion and Contraction:
1. Engineer panels to use concealed anchors that permit expansion and contraction, except at end laps, ridges and hips.

E. Trim/Flashings:
1. Prefinished sheet metal designed and supplied by the architectural standing seam metal roof system manufacturer in the same gage, material and finish as the architectural standing seam metal roofing system.
2. Locations, design, sealing and fastening methods as per the manufacturer's approved engineered shop drawings.
3. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
4. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
   a. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not

allowed on faces of accessories exposed to view.

2.05 FINISH:

A. Fluorocarbon Coating:
   1. Full strength 70% Kynar 500® coating baked on for 15 minutes at 450 degrees F to dry-film thickness of 1.0 mil.
   2. 15% reflective gloss (ASTM D 523). (Low Gloss).
   3. 0.3 mil baked on epoxy primer.
   4. Color: To be selected by Owner/Architect from manufacturer's full range of colors.

PART 3 - EXECUTION

3.01 CONNECTING WORK:

A. General: Provide metal roofing panels of full length from eave to ridge when possible.
   1. Field cutting by torch is not permitted.
   2. Do not apply roofing during inclement weather.
   3. Do not apply roofing to damp or frozen deck surface.
   4. Do not expose materials vulnerable to water, wind or sun damage in quantities greater than can be weatherproofed during the same day.
   5. Rigidly fasten Ridge of metal roof panels and allow free eave movement due to thermal expansion and contraction per the approved shop drawings.
   6. Install screws fasteners with power tools having controlled torque.
   7. Locate and space fasteners per approved shop drawings in true vertical and horizontal alignment.
   8. Install Ridge, Hip and penetration flashings per the approved shop drawings as work progresses.
   9. Position roof jacks only in the flat of the panel; do not alter or impede standing seam ribs.

B. The Panel Applicator shall examine all surfaces on which their work is to be applied, and shall notify the architect in writing if not suitable to receive their work. Work on any surface shall constitute acceptance of this surface by the Panel Applicator. After beginning installation, install approximately 500 square feet of panels for Architect's approval, before proceeding with substantial work.

3.02 FIELD MEASUREMENTS:

A. Panel Applicator must take field measurements to verify or supplement dimensions indicated prior to fabrication of any materials. Where field measurements cannot be made without delaying the work, either establish opening dimensions and proceed with fabricating panels without field measurements or allow for trimming panel units.

3.03 RIGID BOARD INSULATION INSTALLATION:

A. Comply with system manufacturer's written instructions for installing roof insulation.
   1. Install insulation under area of roofing in required thickness to achieve specified 'R' value. Install insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding ¼ inch with insulation.
   2. Attach insulation to deck as recommended by the insulation manufacturer in the required pattern to achieve a UL-90 wind uplift rated assembly.
   3. Use UL rated fasteners as recommended by the insulation manufacturer.
   4. Seal all joints in top layer of insulation with sealing tape.
   5. Apply no more insulation than can be covered in the same workday.

3.04 ACCESSORY INSTALLATION

A. Waterproof Underlayment Installation: Apply waterproof underlayment over entire roof surface perpendicular to metal roofing panels and over parapet blocking per manufacturer's written instructions, but with not less than six (6) inch laps at vertical (side) laps and four (4) inch horizontal (top and bottom) laps.

B. Hanging Gutters: Join sections with riveted and soldered or lapped and sealed joints (minimum 6" lap at joined sections) with elastomeric sealant. Allow for thermal movement. Attach gutters at eave or fascia to firmly anchored gutter brackets spaced not more than 30 inches apart. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

   a. Fasten gutter straps to front and back of gutter at 30" o.c. spaced alternately with brackets.
   b. Loosly lock straps to front gutter bead and anchor to roof deck.
   c. Install gutter with expansion joints at locations not to exceed 50' and at roof expansion joints.
   d. Provide gutter baffles at valleys.

3.05 METAL ROOFING INSTALLATION, GENERAL:

A. Workmanship shall conform to standards set forth in the architectural sheet metal manual as published by SMACNA.

B. Comply with manufacturer's instructions for assembly, installation, and erection in order to achieve a weather tight installation. Install in accordance with approved shop drawings.
   1. Anchor securely in place using clips and fasteners spaced in accordance with manufacturer's recommendations for design wind load criteria.
   2. Panels should be installed in such a manner that horizontal lines are true and level and vertical lines are plumb.
   3. Field apply sealant to penetrations, transitions, and other locations as necessary (not inside the standing seam ribs) for an airtight, waterproof installation.
   4. Remove all protective film, if any, before installation of materials.

C. Dissimilar Metals: Do not allow panels or flashings to come into contact with dissimilar metals.

3.06 CLEAN UP:

A. Clean exposed surfaces of work promptly after completion of installation.
B. Only minor scratches and abrasions will be allowed to be touched up. Any other damaged material shall be replaced.
C. Leave work areas clean, free from grease, dirt, finger marks and stains.
D. Remove scrap and debris from surrounding grounds and work areas daily.

3.07 PROTECTION:

A. Metal Roofing: Protect work as required to ensure that structural standing seam metal roof system will be without damage at time of final completion.
B. Rigid Insulation: Cover insulation as soon as possible with specified underlayment for protection against excessive moisture prior to roofing application.

END OF SECTION

SECTION 07620 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manufactured reglets with counterflashing.
2. Formed roof-drainage sheet metal fabrications.
3. Formed low-slope roof sheet metal fabrications.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Distinguish between shop- and field-assembled work.
3. Include identification of finish for each item.
4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, roof-penetration flashing, and connections to adjoining work.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1. For copings and roof edge flashings that are SPRI ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.

B. Mockups: Build mockups to verify selections made under Sample submittals to demonstrate aesthetic effects and to set quality standards for fabrication and installation.

1.6 WARRANTY

A. Special Warranty on Finishes: 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. Finish Warranty Period: 20 years from date of Final Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's The NRCA Roofing Manual requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1, meeting all applicable codes and capable of resisting the following design pressure:

1. Design Pressure: Per current building codes.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Provide aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 prepainted by coil-coating process to comply with ASTM A 755/A 755M.
1. Exposed Coil-Coated Finish:
A. Finish and color to match 07411 Arch Metal Roof Panels.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Carlisle Coatings & Waterproofing Inc.
    b. Protecto Wrap Company.
    c. SDP Advanced Polymer Products Inc.

2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C) or higher.
3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C) or lower.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as 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

    a. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

2. Fasteners for Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

2.5 MANUFACTURED REGLETS

A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-

mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.

1. Material: Galvanized steel, 0.022 inch (0.56 mm) thick.
2. Finish: Match 07411 Arch Metal Roof Panels

2.6 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Obtain field measurements for accurate fit before shop fabrication.
2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

C. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

F. 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.

2.7 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- long sections. Furnish flat-stock gutter brackets and gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters. Shop fabricated. Gutters to match 07411 Arch Metal Panels.

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.

1. Hanger Style: Straps with concealed flat seam and concealed fasteners
2. Fabricate from the following materials:

    a. Aluminum-Zinc Alloy-Coated Steel: 22 ga. Match 07411 Arch Metal Panels

C. Parapet Scuppers: Fabricate scuppers to 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. Aluminum-Zinc Alloy-Coated Steel: 22 ga thick.

2.8 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing Gravel Stop and Fascia Cap: Fabricate in minimum 96-inch long, but not exceeding 12-foot long sections. Furnish with 6-inch wide, joint cover plates. Shop fabricate interior and exterior corners.

1. Fabricate from the Following Materials:
    a. Aluminum-Zinc Alloy-Coated Steel: 22 ga thick.
    b. Finish and color to match 07411 Arch Metal Roof Panels

B. Copings: Fabricate in minimum 96-inch long, but not exceeding 12-foot long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners. Flat seam, no exposed fasteners.

1. Fabricate from the Following Materials:
    a. Aluminum-Zinc Alloy-Coated Steel: 22 ga thick. Finish to match 07411 Arch Metal Roof Panels

C. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Aluminum-Zinc Alloy-Coated Steel: 24 ga thick.

D. Counterflashing and Flashing Receivers: Fabricate from the following materials:
1. Aluminum-Zinc Alloy-Coated Steel: 24 ga thick.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller. Cover underlayment within 14 days.

3.2 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, 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, levels, and slopes. 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. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws, not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 07900 "Joint Sealants."

G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.3 ROOF-DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters: Join sections with riveted joints sealed with sealant (minimum 6” overlap at sections). Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Install gutter with expansion joints at locations not exceeding, 50 feet apart. Install expansion-joint caps.

C. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c.

D. Parapet Scuppers: Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

E. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints minimum of 4 inches (100 mm) in direction of water flow.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches (100 mm) 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 (100 mm) over base flashing. Lap counterflashing joints minimum of 4 inches (100 mm).

3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise 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 Section 04200 Unit Masonry.

3.6 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.

END OF SECTION 07620

SECTION 07900 - JOINT SEALANTS

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 joint sealants for the applications indicated in the Joint-Sealant Schedule at the end of Part 3.

B. Related Sections include the following:

1. Division 4 Section "Unit Masonry Assemblies" for masonry control and expansion joint fillers and gaskets.
2. Division 7 Section "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
3. Division 8 Section "Glazing" for glazing sealants.

1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Qualification Data: For Installer.

D. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.

E. 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.

F. Field Test Report Log: For each elastomeric sealant application.

G. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

H. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints as directed by Architect.
2. Conduct field tests for each application indicated below:

    a. Each type of elastomeric sealant and joint substrate indicated.

3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
5. Test Method: Test joint sealants according to the following hand pull method:
    a. Install joint sealants in 5-feet joint lengths using same materials and methods for joint preparation and joint sealant installation required for completed work. Allow sealants to cure fully before testing.
    b. Make knife cuts as follows: A horizontal cut from one side of joint to the other followed by 2 vertical cuts approximately 2 inches long at side of joint and meeting horizontal cut at top of 2 inch cuts. Place a mark 1 inch from top of 2 inch piece.
    c. Use fingers to grasp 2 inch piece of sealant just above 1 inch mark; pull firmly down at a 90 degree angle or more while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
    d. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

A. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
Evaluation of Preconstruction Field-Adhesion- Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere

to joint substrates during testing.

D. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:

1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

1.6 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 or are below 40 deg F (5 deg C).
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.
5. Unless specifically indicated on the Drawings, no joints shall exceed W' and will be rejected by the Architect.

1. 7 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 5 years from date of Final Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 5 years from date of Final Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and

application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range. Generally, sealant colors shall match color of adjacent materials.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Single-Component Neutral- and Basic-Curing Silicone Sealant **ES-l**:

1. Products:
   a. Dow Corning Corporation; 790.
   b. GE Silicones; SilPrufLM SCS2700.
   c. Tremco; Spectrem 1 (Basic).
   d. GE Silicones; SilPruf SCS2000.
   e. Pecora Corporation; 864.
   f. Pecora Corporation; 890.
   g. Polymeric Systems Inc.; PSI-641.
   h. Sonneborn, Division of ChemRex Inc.; Omniseal.
   1. Tremco; Spectrem 3.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 50 or *100150.*
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
   a. Use **O** Joint Substrates: Color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, brick, and wood.

C. Single-Component Mildew-Resistant Neutral-Curing or Acid Curing Silicone Sealant **ES-2**:

1. Products:

   a. Dow Corning - 786.
   b. Pecora Corporation; 898.
   c. Tremco; Treinsil200 Sanitary.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

a. Use **O** Joint Substrates: Ceramic tile.

D. Single-Component Nonsag Urethane Sealant **ES-3**:

1. Products:

a. Bostik Findley; Chem-Calk 900.
b. Bostik Findley; Chem-Calk 915.
c. Pecora Corporation; Dynatrol I-XL.
d. Polymeric Systems Inc.; PSI-901.
e. Tremco; DyMonic.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.
   a. Use **O** Joint Substrates: Color anodic aluminum, aluminum coated with a high-performance coating, and galvanized steel.

E. Multicomponent Single Component Urethane Sealant **ES-4**:

1. Products:
   a. Pecora Corp.; Dynatrol 1
   b. Sika Corporation, Inc.; Sikaflex -1a
   c. Tremco; Dymonic
   d. Sherwin Williams: LOXON 1K Smooth (S1)

2. Type and Grade: S (Singlecomponent) and NS (Nonsag). Use Nonsag on joints over ¾".
3. Class: *12-1/2.*
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, A.

F. Single-Component Pourable Urethane Sealant **ES-5**:

1. Products:
   a. Bostik Findley; Chem-Calk 950.
   b. Pecora Corporation; Urexpan NR-201.
   c. Polymeric Systems Inc.; Flexiprene 952.
   d. Sonneborn, Division ofChemRex, Inc.; SL1.
   e. Tremco; Tremflex SIL.
   f. Tremco; Vulkem 45.
   g. Sika Corporation, Inc.; Sikaflex - 1 CSL

2. Type and Grade: S (single component) and P (pourable).
3. Class: 25 or 50.
4. Use Related to Exposure: T (traffic).
5. Uses Related to Joint Substrates: M, and, as applicable to joint substrates indicated, 0.

2.4 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), unless not acceptable to the joint sealant manufacturer' for the joint application

indicated and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

1. If Manufacturer indicates a problem with the specified closed-cell material for the joint application, Contractor shall use backing recommended by the Manufacturers.

2.5 MISCELLANEOUS MATERIALS

A. Primer: Material 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.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 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.

B. Proceed with installation only after unsatisfactory conditions have been corrected

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2.Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out

joints with oil-free compressed air. Porous joint substrates include the following:

a. Concrete.
b. Masonry.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

a. Metal.

B. Joint Priming: Prime joint substrates 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.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 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 sealant backings 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 sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings 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 in 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 sealant from surfaces adjacent to joints.

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure SA in ASTM C 1193, unless otherwise indicated.

a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 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 so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application JS-1: Exterior vertical and horizontal nontraffic construction joints in cast-in-place concrete.

1. Joint Sealant: Single-component neutral- and basic-curing silicone sealant **ES-1**.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match color of concrete.

B. Joint-Sealant Application JS-2: Exterior horizontal traffic isolation and contraction joints in cast-in-place concrete slabs.

1. Joint Sealant: Single-component pourable urethane sealant **ES-5**.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match adjacent materials.

C. Joint-Sealant Application JS-3: Exterior vertical and horizontal nontraffic joints between plant-precast architectural concrete units.

1. Joint Sealant: Single-component neutral- and basic-curing silicone sealant **ES-1**.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match precast.

D. Joint-Sealant Application JS-4: Exterior vertical control and expansion joints in unit masonry.

1. Joint Sealant: Single-component neutral- and basic-curing silicone sealant **ES-l**.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range to

match color of adjacent materials.

E. Joint-Sealant Application JS-5: Exterior joints in exterior insulation and finish systems and/or direct applied exterior finish systems.

1. Joint Sealant: Single-component neutral- and basic-curing silicone sealant ES-l.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match color of EIFSIDEFS systems.

F. Joint-Sealant Application JS-6: Exterior vertical joints between different materials listed above.

1. Joint Sealant: Single-component neutral- and basic-curing silicone sealant **ES-l**.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match color of adjacent materials.

G. Joint-Sealant Application JS-7: Exterior perimeter joints between unit masonry and/or precast and frames of doors windows and louvers.

1. Joint Sealant: Single-component neutral- and basic-curing silicone sealant **ES-l**.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match color of adjacent materials.

H. Joint-Sealant Application JS-8: Vertical control and expansion joints and emu comers on interior walls up to a height of 10'-0" for pick resistance. Above 10'-0", use joint-sealant application JS-9.

1. Joint Sealant: Multicomponent nonsag pick resistant urethane sealant **ES-4**.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match color of adjacent materials.

I. Joint-Sealant Application JS-9: Vertical control and expansion joints and emu comers on interior walls above 10'-0". Use joint-sealant application JS-8 for joints below 10'-0".

J. Joint Sealant: Single-component nonsag urethane sealant **ES-4**
K. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match color of adjacent materials.

J. Joint-Sealant Application JS-I0: Interior perimeter joints of openings.

1. Joint Sealant: Single-component non sag urethane sealant **ES-4**.
2. Joint-Sealant Color: As selected by Architect. from manufacturer's full range to match color of adjacent materials.

K. Joint-Sealant Application JS-11: Interior joints between plumbing fixtures and adjoining walls, floors, and counters.

1. Joint Sealant: Single-component mildew-resistant neutral-curing silicone sealant **ES-2**.

2. Joint-Sealant Color: White

L. Joint-Sealant Application JS-12: Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances, countertops and other materials not indicated elsewhere.

1. Joint Sealant: Single-component non-sag urethane sealant. **ES-4**
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match color of adjacent surfaces.

M. Joint-Sealant Application JS-13: Interior exposed joints in horizontal traffic surfaces not covered elsewhere.

1. Joint Sealant: Single component pourable urethane sealant. **ES-5**
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match color of adjacent surfaces.

N. Joint-Sealant Application JS-13: Interior exposed joints in horizontal traffic surfaces in Exposed Polished Concrete.

3. Joint Sealant: As recommended by Polished Concrete contractor.
4. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match color of adjacent surfaces.

END OF SECTION 07920

SECTION 08110 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes steel doors and frames.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 8 Section "Flush Wood Doors" for hollow-core and solid-core wood doors installed in steel frames.
2. Division 8 Section "Glazing" for glass in steel doors and sidelights.
3. Division 9 Section "Painting" for field painting primed doors and frames.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.

C. Shop Drawings showing fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.

D. Door Schedule: Submit schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings.

1. Indicate coordination of glazing frames and stops with glass and glazing requirements.

1.4 QUALITY ASSURANCE

A. Provide doors and frames complying with ANSI/SDI 100 "Recommended Specifications for Standard Steel Doors and Frames" and as specified.

B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies tested for fire-test-response characteristics per NFPA 252 for positive pressure, and are labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Inspect doors and frames on delivery for damage. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect; otherwise, remove and replace damaged items as directed.

C. Store doors and frames at building site under cover. Place units on minimum 4-inch- (100-mm-) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If cardboard wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Steel Doors and Frames:

a. Amweld Building Products, Inc.
b. Curries
c. Ceco Door Products.
d. Republic Builders Products.
e. Steelcraft.

2.2 MATERIALS

A. Supports and Anchors: Fabricated from not less than 0.0478-inch- (1.2-mm-) thick steel sheet; 0.0516-inch- (1.3-mm-) thick galvanized steel where used with galvanized steel frames.

B. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize complying with ASTM A 153, Class C or D as applicable.

2.3 DOORS

A. Steel Doors: Provide 1-3/4-inch- (44-mm-) thick doors of materials and ANSI/SDI 100 grades and models specified below, or as indicated on Drawings or schedules:

1. Interior Doors: SDI-100, Grade II, heavy duty, Model 1, Minimum 18-gauge faces.
2. Exterior Doors: SDI-100,Grade III, extra heavy-duty, Model 2, Minimum 16-guage faces.

B. Door Louvers: Provide louvers according to SDI 111C for interior doors where indicated, with blades or baffles formed of 0.0239-inch- (0.6-mm-) thick cold-rolled steel sheet set into minimum 0.0359-inch- (0.9-mm-) thick steel frame.

2.4 FRAMES

A. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, according to ANSI/SDI 100, and of types and styles as shown on Drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum 16 gauge thick cold-rolled steel sheet.

1. Fabricate frames with mitered or coped and continuously welded corners for all exterior frames or frames in CMU/masonry openings. Frames for openings in stud wall construction shall be knock-down (KD) type.
2. Fabricate frames for interior openings over 48 inches (1220 mm) wide from 0.0598-inch- (1.5-mm-) thick steel sheet.
3. Fabricate exterior frames for openings over 48 inches (1220 mm) wide from 0.0635-inch- (1.6-mm-) thick galvanized steel sheet.
4. Form exterior frames from 0.0635-inch- (1.6-mm-) thick galvanized steel sheet.
5. Provide grout tight mortar/junction boxes at the electric power transfers (EPT), and door monitor switch locations. Provide conduit from mortar boxes to a junction box inside of the

building located above the ceiling. Provide screw on cover plates for future EPTs as scheduled. See applicable hardware sets in finish hardware section 08710 for specific locations.

B. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single-door frames and 2 silencers on heads of double-door frames.

C. Plaster Guards: Provide minimum 0.0179-inch- (0.45-mm-) thick steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

D. Grout: When required in masonry construction, as specified in Division 4 Section "Unit Masonry."

2.5 FABRICATION

A. Fabricate steel door and frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site. Comply with ANSI/SDI 100 requirements.

1. Internal Construction: One of the following manufacturer's standard core materials according to SDI standards:

a. Resin-impregnated paper honeycomb.
b. Rigid polyurethane conforming to ASTM C 591.
c. Rigid polystyrene conforming to ASTM C 578.
d. Unitized steel grid.
e. Vertical steel stiffeners.
f. Rigid mineral fiber with internal sound deadener on inside of face sheets.

2. Clearances: Not more than 1/8 inch (3.2 mm) at jambs and heads, except not more than 1/4 inch (6.4 mm) between non-fire-rated pairs of doors. Not more than 3/4 inch (19 mm) at bottom.

a. Fire Doors: Provide clearances according to NFPA 80.

B. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only cold-rolled steel sheet.

C. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.

E. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

F. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of SDI 107 and ANSI A115 Series specifications for door and frame preparation for hardware.

1. Provide grout tight mortar/junction boxes at the electric power transfers (EPT), and door monitor switch locations. Provide conduit from mortar boxes to a junction box inside of the building located above the ceiling. Provide screw on cover plates for future EPTs as scheduled. See applicable hardware sets in finish hardware section 08710 for specific locations.

G. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

H. Locate hardware as indicated on Shop Drawings or, if not indicated, according to the Door and Hardware Institute's (DHI) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

I. Glazing Stops: Minimum 0.0359-inch- (0.9-mm-) thick steel or 0.040-inch- (1-mm-) thick aluminum.

1. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
2. Provide screw-applied, removable, glazing beads on inside of glass, louvers, and other panels in doors.

2.6 FINISHES, GENERAL

A. Prime Finish: Apply manufacturer’s standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer’s standard, fast-durring, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

B. Comply with NAAMM's "Metal Finishes Manual" for recommendations relative to applying and designating finishes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.

B. Placing Frames: Comply with provisions of SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

1. Except for frames located in existing concrete, masonry, or gypsum board assembly construction, place frames before constructing enclosing walls and ceilings.
2. In masonry construction, install at least 3 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
3. Install fire-rated frames according to NFPA 80.

C. Door Installation: Fit hollow-metal doors accurately in frames, within clearances specified in ANSI/SDI 100.

1. Fire-Rated Doors: Install with clearances specified in NFPA 80.
2. Smoke-Control Doors: Comply with NFPA 105.

3.2 ADJUSTING AND CLEANING

A. Prime Coat Touchup: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 08110

SECTION 08211 - FLUSH WOOD DOORS

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. Furnish all labor, materials, tools, equipment and services for Flush Wood Doors. Provide all miscellaneous items, appurtenances and devices, incidental to or necessary for a sound, secure and complete installation.

1.2 SUMMARY

A. This Section includes the following:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.3 SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction, trim for openings, and louvers.
1. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire ratings for fire doors.

C. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:

1. Faces of factory-finished doors with transparent finish. Show the full range of colors available for stained finishes.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Quality Standard: Comply with the following standard:
1. AWI Quality Standard: AWI's "Architectural Woodwork Quality Standards" for grade of door, core, construction, finish, and other requirements.

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252. Doors must meet “Cat. A” positive pressure requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Mark each door with individual opening numbers used on Shop Drawings. Use removable tags or concealed markings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during the remainder of the construction period to comply with requirements of the referenced quality standard for Project's geographical location. Temperature must be maintained between 65 and 78 degrees.

1.7 WARRANTY

A. General Warranty: Door manufacturer's warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Door Manufacturer's Warranty: Submit written agreement on door manufacturer's standard form, signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup, or twist) more than 1/4 inch (6.35 mm) in a 42-by-84-inch (1067-by-2134-mm) section or that show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 75-mm) span, or do not comply with tolerances in referenced quality standard.

1. Warranty shall be in effect during the following period of time after the date of Substantial Completion:

a. Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flush Wood Doors:

a. Masonite.
b. VT Industries.
c. Oshkosh Door Company.

2. Metal Louvers for Doors:

a. Air Louvers, Inc.
b. L & L Louvers, Inc.
c. LL Building Products, Inc.; a division of GAF Materials Corporation.
d. Anemostat Door Products.

2.2 DOOR CONSTRUCTION, GENERAL

A. Doors for Transparent Finish: Comply with the following requirements:

1. Premium Grade A Rotary Cut Cherry.
2. Match between Veneer Leaves: Book Match.
3. Match within Door Faces: Running Match.
4. Pair and Set Match: Provide for pairs of doors and for doors hung in adjacent sets.
   a. Comply with requirements in Division 6 Section "Interior Architectural Woodwork."
5. Stiles: Same species as face or a compatible species.

2.3 SOLID-CORE DOORS

A. Particleboard Cores: Comply with the following requirements:

1. Particleboard: ANSI A208.1, Grade LD-2.
2. Construction: Minimum five plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering, using a hot press.

B. Interior Veneer-Faced Doors: Comply with the following requirements:

1. Core: Particleboard core.
2. Construction: Minimum five plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering, using a hot press.

C. Fire-Rated Doors: Comply with the following requirements:

1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as required to provide fire rating indicated.
3. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated.
4. Edge Construction: At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.
4. Pairs: Furnish formed-steel edges and astragals for pairs of fire-rated doors, unless otherwise indicated.
5. Pairs: Provide fire-rated pairs with fire-retardant stiles that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals.

2.4 LOUVERS AND LITE FRAMES

A. Metal Frames for Lite Openings in all Doors: Manufacturer's standard frame formed of 0.0478-inch-(1.2-mm-) thick, cold-rolled steel sheet, factory primed and approved for use in doors of fire rating indicated.

2.5 FABRICATION

A. Fabricate flush wood doors in sizes indicated for Project site fitting.

B. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:

1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements of NFPA 80 for fire-rated doors.

C. 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, DHI A115-W series standards, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

D. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.

1. Lite Openings: Trim openings with moldings of material and profile indicated.

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard's requirements for factory finishing.

B. Finish wood doors at factory. Doors to be finished on all sides.

C. Transparent Finish: Comply with requirements indicated for grade, finish system, staining effect, and sheen.

1. Grade: Custom.
2. Finish: AWI System TR-6 catalyzed polyurathane.
3. Finish: Manufacturer's standard finish with performance requirements comparable to AWI System TR-6 catalyzed polyurathane.
4. Staining: Match approved sample for color.
5. Effect: Open-grain finish.
6. Sheen: Semigloss.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Manufacturer's Written Instructions: Install wood doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation, if fitting or machining is required at Project site.

3.3 ADJUSTING AND PROTECTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Refinish or replace doors damaged during installation.

C. Protect doors as recommended by door manufacturer to ensure that wood doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 08211

SECTION 08360 – SECTIONAL OVERHEAD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Commercial sectional doors.

1.2 RELATED SECTIONS

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM) A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. American Society for Testing and Materials (ASTM) C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

C. American Society for Testing and Materials (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.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33.0- Submittal Procedures.

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. Performance Standards: Provide test data validating the following:
1. Door Section: Gloss retention, fade resistance, FDA compliance, cold crack performance, load to rebound, dent resistance impact.
2. Drive Train: Spring cycle life, track, hinges, rollers, cable assembly, cable strength.
3. Door Assembly: Thermal performance, deflection, wind load.

D. Shop Drawings:
1. Provide drawings indicating door elevations, track details, head and jamb conditions, spring shafts, anchorage, accessories, finish colors, patterns and textures, operator mounts and other related information.
2. Regulatory Requirements and Approvals: Provide shop drawings in compliance with local Authority having Jurisdiction (AHJ).

E. Certifications:
1. Submit manufacturer's certificate that products meet or exceed specified requirements.
2. Submit installer qualifications.

F. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

G. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Utilize an installer having demonstrated experience on projects of similar size and complexity, and trained and authorized by the door manufacturer to perform the work of this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

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 recommended limits.

1.8 WARRANTY

A. Provide manufacturer's standard warranty against defects in material and workmanship, as further described with each model in Part 2 of this Section.

B. Manufacturer's Warranty for ControlHoist 2.0 Commercial Operators Door and Operator Warranty Package: Provide manufacturer's standard warranty.
   1. Raynor warrants the electrical operator and component parts against defects in material and workmanship for three (3) years, on the operator only, when purchased with any model of Raynor commercial sectional door.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Raynor

B. Requests for substitutions will be considered in accordance with provisions of Section 00090

2.2 SECTIONAL RAIL AND STYLE ALUMINUM DOORS

A. AlumaView as manufactured by Raynor Garage Doors:
   1. Doors:
      a. Operation:
         1) Provide doors designed for electric motor operation and auxiliary hand chain operation.
      b. Jamb Construction:
         1) Masonry jambs with anchor bolt fasteners.
      c. Structural Performance Requirements:

1) Wind Load See Structural Drawings

d. International Energy Conservation Code (IECC) Requirements:
1) Air Infiltration: Maximum air leakage of 0.4 cfm/ft2 is required. Testing shall be performed in accordance with DASMA 105 test procedure.

2. Sections:
a. AlumaView AV200:
1) Material: 2 inches (51mm) thick, 6063-T6 aluminum alloy stiles and rails joined together with 5/16 inch (8 mm) diameter screws. Aluminum panels 0.050 inch (1.3 mm) thick or glazing (when specified) fill the spaces between stiles and rails. Combined dimension of two adjoining intermediate meeting rails 3-13/16 inches (97 mm). Bottom rail height 5-1/4 inches (133 mm). Top rail height 3-1/4 inches (83 mm) or 5-1/4 inches (133 mm) as determined by overall door width. End stiles 3-3/8 inches (86 mm) or 6-1/2 inches (165 mm) wide as determined by overall door width. Center stiles 3-5/8 inches (92 mm) wide.
2) Finish: Aluminum frame extrusions and filler panels finish coated.
a) ArmorBrite Powdercoat finish.
1) Color: To be selected from full range of available colors.

b. Seals: Bottom of door to have flexible U-shaped vinyl seal retained in aluminum rail.
1) Bulb-type joint seal between sections.
2) Blade seal on top section to prevent airflow above header.
c. Trussing: Doors designed to withstand specified windload. Deflection of door in horizontal position to be maximum of 1/120th of door width.

3. Windows: Provide door sections with windows and 0.050 inch (1.3mm) aluminum filler panels as shown. Locations to comply with door elevation drawings.

4. Glazing: Provide as follows:

a. 1/2 inch (12.69mm) Insulated Clear Tempered Glass consisting of two panes of 1/8 inch (3.2mm) Tempered insulated glass.

5. Mounting: Sections mounted in door opening using:

a. Lap Jamb Angle Mounting: section overlap door jambs by 1 inch (25 mm) on each side of door opening.

6. Track:
a. Material: Hot-dipped galvanized steel (ASTM A 653), fully adjustable for adequate sealing of door to jamb or weatherseal.
b. Configuration Type:
1) Configuration Type: Normal Headroom.
c. Track Size:
1) Size: 3 inches (76 mm).
d. Mounting:

1) Floor-to-Shaft Angle-Mount consisting of continuous angle extending from the floor, past header, completely up to door shaft for use with masonry jambs. Continuous angle size not less than 2-5/16 inches by 4 inches by 3/32 inch (59 by 102 by 2.5 mm) on 2-inch track and 3-1/2 inches by 5 inches by 1/8 inches (89 by 127by 3.2 mm) on 3-inch track.

e. Finish:
1) Galvanized.

7. Counterbalance:
a. Counterbalance System: Provided with aircraft-type, galvanized steel lifting cables with minimum safety factor of 5. Torsion Springs consisting of heavy-duty oil-tempered wire torsion springs on a continuous ball-bearing cross-header shaft.
1) Spring Cycle Requirements: 100,000 cycles.
8. Hardware:
a. Hinges and Brackets: Fabricated from galvanized steel.
b. Track Rollers: 3 inches (76.2 mm) diameter consistent with track size, with hardened steel ball bearings.
c. Perimeter Seal: Provide complete weather stripping system to reduce air infiltration. Weather stripping shall be replaceable.
1) For bracket mounted doors provide climate seal or vinyl seal with aluminum retainer.
2) For angle mounted doors provide angle clip-on seal.
9. Limited Warranty: Warrant the door sections against defects in material and workmanship for five years from date of delivery to the original purchaser. Window components are warranted against defects in material and workmanship for three years from date of delivery to the original purchaser. All hardware and spring components against defects in material and cycle life of the springs.

B. ControlHoist 2.0 as manufactured by Raynor Garage Doors:
1. Model:
a. Raynor ControlHoist 2.0 Optima:
1) Type: Jackshaft with manual chain hoist.
2) Motor Horsepower Rating: Continuous 1/2 HP.
3) Electrical Requirements: 120 volt single phase.
4) Duty Cycle: 30 cycles/hour or 300 cycles/day.
5) Control Wiring: Solid state circuitry with provisions for connection of safety edge to reverse, external radio control hook-up and maximum run timer. Provisions for timers to close, monitored reversing devices, mid stop and lock bar sensor capability.
a) Provide three button momentary contact "open-stop", constant pressure on close (can be changed to momentary to close).
b) Custom wiring.
c) Doors shall operate separately. Provide two wall mounted (locate where directed by architect) push button stations for each door. Doors to also be operated by remote control unit and have timer to automatically close doors after

preset time. Provide 2 each, remotes, per door.

d) Entrapment Protection: Required for momentary contact, includes radio control operation. Photoelectric sensors monitored to meet UL 325/2010. Provide two each per door.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared. Verify that site conditions are acceptable for installation of doors, operators, controls and accessories. Ensure that openings are square, flush and plumb.

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. General: Install door, track and operating equipment complete with all necessary accessories and hardware according to shop drawings, manufacturer's instructions.

B. Lubricate bearings and sliding parts, and adjust doors for proper operation, balance, clearance and similar requirements.

3.4 PROTECTION

A. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove and legally dispose of construction debris from project site.

B. Remove temporary coverings and protection of adjacent work areas. Repair or replace installed products damaged prior to or during installation.

C. Lubricate bearings and sliding parts, assure weather tight fit around door perimeter and adjust doors for proper operation, balance, clearance and similar requirements. Protect installed products until completion of project.

D. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 08411 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

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: Architectural Aluminum Storefront Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront units.

1. Basis of design: Kawneer Aluminum Storefront Systems include:

   a. Trifab® 451UT Storefront System – 2" x 4-1/2" (50.8 mm x 114.3 mm) nominal dimension; Thermal; Center Plane, Screw Spline Fabrication.

   b. Other manufacturers subject to the requirements of this specification:
      1) EFCO Corporation
      2) Old Castle
      3) YKK

B. Related Sections:

1. "Air Barriers" for materials used to bridge between aluminum storefront system and building intersection.
2. "Fire-Resistant Joint systems" for fire resistive material installed between aluminum storefront system and floor intersections.
3. "Joint Sealants" for joint sealants installed as part of the aluminum storefront system.
4. "Sloped Glazing Assemblies".

1.3 DEFINITIONS

A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufactures Association (AAMA) – AAMA Glossary (AAMA AG).

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed storefront system shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

1. Design Wind Loads: Determine design wind loads applicable to the Project from basic wind speed indicated in miles per hour, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings. System must be designed to withstand windloads as determined by applicable local, state and federal building codes.

B. 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/ft^2 (0.3 l/s · m^2) at a static air pressure differential of 6.24 psf (300 Pa).
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 10 psf (479 Pa) as defined in AAMA 501.
3. Uniform Load: A static air design load of 30 psf (1436 Pa) 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.
4. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than:
   a. U = 0.39 BTU/hr/ft^2/°F.
5. Solar Heat Gain Coefficient (SHGC): Provide aluminum windows with a whole-window SHGC maximum of 0.38
5. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than:
   a. 68 $_{\text{frame}}$ and 68$_{\text{glass}}$ (low-e).
6. Condensation Resistance (I): When tested to CSA A-440, the condensation index shall not be less than:
   a. 60 $_{\text{frame}}$ and 62$_{\text{glass}}$ (low-e).
7. Sound Transmission Class (STC) and Outdoor-Indoor Transmission Class (OITC): When tested to AAMA Specification 1801 and in accordance with ASTM E1425 and ASTM E90, the STC and OITC Rating shall not be less than:
   a. 37 (STC) and 30 (OITC).

1.5 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, coordination of doors and hardware, finishes, and installation instructions for each type of aluminum frame storefront system indicated. Field verify each opening prior to fabrication.

B. Shop Drawings: Include plans, elevations, sections, details, coordination of doors and hardware, and attachments to other work, operational clearances and installation details.

C. Samples for Initial Selection: For units with factory-applied color finishes including samples of hardware and accessories involving color selection.

D. Samples for Verification: For aluminum framed storefront system and components required.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type of aluminum-framed storefront.

F. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12” (300 mm) lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

G. Other Action Submittals:

1. Entrance Door Hardware Schedule: Coordinate door prep with hardware supplied by others.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project and other projects of similar size and scope.

B. Manufacturer Qualifications: A manufacturer capable of providing aluminum framed storefront system that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.

C. Source Limitations: Obtain aluminum framed storefront system and Aluminum Curtain Wall Systems through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum framed storefront system and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements." Do not modify size and dimensional requirements.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup for type(s) of storefront elevation(s) indicated, in location(s) shown on Drawings.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination".

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of aluminum framed storefront openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

1.8 WARRANTY

A. Manufactures Warranty: Submit, for Owner’s acceptance, manufacturer’s standard warranty.

1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product:

1. Kawneer Company Inc.
2. Trifab® 451UT (thermal) Storefront System
3. 2” x 4-1/2” (50.8 mm x 114.3 mm) System Dimensions
4. Glass: Center Plane

B. Substitutions:

1. Product Literature and Drawings: Submit product literature and drawings modified to suit specific project requirements and job conditions.
2. Certificates: Submit certificate(s) certifying substitute manufacturer (1) attesting to adherence to specification requirements for storefront system performance criteria, and (2) has been engaged in the design, manufacturer and fabrication of aluminum storefronts for a period of not less than ten (10) years. (Company Name)
3. Test Reports: Submit test reports verifying compliance with each test requirement required by the project.
4. Samples: Provide samples of typical product sections and finish samples in manufacturer's standard sizes.

2.2 MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070” wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.

B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim hardware, anchors, and other components.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

E. Sealant: For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

F. 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.

2.3 STOREFRONT FRAMING SYSTEM

A. Thermal Barrier (Trifab® VG 451UT):

1. Kawneer DUAL IsoLock® Thermal Break with two (2) 1/4" (6.4 mm) separations consisting of a two-part chemically curing, high-density polyurethane, which is mechanically and adhesively joined to aluminum storefront sections.

   a. Thermal Break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.

B. Trifab Versoleil SunShade: An aluminum sunshade (consisting of outriggers, louvers, and fascia, Blade style shall be “Airfoil” that is anchored directly to the vertical mullions. Outriggers shall be shop painted to match storefront system. Louvers and fascia shall be painted or anodized to match storefront system.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposes shall be stainless steel.

E. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

F. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

G. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront material against damage from elements, construction activities, and other hazards before, during and after storefront installation.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Division 08 Section "Glazing".

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: As recommended by manufacturer for joint type.

2.5 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Coordinate with doors as included in the door schedule.

B. Entrance Door Hardware: As specified in Division 08 Section "Door Hardware".

2.6 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants".

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30 mil (0.762 mm) thickness per coat.

2.7 FABRICATION

A. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fit joints; make joints flush, hairline and weatherproof.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

B. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

C. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

D. Storefront Framing: Fabricate components for assembly using manufactures standard installation instructions.

E. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

D. Factory Finishes: Kawneer Permafluo (70%), AAMA 2605, Fluoropolymer Coating. Architect to select from a full range of colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall

flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather tight sliding door installation.

1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing aluminum framed storefront system, accessories, and other components.

B. Install aluminum framed storefront system level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.

D. Install aluminum framed storefront system and components to drain condensation, water penetrating joints, and moisture migrating within frame to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

A. Field Tests: Architect shall select storefront units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present. Tests not meeting specified performance requirements and units having deficiencies shall be corrected as part of the contract amount.

1. Testing: Testing shall be performed by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements. Testing Standard per AAMA 503, including reference to ASTM E 783 for Air Infiltration Test and ASTM E 1105 Water Infiltration Test.

    a. Air Infiltration Tests: Conduct tests in accordance with ASTM E 783. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft^2, whichever is greater.
    b. Water Infiltration Tests: Conduct tests in accordance with ASTM E 1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 6.24 psf (300 Pa).

B. Manufacturer's Field Services: Upon Owner’s written request, provide periodic site visit by manufacturer’s field service representative.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Clean aluminum surfaces immediately after installing aluminum framed storefronts. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 08410

SECTION 087100 – DOOR HARDWARE

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. Mechanical and electrified door hardware for Swinging Doors
2. Electronic access control system components, including electronic access control devices as specified in Part 3 Hardware Schedule.
3. Field verification, preparation and modification of existing doors and frames to receive new door hardware.

B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 Section “Alternates” for alternates affecting this section.
2. Division 07 Section “Joint Sealants” for sealant requirements applicable to threshold installation specified in this section.
3. Division 09 sections for touchup finishing or refinishing of existing openings modified by this section.
4. Division 26 sections for connections to electrical power system and for low-voltage wiring.
5. Division 28 sections for coordination with other components of electronic access control system.

1.3 REFERENCES

A. UL - Underwriters Laboratories

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

C. ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

D. Regulatory standards of the following as referenced:

1. Department of Justice, Office of the Attorney General, Americans with Disabilities Act, Public Law 101-336 (ADA).
2. CABO/ANSI A117.1: Providing Accessibility and Usability for Physically Handicapped People.

1.4 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.
2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article, herein.

B. Action Submittals:

1. Product Data: Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:

    a. Wiring Diagrams: For power, signal, and control wiring and including:
        1) Details of interface of electrified door hardware and building safety and security systems.
        2) Schematic diagram of systems that interface with electrified door hardware.
        3) Point-to-point wiring.
        4) Risers.

3. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.

    a. Samples will be returned to supplier in like-new condition. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:

    a. Door Index; include door number, heading number, and Architects hardware set number.
    b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
    c. Type, style, function, size, and finish of each hardware item.
    d. Name and manufacturer of each item.
    e. Fastenings and other pertinent information.
    f. Location of each hardware set cross-referenced to indications on Drawings.
    g. Explanation of all abbreviations, symbols, and codes contained in schedule.
    h. Mounting locations for hardware.
    i. Door and frame sizes and materials.
    j. Name and phone number for local manufacturer's representative for each product.
    k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components). Operational description should include how door will operate on egress, ingress, and fire and smoke alarm connection.

1) Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.

5. Key Schedule:

   a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
   b. Use ANSI/BHMA A156.28 “Recommended Practices for Keying Systems” as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
   c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
   d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
   e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
      1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.

   f. Prepare key schedule by or under supervision of supplier, detailing Owner’s final keying instructions for locks.

6. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.

C. Informational Submittals:

1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
2. Product Certificates for electrified door hardware, signed by manufacturer:

   a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

3. Certificates of Compliance:

   a. Certificates of compliance for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
   b. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in “QUALITY ASSURANCE” article, herein.
   c. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in “QUALITY ASSURANCE” article, herein.

4. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by qualified testing agency, for door hardware on doors located in accessible routes.
5. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:

   a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.

b. Catalog pages for each product.
c. Name, address, and phone number of local representative for each manufacturer.
d. Parts list for each product.
e. Final approved hardware schedule, edited to reflect conditions as-installed.
f. Final keying schedule
g. Copies of floor plans with keying nomenclature
h. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
i. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.5 QUALITY ASSURANCE

A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.

1. Where specific manufacturer's product is named and accompanied by "No Substitute," including make or model number or other designation, provide product specified. (Note: Certain products have been selected for their unique characteristics and particular project suitability.)

    a. Where no additional products or manufacturers are listed in product category, requirements for "No Substitute" govern product selection.

2. Where products indicate "acceptable manufacturers" or "acceptable manufacturers and products", provide product from specified manufacturers, subject to compliance with specified requirements and "Single Source Responsibility" requirements stated herein.

B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
4. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.

    a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.

C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.

D. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
2. Can provide installation and technical data to Architect and other related subcontractors.
3. Can inspect and verify components are in working order upon completion of installation.
4. Capable of producing wiring diagrams.

5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.

E. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.
2. Manufacturers that perform electrical modifications and that are listed by testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

F. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.

G. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

H. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

I. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in “REFERENCES” article, herein.

J. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01.

1. Attendees: Owner, Contractor, Architect, Installer, Owner's security consultant, and Supplier’s Architectural Hardware Consultant.
2. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:

    a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
    b. Preliminary key system schematic diagram.
    c. Requirements for key control system.
    d. Requirements for access control.
    e. Address for delivery of keys.

K. Pre-installation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Inspect and discuss electrical roughing-in for electrified door hardware.
4. Review sequence of operation for each type of electrified door hardware.
5. Review required testing, inspecting, and certifying procedures.

L. Coordination Conferences:

1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.

    a. Attendees: Door hardware supplier, door hardware installer, Contractor.
    b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.

2. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

    a. Attendees: electrified door hardware supplier, doors and frames supplier, electrified door hardware installer, electrical subcontractor, Owner, Owner's security consultant, Architect and Contractor.
    b. After meeting, provide letter of compliance to Architect, indicating when coordination conference was held and who was in attendance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

1. Deliver each article of hardware in manufacturer's original packaging.

C. Project Conditions:

1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

D. Protection and Damage:

1. Promptly replace products damaged during shipping.
2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

E. Final keys and cores to be furnished by Owner.

1.7 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

F. Direct shipments not permitted, unless approved by Contractor.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Years from date of Substantial Completion, for durations indicated.

a. Closers: 30 years.
b. Locksets: 10 years.
c. Continuous Hinges: Lifetime warranty.

2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.9 MAINTENANCE TOOLS

A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The Owner requires use of certain products for their unique characteristics and particular project suitability to insure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: “No Substitute.”

1. Where “No Substitute” is noted, submittals and substitution requests for other products will not be considered.

B. Approval of manufacturers and/or products other than those listed as ”Scheduled Manufacturer ” or “Acceptable Manufacturers” in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.

C. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

D. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.

E. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.2 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
4. Install hardware with fasteners provided by hardware manufacturer.

B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.

1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
2. Use materials which match materials of adjacent modified areas.
3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.

C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

D. Cable and Connectors: Hardwired Electronic Access Control Lockset and Exit Device Trim:

1. Data: 24AWG, 4 conductor shielded, Belden 9843, 9841 or comparable.
2. DC Power: 18 AWG, 2 conductor, Belden 8760 or comparable.
3. Provide type of data and DC power cabling required by access control device manufacturer for this installation.
4. Where scheduled in the hardware sets, provide each item of electrified hardware with wire harnesses with sufficient number and wire gauge with standardized Molex plug connectors to accommodate electric function of specified hardware. Provide Molex connectors that plug directly into connectors from harnesses.

2.3 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Ives
2. Acceptable Manufacturers and Products: Hager, PBB

B. Requirements:

1. Provide five-knuckle, ball bearing hinges conforming to ANSI/BHMA A156.1.
2. Doors up to 36 inches wide provide standard weight steel-based hinges sized 4-1/2 inches high and 4-1/2 inches wide.
3. Doors 36 inches wide or more provide standard weight steel-based hinges sized 5 inches high and 4-1/2 inches wide.
4. Provide three hinges per door leaf for doors 90 inches or less in height, and one additional hinge for each 30 inches of additional door height.
5. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
6. Hinge Pins: Except as otherwise indicated, provide steel based hinge pins as follows:

a. Out-Swinging Lockable Doors: Non-removable pins
b. In-Swinging or Non-lockable Doors: Non-rising pins

2.4 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage ND Series, Owner Standard

B. Requirements:

1. Provide Schlage ND Series cylindrical locks conforming to the following standards and requirements:

    a. ANSI/BHMA A156.2 Series 4000, Grade 1.
    b. UL 10C for 4'-0" x 10'-0" 3-hour fire door.
    c. Florida Building Code (ASTM E330, E1886, E1996) and Miami Dade (TAS 201, 202, 203) requirements for hurricanes.

2. Cylinders: Refer to "KEYING" article, herein.
3. Provide cylindrical locksets exceeding the ANSI/BHMA A156.2 Grade 1 performance standards for strength, security, and durability in the categories below:

    a. Abusive Locked Lever Torque Test – minimum 3,100 inch-pounds without gaining access
    b. Offset lever pull – minimum 1,600 foot pounds without gaining access
    c. Vertical lever impact – minimum 100 impacts without gaining access
    d. Cycle life - tested to minimum 16 million cycles per ANSI/BHMA A156.2 Cycle Test with no visible lever sag or use of performance aids such as set screws or spacers.

4. Provide solid steel anti-rotation through bolts and posts to control excessive rotation of lever.
5. Provide lockset that allows lock function to be changed to over twenty other common functions by swapping easily accessible parts.
6. Provide locks with standard 2-3/4 inches backset, unless noted otherwise, with 1/2 inch latch throw capable of UL listing of 3 hours on a 4' x 10' opening. Provide proper latch throw for UL listing at pairs.
7. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
8. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
9. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
10. Lever Trim: Solid cast levers without plastic inserts, and wrought roses on both sides. Lever Design: Schlage Athens.

2.5 ELECTRIC STRIKES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Von Duprin 6400 series, Owner Standard

B. Requirements:

1. Provide electric strikes designed for use with type of locks shown at each opening.
2. Provide electric strikes UL Listed as burglary-resistant.
3. Where required, provide electric strikes UL Listed for fire doors and frames.
4. Provide fail-secure type electric strikes, unless specified otherwise.
5. Coordinate voltage and provide transformers and rectifiers for each strike as required.

2.6 EXIT DEVICES

A. Manufacturer and Product:

1. Scheduled Manufacturer: Von Duprin 98 series, Owner Standard

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3-2014 Grade 1, and UL listed for Panic Exit or Fire Exit Hardware. Cylinders: Refer to "KEYING" article, herein.
2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
3. Quiet Operation: Incorporate fluid damper or other device that eliminates noise of exit device operation.
4. Touchpad: Extend minimum of one half of door width, but not the full length of exit device rail. Provide flush end-cap with two-point attachment to door. Match exit device finish, stainless steel for US26, US26D, US28, US32, and US32D finishes; and for all other finishes, provide compatible finish to exit device. Provide compression springs in devices, latches, and outside trims or controls; tension springs prohibited.
5. Provide rim devices with a dual cylinder or inside thumb turn cylinder option with a visual security indicator that identifies the trims locked/unlocked status of the door from the inside of the room. Indicator in unlocked state presents a 1/2 inch x 1/2 inch white metal flag with black icon at top of device head. Indicator in locked state has no flag present. Provide rim devices without the dual cylinder or inside thumb turn cylinder option capable of being retrofitted with the visual security indicator.
6. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrical requirements.
7. Provide exit devices with manufacturer's approved strikes.
8. Provide exit devices cut to door width and height. Locate exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
9. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
10. Provide hex-key dogging at non-fire-rated exit devices, unless specified less dogging.
11. Removable Mullions: 2 inches x 3 inches steel tube. Where scheduled as keyed removable mullion that is removed by use of a keyed cylinder, which is self-locking when re-installed.
12. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set. Lever Style: 07 to match lever style of locksets.
13. Provide UL labeled fire exit hardware for fire rated openings.

2.7 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer: Schlage, Owner Standard

B. Requirements:

1. Provide 6-pin interchangeable cylinders to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Replaceable Construction Cores.

a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
   1) 3 construction control keys
   2) 12 construction change (day) keys.

b. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2.8 KEYING

A. Provide cylinders/cores keyed into Owner's existing keying system managed by Owner's locksmith, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference, if desired by Owner, and if Owner is not providing permanent cores.

B. Requirements:

1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.

   Master Keying system as directed by the Owner.

2. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
3. Provide keys with the following features:

   a. Material: Nickel silver; minimum thickness of .107-inch

4. Identification:

   a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Blind code marks shall not include actual key cuts.
   b. Identification stamping provisions must be approved by the Architect and Owner.
   c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
   d. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.
   e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

5. Quantity: Furnish in the following quantities.

   a. Change (Day) Keys: 3 per cylinder/core.
   b. Permanent Control Keys: 3.
   c. Master Keys: 6.

2.9 KEY CONTROL SYSTEM

A. Manufacturers:

1. Scheduled Manufacturer: Telkee
2. Acceptable Manufacturers: HPC, Lund

B. Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.

    a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
    b. Provide hinged-panel type cabinet for wall mounting.

2.10 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4040XP SCUSH series, Owner Standard.

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2 inch diameter with 3/4 inch diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.11 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Trimco, Burns

B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:

    a. Kick Plates: 10 inches high by 2 inches less width of door on single doors, 1 inch less width of door on pairs
    b. Mop Plates: 10 inches high by 2 inches less width of door on single doors, 1 inch width of door on pairs

2.12 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Trimco, Burns

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.13 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: Zero International
2. Acceptable Manufacturers: National Guard, Reese

B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds:

    a. Saddle Thresholds: 1/2 inch high by jamb width by door width
    b. Bumper Seal Thresholds: 1/2 inch high by 5 inches wide by door width

3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.14 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Door Closers: BHMA 689 Powder Coat to Match
6. Wall Stops: BHMA 630 (US32D)
7. Latch Protectors: BHMA 630 (US32D)
8. Weatherstripping: Clear Anodized Aluminum
9. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Existing Door and Frame Compatibility: Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Where on-site modification of doors and frames is required:

1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
2. Field modify and prepare existing door and frame for new hardware being installed.
3. When modifications are exposed to view, use concealed fasteners, when possible.
4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:

    a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
    b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
    c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each hardware item in compliance with manufacturer’s instructions and recommendations, using only fasteners provided by manufacturer.

C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

H. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Owner to provide permanent cores.

I. Wiring: Coordinate with Division 26, ELECTRICAL sections for:

1. Conduit, junction boxes and wire pulls.
2. Connections to and from power supplies to electrified hardware.
3. Connections to fire/smoke alarm system and smoke evacuation system.
4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
5. Testing and labeling wires with Architect's opening number.

J. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

K. Door Closers: Mount closers as parallel SCUSH closers per Owner request.

L. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

M. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

N. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

O. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

P. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

A. Architectural Hardware Consultant: Engage qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust

door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.8 DOOR HARDWARE SCHEDULE

HW SET: AL-01
DOOR #(S):
100
EACH TO HAVE:

1	EA	CONT. HINGE	112XY	628	IVE
1	EA	PANIC HARDWARE	98-NL-OP-SNB	626	VON
1	EA	PERMANENT CORE	BY OWNER		
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	90 DEG OFFSET PULL	8190HD 10” O	630	IVE
1	EA	ELECTRIC STRIKE	6211 FSE AL	630	VON
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	SEALS	FRAME MFR STD		
1	EA	DOOR SWEEP	DOOR MFR STD		
1	EA	THRESHOLD	545A-223	A	ZER
1	EA	CARD READER	BY ACCESS CONTROL		
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	BY ACCESS CONTROL		

COORDINATE WITH ACCESS CONTROL AND ELECTRICAL.
OPERATION: VALID CREDENTIAL AT READER RELEASES STRIKE FOR AUTHORIZED ENTRY. FREE EGRESS AT ALL TIMES. FAIL SECURE.

HW SET: 01
DOOR #(S):
101 110 111
EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND40S ATH O/S OCC	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	MOP PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

NOTE: CLOSER ARM IS OWNER REQUEST.

HW SET: 02
DOOR #(S):
102 103 116
EACH TO HAVE:

3	EA	HEAVY WT. HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PULL PLATE	8303 10” 4” X 16”	630	IVE
1	EA	PUSH PLATE	8200 6” X 16”	630	IVE
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10” X 2” LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HW SET: 03
DOOR #(S):
104
EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD ATH	626	SCH
1	EA	PERMANENT CORE	BY OWNER	626	
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

NOTE: CLOSER ARM OWNER REQUEST.

HW SET: 04
DOOR #(S):
105
EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD ATH	626	SCH
1	EA	PERMANENT CORE	BY OWNER	626	
1	EA	ELECTRIC STRIKE	6400 FSE	630	VON
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	CARD READER	BY ACCESS CONTROL		
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	BY ACCESS CONTROL		

COORDINATE WITH ACCESS CONTROL AND ELECTRICAL.
OPERATION: VALID CREDENTIAL AT READER RELEASES STRIKE FOR AUTHORIZED ENTRY. FREE EGRESS AT ALL TIMES. FAIL SECURE.

HW SET: 05
DOOR #(S):
106 107
EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50TD ATH	626	SCH
1	EA	PERMANENT CORE	BY OWNER	626	
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 06
DOOR #(S):
108 123
EACH TO HAVE:

1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PANIC HARDWARE	98-NL-SNB	626	VON
1	EA	PERMANENT CORE	BY OWNER		
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE AL	630	VON
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	8192AA	AA	ZER
1	EA	THRESHOLD	655A-223	A	ZER
1	EA	CARD READER	BY ACCESS CONTROL		
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	BY ACCESS CONTROL		

COORDINATE WITH ACCESS CONTROL AND ELECTRICAL.
OPERATION: VALID CREDENTIAL AT READER RELEASES STRIKE FOR AUTHORIZED ENTRY. FREE EGRESS AT ALL TIMES. FAIL SECURE.

HW SET: 07
DOOR #(S):
109
EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70TD ATH	626	SCH
1	EA	PERMANENT CORE	BY OWNER	626	
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 08
DOOR #(S):
112
EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	ND80TD ATH	626	SCH
1	EA	PERMANENT CORE	BY OWNER	626	
1	EA	LOCK GUARD	LG13	630	IVE
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	8192AA	AA	ZER
1	EA	THRESHOLD	655A-223	A	ZER

COORDINATE HARDWARE WITH EXISTING DOOR PREPS. MATCH HINGE SIZE AND WEIGHT TO EXISTING FRAME PREP.

HW SET: 09
DOOR #(S):
113 114 115
EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HW SET: 10
DOOR #(S):
117
EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HW SET: 11
DOOR #(S):
118
EACH TO HAVE:

3	EA	HEAVY WT. HINGE	5BB1HW 4.5 X 4.5	630	IVE
1	EA	PANIC HARDWARE	98-L-BE-F-07-SNB	626	VON
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A-223	A	ZER

HW SET: 12
DOOR #(S):
119 124
EACH TO HAVE:

1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PANIC HARDWARE	98-EO-SNB	626	VON
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	8192AA	AA	ZER
1	EA	THRESHOLD	655A-223	A	ZER

HW SET: 13
DOOR #(S):
120
EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	630	IVE
1	EA	CLASSROOM LOCK	ND70TD ATH	626	SCH
1	EA	PERMANENT CORE	BY OWNER	626	
1	EA	SURFACE CLOSER	4040XP SHCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	545A-223	A	ZER

HW SET: 14
DOOR #(S):
121
EACH TO HAVE:

3	EA	HEAVY WT. HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PULL PLATE	8303 10” 4” X 16”	630	IVE
1	EA	PUSH PLATE	8200 6” X 16”	630	IVE
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10” X 2” LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	AA	ZER
1	EA	THRESHOLD	545A-223	A	ZER

HW SET: 15
DOOR #(S):
122
EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	ND80TD ATH	626	SCH
1	EA	PERMANENT CORE	BY OWNER	626	
1	EA	ELECTRIC STRIKE	6400 FSE	630	VON
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	AA	ZER
1	EA	THRESHOLD	545A-223	A	ZER
1	EA	CARD READER	BY ACCESS CONTROL		
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	BY ACCESS CONTROL		

COORDINATE WITH ACCESS CONTROL AND ELECTRICAL.
OPERATION: VALID CREDENTIAL AT READER RELEASES STRIKE FOR AUTHORIZED ENTRY. FREE EGRESS AT ALL TIMES. FAIL SECURE.

END OF SECTION

SECTION 08800 – GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Furnish all labor materials, tools, equipment, and services for Glazing. Provide alal miscellaneous items, appurtenances and devices, incidental to or necessary for a sound, secure and complete installation.

1.2 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.
3. Glazed entrances.
4. Interior borrowed lites.

1.3 DEFINITIONS

A. Manufacturer: A firm that produces primary glass or fabricated glass as defined in referenced glazing publications.

B. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

C. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass and of 12-inch- (300-mm-) long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

C. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Product Data: For each glass product and glazing material indicated.

LEED Submittals:

1. Product Data for Credit IEQ 4.1: For glazing sealants used inside the weatherproofing system, documentation including printed statement of VOC content.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations for Glass: Obtain clear float glass from one primary-glass manufacturer.

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

D. Fire-Rated Window Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.

E. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.

F. 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 inspecting and testing agency:

1. Insulating Glass Certification Council.

1.7 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.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F (4.4 deg C).

1.9 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Manufacturer's Special Warranty on Insulating Glass: Written warranty, made out to Owner and signed by insulating-glass manufacturer agreeing to furnish replacements for insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

Note: Provide safty glass in all areas where required by code.

2.1 PRODUCTS AND MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in schedules at the end of Part 3.

B. Products: Subject to compliance with requirements, provide one of the products indicated in schedules at the end of Part 3.

2.2 PRIMARY FLOAT GLASS

A. Float Glass: ASTM C 1036, Type I (transparent glass, flat), Quality q3 (glazing select); class as indicated in schedules at the end of Part 3.

2.3 HEAT-TREATED FLOAT GLASS

A. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent glass, flat); Quality q3 (glazing select); class, kind, and condition as indicated in schedules at the end of Part 3.

2.4 WIRED GLASS

A. Wired Glass: ASTM C 1036, Type II (patterned and wired glass, flat), Class 1 (clear), Quality q8 (glazing); 6.4 mm thick; of form and mesh pattern indicated below:

1. Polished Wired Glass: Form 1 (wired, polished both sides), and as follows:

a. Mesh m1 (diamond).

B. 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:

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Polished Wired Glass:

a. Ashai Glass Co./Ama Glass Corp.
b. Central Glass Co., Ltd.
c. Nippon Sheet Glass Co., Ltd.
d. Pilkington Glass Ltd.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Preassembled 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 the Insulating-Glass Schedule at the end of Part 3.

B. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated in the Insulating-Glass Schedule are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.

C. Sealing System: Dual seal, with primary and secondary sealants as follows:

1. Manufacturer's standard sealants meeting requirements of LEED IEQ 4.1.

D. Spacer Specifications: Manufacturer's standard spacer material and construction.

E. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:

1. Corner Construction: Manufacturer's standard corner construction.

2.6 GLAZING GASKETS

A. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock strips, complying with ASTM C 542, black.

B. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

1. Neoprene, ASTM C 864.
2. EPDM, ASTM C 864.
3. Silicone, ASTM C 1115.
4. Thermoplastic polyolefin rubber, ASTM C 1115.
5. Any material indicated above.

C. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:

1. Neoprene.
2. EPDM.
3. Silicone.
4. Thermoplastic polyolefin rubber.
5. Any material indicated above.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.8 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products 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 standard, to comply with system performance requirements.

B. Grind smooth and polish exposed glass edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where the length plus width is larger than 50 inches (1270 mm) as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and

glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. It shall be the responsibility of the Contractor to provide tempered “Safety Glass” as required by Code.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 PROTECTION AND CLEANING

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

3.8 GLAZING SCHEDULE:

NOTE: All glazing thicknesses must be designed to resist wind loads for the project area. The following should be considered a minimum:

Location	Thickness
Interior	¼” Provide safety glass as required by code
Exterior Glazing 1	PPG Solarban z75 (2) with Clear Glass on one lite.

A. Type: Exterior Glazing - Low-E Tinted Insulating Glass, low-reflective glass outdoor appearance.

1. Product: “Solarban” z75 (2) + Clear by PPG Industries, Inc.
2. Insulating Unit Construction: 1/4 inch “Solarban” z75 Solar Control (Sputtered) on second surface (2), + 1/2 inch (13mm) air space + 1/4 inch (6mm) Clear Float Glass.

3. Performance Values: Visible Light Transmission – 48 percent; SHGC – 0.24; Shading Coefficient – 0.28; Outdoor Visible Light Reflectance – 9 percent.

END OF SECTION 08800

SECTION 08817 – FIRE-RATED GLASS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fire-rated glazing materials installed as windows in fire-rated frames.

B. Related Sections include the following:
1. Section 08110 “Steel Doors and Frames” for vision panels in interior doors and interior vision panel (borrowed lites) frames.

1.2 REFERENCES
1. ASTM E2074-00: Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.
2. ASTM E2010-01: Standard Test Method for Positive Pressure Fire Tests of Window Assemblies.

B. American National Standards Institute (ANSI):
1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings

C. Consumer Product Safety Commission (CPSC):
1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials

D. Glass Association of North America (GANA):
1. GANA – Glazing Manual.
2. FGMA – Sealant Manual.

E. National Fire Protection Association (NFPA):
1. NFPA 80: Fire Doors and Windows.
2. NFPA 252 – Fire Tests of Door Assemblies.
3. NFPA 257 – Fire Tests of Window Assemblies.

F. Underwriters Laboratories, Inc. (UL):
1. UL 9 – Fire Tests of Window Assemblies.
2. UL 10B – Fire Tests of Door Assemblies.
3. UL 10C – Positive Pressure Fire Tests of Door Assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. Fire-rated glass ceramic laminated clear and wireless glazing material for use in impact safety-rated locations such as doors, transoms and borrowed lites with fire rating requirements ranging from 20 minutes to 3 hours with hose stream test.

B. Passes positive pressure test standards UL10C, UBC 7-2 and UBC 7-4.

1.4 SUBMITTALS

A. Comply with requirements of Division 1 – General Requirements

B. Product Data: Submit manufacturer's technical data for each glazing material required, including installation and maintenance instructions.

C. Certificates of compliance from glass and glazing materials manufacturers attesting that glass and glazing materials furnished for project comply with requirements. Separate certification will not be required for glazing materials bearing manufacturer's permanent label designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.

D. Product Test Listings: From UL indicating fire-rated glass complies with requirements, based on comprehensive testing of current product.

E. Samples: Submit, for verification purposes, approx. 8-invh by 10-inch sample for each type of glass indicated.

1.5 QUALITY ASSURANCE

A. Glazing Standards: FGMA Glazing Manual and Sealant Manual.

B. Fire Protective Rated Glass: Each lite shall bear permanent, nonremovable label of UL certifying it for use in tested and rated fire protective assemblies.

C. Fire Protective Glazing Products for Door Assemblies: Products identical to those tested per ASTM E2074-00 and UL 10B, labeled and listed by UL.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to specified destination in manufacturer's or distributor's packaging, undamaged, complete with installation instructions.

B. Store off ground, under cover, protected from weather and construction activities.

1.7 WARRANTY

A. Provide manufacturer's limited warranty.

B. Warranty Period: Five years from date of Final Completion.

PART 2 - PRODUCTS

2.1 FIRE-RATED GLAZING MATERIALS

A. Manufacturer: FireLite®Plus as manufactured by Nippon Electric Glass Company, Ltd., and distributed by Technical Glass Products, Kirkland, Washington. Other manufactures meeting the performance requirements of this specification.

B. Properties:
   1. Thickness: 5/16 inch [8 mm] overall.
   2. Weight: 4 lbs./sq. ft.
   3. Approximate Visible Transmission: 85 percent.
   4. Approximate Visible Reflection: 9 percent.
   5. Fire-rating: 90 minutes.
   6. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).
   7. STC Rating: Approximately 35 dB.
   8. Surface Finish: Premium (polished).
   9. Positive Pressure Test: UL 10C, UBC 7-2 and 7-4; passes.

C. Maximum sheet sizes based on surface finish:
   1. Premium: 48 inches by 96 inches.

D. Labeling: Permanently label each piece of FireLite®Plus with the FireLite® logo, UL logo and fire rating in sizes up to 3,325 sq. in., and with the FireLite label only for sizes that exceed the listing (as approved by the local authority having jurisdiction).

E. Fire Rating: Fire rating listed and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with [ASTM E2074-00 and ASTM E2010-01] [ULC Standards CAN4 S-104 and CAN4 S-106] [NPFA 252 and NFPA 257] [UL 9, UL 10B and UL 10C].

2.2 GLAZING COMPOUND FOR FIRE-RATED GLAZING MATERIALS

A. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent. Glass panels that exceed 1,393 sq. inches for 90-minute ratings must be glazed with fire-rated glazing tape supplied by manufacturer.

B. Setting Blocks: Neoprene, EPDM, or silicone; tested for compatibility with glazing compound; of 70 to 90 Shore A hardness.

C. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

2.3 FABRICATION

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine glass framing, with glazier present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
   2. Minimum required face or edge clearances.
   3. Observable edge damage or face imperfections.

B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

C. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.2 INSTALLATION (GLAZING)

A. Comply with referenced FGMA standards and instructions of manufacturers of glass, glazing sealants, and glazing compounds.

B. Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.

C. Set units of glass in each series with uniformity of pattern, draw, bow, and similar characteristics.

D. Cut glazing tape to length and set against permanent stops, flush with sight lines to fit openings exactly, with stretch allowance during installation.

E. Place setting blocks located at quarter points of glass with edge block no more than 6 inches from corners.

F. Glaze vertically into labeled fire-rated metal frames or partition walls with same fire rating as glass and push against tape for full contact at perimeter of pane or unit.

G. Place glazing tape on free perimeter of glazing in same manner described above.

H. Install removable stop and secure without displacement of tape.

I. [Use specified glazing compound, without adulteration; bed glazing material in glazing compound; entirely fill all recess and spaces. Provide visible glazing compound with smooth and straight edges.]

J. Install in vision panels in fire-rated doors to requirements of NFPA 80.

K. Install so that appropriate [UL] [FireLite®Plus] markings remain permanently visible.

3.3 PROTECTION AND CLEANING

A. Protect glass from contact with contaminating substances resulting from construction operations. Remove any such substances by method approved by glass manufacturer.

B. Wash glass on both faces not more than four days prior to date scheduled for inspections intended to establish date of substantial completion. Wash glass by method recommended by glass manufacturer.

3.4 GLAZING SCHEDULE

A. See drawings for locations of fire rated glazing.

Rating	Assembly	Max. Exposed Area (Sq. In.)	Max. Width Of Exposed Glazing (In.)	**OR**	Max. Height Of Exposed Glazing (In.)	Stop Height
20 min.	Doors					
	HMS or Wood*	3,204	36		89	5/8”
	Fireframes D.S.	3,204	36		89	3/4"
	Other than doors					
	HMS or Wood	3,325	95		95	5/8”
	Fireframes D.S.	3,325	95		95	3/4"
45 min.	Doors					
	HMS or Wood	3,204	36		89	5/8”
	Fireframes D.S.	3,204	36		89	3/4"
	Other than doors					
	HMS or Wood	3,325	95		95	5/8”
	Fireframes D.S.	3,325	95		95	3/4"
60 min.	Doors (non-temp rise)					
	HMS or Wood	3,204	36		89	5/8”
	Fireframes D.S.	3,204	36		89	3/4"
	Doors (temp rise)	100	12		33	5/8”
	Other than doors					
	HMS or Wood	3,325	95		95	5/8”
	Fireframes D.S.	3,325	95		95	3/4"
90 min.	Doors (non-temp rise)	2,034	36		56 ½”	3/4”
	Doors (temp rise)	100	12		33	1/2”
	Other than doors					
	HMS	2,627	56 ½”		56 ½”	5/8”
	Fireframes D.S.	2,627	56 ½”		56 ½”	3/4"
3 hours	Doors	100	12		33	1/2”

* HMS indicates hollow metal steel framing. Fireframes D.S. indicates Designer Series narrow profile framing by Forster. For wood frames, check with manufacturer for maximum tested glass sizes.

END OF SECTION

SECTION 09250 – EXTERIOR SHEATHING

PART 1 – GENERAL

1.1 DESCRIPTION:

A. Work in this section includes, but is not limited to: exterior wall sheathing.

1. Related work specified elsewhere:

a. Cold formed metal framing.
b. Rough carpentry.
c. Joint sealers.
d. Light-gauge metal framing.
e. Architectural wall panels.

1.2 SUBMITTALS:

A. Product data: Submit manufacturer's descriptive literature indicating material composition, thickness, sizes and fire resistance.

1.3 QUALITY ASSURANCE:

A. Fire-resistance ratings: Where applicable, provide materials and construction that are identical to those of assemblies whose fire-resistance ratings are indicated.

1.4 DELIVERY, STORAGE AND HANDLING:

A. Delivery: Deliver materials to the job site in manufacturer's original packaging, containers and bundles with manufacturer's brand name and identification intact and legible.
B. Storage and handling: Store and handle materials to protect against contact with damp and wet surfaces, exposure to weather, breakage and damage to edges. Provide air circulation under covering and around stacks of materials.

1.5 LIMITATIONS:

A. For all installations, design details such as fasteners, sealants and control joints per system specifications must be properly installed. Openings and penetrations must be properly flashed and sealed.
B. Do not use DensGlass Gold sheathing as a base for nailing or mechanical fastening. Fasteners should be flush to the face of the board, not countersunk.

PART 2 – PRODUCTS

2.1 SHEATHING BOARD:

A. Acceptable Products:

1. ½" DensGlass Gold Exterior Sheathing or preapproved equals.

2. ½" DensDeck Roof Board wherever Membrane roofing shall be adhered to sheathing.

B. Composition:

1. Gypsum sheathing manufactured in accordance with ASTM C 1177 with glass mats both sides and long edges, water-resistant treated core.

C. Fire resistance:

1. ½" DensGlass Gold Exterior Sheathing: Flame spread 10, smoke developed 0, when tested in accordance with ASTM E 84.

2.2 AIR, WATER AND WEATHER BARRIER:

A. Tape all joints and apply water-resistive membrane and air barrier to entire exterior side of sheathing. See section 07240.

2.3 ACCESSORIES:

A. Joint tape: 2" wide 10x10 glass mesh tape.
B. Screws, metal framing:

1. Bugle or wafer head, self-tapping, rust-resistant, fine thread for heavy-steel gauge.
2. Bugle or wafer head, rust-resistant sharp point, fine thread for light-gauge metal framing or furring.

PART 3 – EXECUTION

3.1 PREPARTION:

A. Examine subframing; verify that surface of framing and furring members to receive sheathing does not vary more than 1/8" from the placement of faces of adjacent members.

3.2 SHEATHING:

A. Provide DensGlass Gold Exterior Sheathing where indicated on drawings. Install sheathing in accordance with manufacturer's instructions and applicable instructions in GA-253 and ASTM C 1280.
B. Install DensGlass Gold Exterior Sheathing with gold side out.
C. Use maximum lengths possible to minimize number of joints.
D. Attach DensGlass Gold Exterior Sheathing to metal framing with screws spaced 8" o.c. at perimeter where there are framing supports; and 8" o.c. along intermediate framing in field.
E. Drive fasteners to bear tight against and flush with surface of sheathing. Do not counter sink.
F. Locate fasteners minimum 3/8" from edges and ends of sheathing panels, tight against and flush with surface of sheathing.

END OF SECTION

SECTION 09255 - GYPSUM BOARD ASSEMBLIES

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. Gypsum board assemblies.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Section 06100 Rough Carpentry

1.3 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 ASSEMBLY PERFORMANCE REQUIREMENTS

A. Fire Resistance: Provide gypsum board assemblies with fire-resistance ratings indicated.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified.

C. Proposed control joint layout.

1.6 QUALITY ASSURANCE

A. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.

B. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

C. Fire-Test-Response Characteristics: Where fire-resistance-rated gypsum board assemblies are indicated, provide gypsum board assemblies that comply with the following requirements:

1. Fire-Resistance Ratings: As indicated by GA File Numbers in GA-600 "Fire Resistance Design Manual" or design designations in UL "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.

1.8 PROJECT CONDITIONS

A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 requirements or gypsum board manufacturer's recommendations, whichever are more stringent.

B. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F (10 deg C) for 48 hours before application and continuously after until dry. Do not exceed 95 deg F (35 deg C) when using temporary heat sources.

C. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Gypsum Board and Related Products:
    a. Georgia-Pacific Corp.
    b. National Gypsum Co.; Gold Bond Building Products Division.
    c. United States Gypsum Co.

2.2 GYPSUM BOARD PRODUCTS

A. General: Provide gypsum board of types indicated in maximum lengths available that will minimize end-to-end butt joints in each area indicated to receive gypsum board application.

1. Widths: Provide gypsum board in widths of 48 inches (1219 mm).

B. Gypsum Wallboard:

1. Type: Interior -. Thickness: 5/8 inch (15.9 mm).
2. Type: Type X where required for fire-resistance-rated assemblies.
3. Exterior: See 09250 – Exterior Sheathing.
4. Edges: Tapered and featured (rounded or beveled) for prefilling.

C. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M and as follows:

1. Type: Regular, unless otherwise indicated.

2.3 TRIM ACCESSORIES

A. Accessories for Interior Installation: Cornerbead, edge trim, and control joints complying with ASTM C 1047 and requirements indicated below:

1. Material: Formed metal complying with the following requirement:

a. Steel sheet zinc coated by hot-dip process or rolled zinc.
b. Steel sheet zinc coated by hot-dip or electrolytic process, or steel sheet coated with aluminum or rolled zinc.

2. Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047:

a. Cornerbead on outside corners.
b. LC-bead with both face and back flanges; face flange formed to receive joint compound. Use LC-beads for edge trim, unless otherwise indicated.
c. L-bead with face flange only; face flange formed to receive joint compound. Use L-bead where indicated.
d. U-bead with face and back flanges; face flange formed to be left without application of joint compound. Use U-bead where indicated.
e. One-piece control joint formed with V-shaped slot and removable strip covering slot opening spaced no more than 20’-0’ o.c. Provide layout for approval prior to installation.

B. Accessory for Curved Edges: Cornerbead formed of metal, plastic, or metal combined with plastic, with either notched or flexible flanges that are bendable to curvature radius.

C. Finished accessories – 16 ga Stainless Steel corner guards. Install at all exposed outside corners. Leg length 2”. Min 6’-0” in height.

2.4 JOINT TREATMENT MATERIALS

A. General: Provide joint treatment materials complying with ASTM C 475/C 475M and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

B. Joint Tape for Gypsum Board: Paper reinforcing tape, unless otherwise indicated.

C. Setting-Type Joint Compounds for Gypsum Board: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.

1. Where setting-type joint compounds are indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.
2. For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer.
3. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by gypsum board manufacturer.
4. For topping compound, use sandable formulation.

2.5 MISCELLANEOUS MATERIALS

A. General: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel drill screws complying with ASTM C 1002 for the following applications:
1. Fastening gypsum board to wood members.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING GYPSUM BOARD, GENERAL

A. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840 and GA-216.

B. Install sound-attenuation blankets, where indicated, prior to installing gypsum panels.

C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

E. Locate both edge or end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Avoid joints other than control joints at corners of framed openings where possible.

F. Attach gypsum panels to framing provided at openings and cutouts.

3.3 GYPSUM BOARD APPLICATION METHODS

A. Single-Layer Application: Install gypsum wallboard panels as follows:

1. On ceilings, apply gypsum panels prior to wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated, and provide panel lengths that will minimize end joints.

B. Wall Tile Substrates: For substrates indicated to receive thin-set ceramic tile and similar rigid applied wall finishes, comply with the following:
1. Install water-resistant gypsum backing board panels at showers, tubs, and where indicated. Install with 1/4-inch (6.4-mm) open space where panels abut other construction or penetrations.

C. Single-Layer Fastening Methods: Apply gypsum panels to supports as follows:
1. Fasten to wood supports with adhesive and supplementary nails or screws.

3.4 INSTALLING TRIM ACCESSORIES

A. General: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.

B. Install cornerbead at external corners.

3.5 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Treat gypsum board joints, interior angles, flanges of cornerbead, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.

B. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.

C. Apply joint tape over gypsum board joints and to flanges of trim accessories as recommended by trim accessory manufacturer.

D. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-214.

1. Level 1 for ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
2. Level 2 where panels form substrates for tile.
3. Level 3 for gypsum board where indicated. (Ceilings)
4. Level 5 for gypsum board surfaces. (Walls)

E. Use the following joint compound combination as applicable to the finish levels specified:

1. Embedding and First Coat: Setting-type joint compound. Fill (Second) Coat: Setting-type joint compound. Finish (Third) Coat: Sandable, setting-type joint compound.

F. Where Level 5 gypsum board finish is indicated, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories; and apply a thin, uniform skim coat of joint compound over entire surface. For skim coat, use joint com-

pound specified for third coat, or a product specially formulated for this purpose and acceptable to gypsum board manufacturer. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects, tool marks, and ridges and ready for decoration.

G. Where Level 3 gypsum board finish is indicated, embed tape in joint compound and apply first and fill (second) coats of joint compound.

H. Where Level 2 gypsum board finish is indicated, embed tape in joint compound and apply first coat of joint compound.

I. Where Level 1 gypsum board finish is indicated, embed tape in joint compound.

J. Finish water-resistant gypsum backing board forming base for ceramic tile to comply with ASTM C 840 and gypsum board manufacturer's directions for treatment of joints behind tile.

K. Finish cementitious backer units to comply with unit manufacturer's directions.

3.6 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Architect will conduct an above-ceiling observation prior to installation of gypsum board ceilings and report any deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

3.7 CLEANING AND PROTECTION

A. Promptly remove any residual joint compound from adjacent surfaces.

B. Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure gypsum board assemblies are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 09255

SECTION 09301 - TILE

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. Ceramic mosaic tile.
2. Pressed floor tile.
3. Porcelain tile.
4. Glazed wall tile.
5. Glass mosaic tile.
6. Stone thresholds.
7. Tile backing panels.
8. Waterproof membrane for thinset applications.
9. Crack isolation membrane.
10. Metal edge strips.

1.3 REFERENCES

A. ANSI A108/A1118 Series: American National Standards for Installation of Ceramic Tile.

B. ANSI A137.1: American National Standard Specifications for Ceramic Tile.

C. ISO 13007: International Standards Organization; Classification for Grout and Adhesives.

D. TCNA (HB); Handbook for Ceramic, Glass and Stone Tile Installation; Tile Council of North America.

1.4 DEFINITIONS

A. Module Size: Actual tile size plus joint width indicated.

B. Face Size: Actual tile size, excluding spacer lugs.

1.5 PREINSTALLATION MEETINGS

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

C. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

D. Samples for Initial Selection: For tile, grout, and accessories involving color selection.

E. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
2. Full-size units of each type of trim and accessory for each color and finish required.
3. Stone thresholds in 6-inch (150-mm) lengths.
4. Metal edge strips in 6-inch (150-mm) lengths.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

C. Product Certificates: For each type of product.

D. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Provide installation products of this section by companies which have successfully specialized in production of this type for not less than five years.

2. Installation product must have a hydraulic cement-based inorganic binder content to include Portland cement ASTM C150; Standard Specification for Portland Cement and other specialty hydraulic cements. Gypsum-based products are not acceptable.

B. Installer Qualifications:

1. Installer is a five-star member of the National Tile Contractors Association

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of floor tile installation.
2. Build mockup of each type of wall tile installation.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.11 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.12 WARRANTY

A. System Warranty: Provide a minimum 1 year, non pro-rated, comprehensive warranty for the tile and stone installation products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:

1. Stone thresholds.
2. Waterproof membrane.
3. Crack isolation membrane.
4. Cementitious backer units.
5. Metal edge strips.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

2.3 TILE PRODUCTS

A. Porcelain Tile Type Floor: Unglazed pressed floor tile.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Shaw Industries
   b. Daltile
   c. American Olean
   d. Interceramic

2. Certification: Tile certified by the Porcelain Tile Certification Agency.

3. Composition: Impervious natural clay or porcelain
4. Face Size: nominal **12 by 12 inches**
5. Thickness: 1/4 inch
6. Face: Plain with square or cushion edges
7. Dynamic Coefficient of Friction: Not less than 0.42.
8. Tile Color and Pattern: As selected by Owner from manufacturer's full range
9. Grout Color: As selected by Owner from manufacturer's full range.
10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable **and matching characteristics of adjoining flat tile**. Provide shapes as follows, selected from manufacturer's standard shapes:

a. Base Cove: Cove, module size **same as adjoining flat tile**.
b. Base Cap for Thinset Mortar Installations: Surface bullnose, module size **same as adjoining flat tile.**
c. Wainscot Cap for Thinset Mortar Installations: Surface bullnose, module size **same as adjoining flat tile**.
d. External Corners for Thinset Mortar Installations: Surface bullnose, module size.
e. Internal Corners: Cove, module size **same as adjoining flat tile**.

B. Porcelain Tile Type **Wall**: Glazed wall tile. Accent with glass mosaic tile.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Shaw Industries
   b. Daltile
   c. American Olean
   d. Interceramic

2. Module Size: **Varies – see drawings**
3. Face Size Variation: Rectified.
4. Thickness: 5/16 inch (8 mm).
5. Face: **Plain with modified square edges or cushion edges**
6. Finish: **Bright, opaque** and **Bright, clear** glaze.
7. Tile Color and Pattern: **As selected by Owner from manufacturer's full range**
8. Grout Color: **As selected by Owner from manufacturer's full range**
9. Mounting: Factory, back mounted.
10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable **and matching characteristics of adjoining flat tile**. Provide shapes as follows, selected from manufacturer's standard shapes:
    a. Wainscot Cap for Thinset Mortar Installations: 3/8” bullnose edge trim with satin nickel finish
    b. External Corners for Thinset Mortar Installations: Surface bullnose, same size as adjoining flat tile.
    c. Internal Corners: Field-butted square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.

C. Accessories: Provide vitreous china accessories of type and size indicated, suitable for installing by same method as used for adjoining wall tile.

2.4 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/4 inch (12.7 mm) or less above adjacent floor surface.

B. Marble Thresholds: ASTM C 503/C 503M, with a minimum abrasion resistance of **10** according to ASTM C 1353 or ASTM C 241/C 241M and with honed finish.

1. Description: Uniform, fine- to medium-grained white stone with gray veining.

2.5 TILE BACKING PANELS

A. Fiber-Cement Backer Board: ASTM C 1288, in maximum lengths available to minimize end-to-end butt joints.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation.
b. James Hardie Building Products, Inc.

2. Thickness: **1/2”**

2.6 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Latex-Portland Cement Waterproof Mortar: Flexible, waterproof mortar consisting of cement-based mix and latex additive.

1. Basis-of-Design Product: Subject to compliance with requirements, provide ARDEX GmbH; Ardex 8+9™ Waterproofing Compound or a comparable product by one of the following:

a. MAPEI Corporation.
b. TEC; H.B. Fuller Construction Products Inc.

2.7 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.12. Include reinforcement and accessories recommended by manufacturer.

B. Latex-Portland Cement Crack-Resistant Mortar: Flexible mortar consisting of cement-based mix and latex additive.

1. Basis-of-Design Product: Subject to compliance with requirements, provide ARDEX Americas; Ardex 8+9™ Waterproofing and Crack Isolation Compound or a comparable product by one of the following:

a. MAPEI Corporation.
b. TEC; H.B. Fuller Construction Products Inc.

2.8 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thinset): ANSI A118.4 and/or conforms with ISO 13007.

1. Basis-of-Design Product: Subject to compliance with requirements, provide ARDEX Americas; latex-portland cement mortar (thinset) or a comparable product by one of the following:

    a. Bostik, Inc.
    b. TEC; H.B. Fuller Construction Products Inc.

2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.9 GROUT MATERIALS

A. High-Performance Sanded Tile Grout: ANSI A118.7 and/or conforms to EN 13888 and/or ISO 13007 CG2 WA.

1. Basis-of-Design Product: Subject to compliance with requirements, provide ARDEX Americas; FL Rapid Set, Flexible Sanded Grout or a comparable product by one of the following:

    a. Bostik, Inc.
    b. TEC; H.B. Fuller Construction Products Inc.

2. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

2.10 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated. Use same manufacturer as the adhesive manufacturer.

1. Basis-of-Design Product: Subject to compliance with requirements, provide ARDEX Americas; trowelable underlayment or a comparable product by one of the following:

    a. TEC; H.B. Fuller Construction Products Inc.

B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

C. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Custom Building Products.
    b. TEC; H.B. Fuller Construction Products Inc.

2.11 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with **thinset mortar** comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with **thinset mortar** with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 CERAMIC TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:

    a. Exterior tile floors.
    b. Tile floors in wet areas.
    c. Tile swimming pool decks.
    d. Tile floors in laundries.
    e. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
    f. Tile floors consisting of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
1. Porcelain Tile: **1/4 inch**

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, as required. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
1. Do not extend **waterproofing or crack isolation membrane** under thresholds set in **dry-set portland cement** mortar. Fill joints between such thresholds and adjoining tile set on **waterproofing or crack isolation membrane** with elastomeric sealant.

3.4 TILE BACKING PANEL INSTALLATION

A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. **Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.**

3.5 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

B. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.6 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.7 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.8 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 09301

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SECTION 09511 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes acoustical panel ceilings installed with exposed suspension systems.

1.2 SUBMITTALS

A. Product data for each type of product specified.

B. Samples: Submit samples of the following:

1. 6 inch square samples of each acoustical panel type, pattern, and color.
2. Set of 6 inch long samples of exposed suspension system members, including moldings, for each color and system type required.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has successfully completed acoustical ceilings similar in materials, design, and extent to those indicated for Project.

B. Fire-Performance Characteristics: Provide acoustical ceilings that are identical to those tested for the following fire performance characteristics, according to ASTM test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

1. Surface Burning Characteristics: As follows, tested per ASTM E 84, and complying with ASTM E 1264 for Class A products.

a. Flame Spread: 25 or less.
b. Smoke Developed: 50 or less.

C. Single-Source Responsibility for Ceiling Units: Obtain each type of acoustical ceiling unit from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

D. Single-Source Responsibility for Suspension System: Obtain each type of suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

E. Coordination of Work: Coordinate layout and installation of acoustical ceiling units and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition system (if any). Do not install panels prior to the approval by the Owner and Architect of all of the work above the ceiling, including, but not limited to Mechanical, Electrical, Plumbing, and Structural. All four corners of grid at all locations of ceiling mounted projectors shall be supported.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way.

1.5 PROJECT CONDITIONS

A. Space Enclosure: Do not install interior acoustical ceilings until space is enclosed, conditioned, and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient conditions of temperature and humidity will be continuously maintained at values indicated for final occupancy.

PART 2 - PRODUCTS

2.1 ACOUSTICAL CEILING UNITS, GENERAL

A. Standard for Acoustical Ceiling Units: Provide manufacturer's standard units of configuration indicated that comply with ASTM E 1264 classifications as designated by reference to types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

B. Colors and Patterns: Provide products to match appearance characteristics indicated under each product type.

2.2 MINERAL-BASE PANELS - WATER FELTED

A. Type, Form, and Finish: Provide Type III, Form 2 units per ASTM E 1264 with painted finish that comply with pattern and other requirements indicated.

B. Perforated and Fissured Pattern: Units matching pattern indicated by reference to manufacturer standard pattern designations, with other characteristics as follows:

1. Color/Light Reflectance Coefficient: White/LR 0.80.
2. Noise Reduction Coefficient: NRC 0.55.
3. Ceiling Sound Transmission Class: CSTC 35.
4. Edge Detail: Square.
5. Size: 24 inches by 24 inches by 5/8-inch.

C. Products: Subject to compliance with requirements, provide one of the following, or approved substitute. Basis of design: #756A Armstrong.

1. "Hytone Baroque", Celotex Corp.
2. "Radar", USG Interiors, Inc.
3. “Baroque”, Certain Teed Corporation

2.3 CEILINGS OF VINYL FACED GYPSUM PANELS

A. Panel Characteristics: Type III units per ASTM E 1264 impact and soil resistant and complying with pattern and other requirements indicated.

1. Approval: USDA approved for food service areas
2. Pattern: Embossed stipple
3. Color/Light Reflectance Coefficient: White/LR-1
4. Noise Reduction Coefficient: NA
5. Ceiling Sound Transmission Class: CAC 40-50

6. Edge Detail: Square
7. Thickness: ½ inch
8. Size: 24 by 24 inches (610 by 610 mm)

B. Suspension System Type: As described below and specified in Part 2 "Non-Fire-Resistance-Rated, Direct-Hung Suspension Systems" Article:

1. Wide-faced, aluminum-capped, double-web, hot-dip galvanized-steel suspension system.
2. Provide all aluminum system in areas shown to receive vinyl faced gypsum ceiling tile.
3. Coordinate suspension system with other trades. No wire supports shall pass through the building's cable tray system.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Standard for Metal Suspension Systems: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.

B. Finishes and Colors: Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Attachment Devices: Size for 5 times design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.

D. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.

1. Gage: Provide wire sized so that stress at 3 times hanger design load (ASTM C 635, Table 1, Direct-Hung), will be less than yield stress of wire, but provide not less than 0.106-inch diameter (12 gage).

E. Edge Moldings and Trim: Manufacturer's standard molding for edges and penetrations of ceiling which fits with type of edge detail and suspension system indicated.

2.5 NON-FIRE-RESISTANCE-RATED DIRECT-HUNG SUSPENSION SYSTEMS

A. Wide-Face Capped Double-Web Steel Suspension System: Main and cross-runners roll-formed from prepainted or electrolytic zinc-coated cold-rolled steel sheet, with prefinished 15/16-inch-wide metal caps on flanges; other characteristics as follows:

1. Structural Classification: Intermediate-Duty System.
2. End Condition of Cross-Runners: Override (stepped) or butt-edge type, as standard with manufacturer.
3. Cap Material and Finish: Steel sheet painted white.

B. Manufacturer: Subject to compliance with requirements, provide products of one of the following, or approved substitute:

1. Armstrong World Industries, Inc.
2. Chicago Metallic Corporation.
3. National Rolling Mills, Inc.
4. USG Interiors, Inc.

2.6 MISCELLANEOUS MATERIALS

A. Concealed Acoustical Sealant: Manufacturers standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission

of airborne sound.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and structural framing to which ceiling system attached or abuts for compliance with requirements specified in this and other sections that affect installation and anchorage of ceiling system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half-width units at borders and comply with reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical ceiling systems to comply with installation standard referenced below, per manufacturer's instructions and CISCA "Ceiling Systems Handbook".

1. Standard for Installation of Ceiling Suspension Systems: Comply with ASTM C 636.

B. Arrange acoustical units and orient directionally patterned units in manner shown by reflected ceiling plans.

C. Suspend ceiling hangers from building structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye-screws, or other devices that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
4. Do not attach hangers to steel roof deck. Attach hangers to structural members.
5. Space hangers not more than 4'-0" o.c. along each member supported directly from hangers, unless otherwise shown, and provide hangers not more than 8 inches from ends of each member.

D. Install edge moldings of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical units.

1. Sealant Bed: Apply continuous ribbon of acoustical sealant, concealed on back of vertical leg before installing moldings.
2. Screw-attach moldings to substrate at intervals not over 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to tolerance of 1/8 inch in 12'-0". Miter corners accurately and connect securely.

E. Install acoustical panels in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations.

3.4 CLEANING

A. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09511

SECTION 09651 - LUXURY VINYL FLOOR TILE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Luxury vinyl floor tile. LVT

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.

C. Samples: Full-size units of each color and pattern of floor tile required.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 LUXURY VINYL FLOOR TILE

Specified Product: Min. wear layer 0.020 in.

1. Shaw Contract: Shaw LVT with ExoGuard +
   a) Terrain II, COREtec 4125V – selected from full line

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:

    a) Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate recommended by manufacturer in writing.
    b) Proceed with installation only after substrates have met manufacturer’s written requirements.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound approved by manufacturer; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.2 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern determined by architect.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures. Extend beneath built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to flooring substrates using a full spread of manufacturer’s recommended adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.3 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Cover floor tile until Substantial Completion.

END OF SECTION 09651

SECTION 09653 - RESILIENT BASE AND ACCESSORIES

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 base.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1.5 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 manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than **70 deg F (21 deg C)** or more than **95 deg F (35 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.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RUBBER BASE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong World Industries, Inc.
2. Johnsonite; A Tarkett Company.
3. Mondo Rubber International, Inc.
4. Roppe Corporation, USA.

B. Product Standard: ASTM F 1861, Type TS (vulcanized thermoset)

1. Group: I - solid, homogeneous
2. Style and Location:

    a. Style, Cove (base with toe)

C. Thickness: 0.125 inch

D. Height: 4 inches. Match base height at locker bases.

E. Lengths: Coils in manufacturer's standard length. Do not break continuous lengths of base run in spaces to receive cove base. Each span of wall shall receive one, unbroken length. No “piecing” is accepted.

F. Outside Corners: Preformed

G. Inside Corners: Job formed

H. Colors: As selected by Architect from full range of industry colors.

2.2 RUBBER MOLDING ACCESSORY

A. Manufacturers: All resilient base accessories shall be by one manufacturer.

B. Profile and Dimensions: To be selected from manufactures full line.

C. Locations: Where scheduled, at each transition between dissimilar flooring materials and at platform nosing.

D. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

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.

1. 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.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Inside Corners: Use straight pieces of maximum lengths possible.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting 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 horizontal surfaces thoroughly.
3. Damp-mop horizontal 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. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09653

SECTION 09656 - Resilient Athletic Flooring

PART 1.0 – GENERAL

1.1 SUMMARY

A. The work of this section includes:

1. Ecore Athletic Recycled Rubber Stacked Performance Collection Rolls
2. Adhesives

B. Related Sections: Section(s) related to this section include:

1. Concrete Substrate: Division 3 Concrete Section(s)

1.2 REFERENCES

A. Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title, or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

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

1. ASTM D412: Test method used to evaluate the tensile (tension) properties of rubber.

2. ASTM F137: Standard Test Method for Flexibility of Resilient Flooring Materials with Cylindrical Mandrel Apparatus.

3. ASTM C518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

4. ASTM D2047: Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as measured by the James Machine.

5. ASTM D2859: Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.

6. ASTM D5116: Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.

7. ASTM D3389: Standard Test Method for Coated Fabrics Abrasion Resistance.

8. ASTM F970: Standard Test Method for Static Load Limit.

9. ASTM F1514: Standard Test Method for Measuring Heat Stability of Resilient Flooring by Color Change.

10. ASTM F1515: Standard Test Method for Measuring Light Stability of Resilient Flooring by Color Change

11. ASTM F925: Standard Test Method for Resistance to Chemicals of Resilient Flooring

12. ASTM F1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

13. ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

14. ASTM F2753: Standard Practice to Evaluate the Effect of Dynamic Rolling Load over Resilient Floor Covering System.

15. ASTM F710: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

16. ASTM F2772: Standard Specification for Athletic Performance Properties of Indoor Sports Floors.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: Provide recycled rubber resilient flooring, which has been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage, or failure.

1.4 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit product data, including manufacturer’s guide specifications product sheet, for specified products.

C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, finish colors, patterns, and textures.

D. Samples: Submit selection and verification samples for finishes, colors, and textures.

E. Quality Assurance Submittals: Submit the following:

1. Certificates: If required, certification of performance characteristics specified in this document shall be provided by the manufacturer.

2. Manufacturer’s Instructions: Manufacturer’s installation instructions.

3. Manufacturer’s Field Reports: Manufacturer’s field reports specified herein.

G. Closeout Submittals: Submit the following:

1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operational Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.

2. Warranty: Warranty documents specified herein.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project for a minimum of five years.

a. Certificate: When requested, submit certificate, indicating qualification.

2. Manufacturer's Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.

B. Mock-Ups: Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain owner and architect's acceptance of finish color, texture and pattern, and workmanship standard.

1. Mock-Up Size: 60" x 60"

2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.

3. Incorporation: Mock-up may be incorporated into final construction upon owner's approval.

C. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's instructions, and manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.

D. Pre-installation Testing: Conduct pre-installation testing. (Specify substrate testing; consult with flooring manufacturer.)

1.6 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 1 Product Requirements Sections.

B. Ordering: 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 at temperature and humidity conditions recommended by manufacturer and protect from exposure to harmful weather conditions.

1.7 PROJECT CONDITIONS

A. Temperature Requirements: Maintain air temperature in spaces where products will be installed for time period before, during, and after installation as recommended by manufacturer.

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.

1.8 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Submit, for owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not a limitation of, other rights owner may have under contract documents.

1. Warranty Period: Ten years commencing on date of substantial completion.

1.9 MAINTENANCE

A. Extra Materials: Deliver to owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. 5% per area of specified product.

1. Delivery, Storage, and Protection: Comply with owner's requirements for delivery, storage, and protection of extra materials.

2. Cleaning: Furnish flooring manufacture's neutral cleaner for initial cleaning and maintenance of the finished floor surface.

PART 2.0 – MANUFACTURER/PRODUCTS

2.1 MANUFACTURERS:

Basis of design: Ecore Beast

A. Any substitutions must be submitted for prior approval during the proposal process.

2.2 PRODUCT(S)

A. Basis of Design - Ecore Athletic Stacked Performance Beast Rolls with itstru-8 technology. Consisting of an 8mm base layer with a 2.5mm EPDM surface wear layer. Adhesive: E-Grip III™ one-component polyurethane adhesive.

2.3 SOURCE QUALITY

A. Source Quality: Obtain recycled rubber resilient flooring materials from a single manufacturer.

PART 3.0 – EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.

3.2 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.

3.3 PREPARATION

A. Surface Preparation: Shall be as noted per the manufacturer's requirements.

3.4 ERECTION / INSTALLATION / APPLICATION / CONSTRUCTION

A. Recycled Rubber Flooring Installation: Comply with Ecore Athletic Installation Manual for installation procedures and techniques for Performance Collection Rolls.

B. Finish Color/Textures/Patterns: All Field tile to be selected from manufacturers full range.

C. Related Products Installation: Refer to other sections listed in Related Sections paragraph herein for related products installation.

3.5 CLEANING

A. Cleaning: Remove temporary coverings and protection of adjacent work areas. 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.

3.6 PROTECTION

A. Protection: Protect installed product and finished surfaces from damage during construction.

END OF SECTION

SECTION 09900 – PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation, painting, and finishing of exposed interior and exterior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this section are in addition to shop priming and surface treatment specified under other sections.

B. Paint exposed surfaces whether or not designated in "schedules", except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.

1. Painting includes field painting exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.

C. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces except as indicated, operating parts, and labels.

1. Concealed Gypsum Drywall: Provide scheduled moisture retarding primer finish at all concealed gypsum drywall located above acoustical panel ceilings.

2. Labels: Do not paint over UL, FM, or other code required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 8 Section "Steel Doors and Frames" for shop priming steel doors and frames.

1.2 DEFINITIONS

A. "Paint" includes coating systems materials, primers, emulsions, enamels, stains, sealers, and fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1.3 SUBMITTALS

A. Product Data: Manufacturer's technical information, label analysis, and application instructions for each material proposed for use.

1. List each material and cross-reference the specific coating and finish system and application. Identify each material by the manufacturer's catalog number and general classification.

B. Samples for initial color selection in the form of manufacturer's color charts.

1. After color selection, the Architect will furnish color chips for surfaces to be coated.

C. Samples for Verification Purposes: Provide samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate. Define each separate coat,

including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.

1. Provide a list of material and application for each coat of each sample. Label each sample as to location and application.

2. Submit samples on the following substrates for the Architect's review of color and texture only:

   a. Concrete Masonry: Provide two 4 - by 8 - inch samples of masonry, with mortar joint in the center, for each finish and color.
   b. Gypsum Board: Provide two 12 - by 12 - inch samples of each finish and color on gypsum board.
   c. Ferrous Metal: Provide two 4 - by 8 - inch samples of flat metal for each finish and color.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.

B. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Architect of problems anticipated using the materials specified.

C. Material Quality: Provide the manufacturer's best quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary names used to designate colors or materials are not intended to imply that products names are required or to exclude equal products of other manufacturers.

D. Field Constructed Mock-Ups: Apply primer and each coat of paint to one typical classroom. Classroom shall be reviewed and approved by the Owner and Architect prior to the application to any other paint. The mock-up classroom shall serve as the standard for all CMU paint application throughout the building.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Federal Specification number, if applicable.
4. Manufacturer's stock number and date of manufacture.
5. Contents by volume, for pigment and vehicle constituents.
6. Thinning instructions.
7. Application instructions.
8. Color name and number.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg.F (7 deg.C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.6 JOB CONDITIONS

A. The building must be completely enclosed and dryed-in. Perform moisture test on masonry walls prior to application of paint. Moisture levels must meet manufacturers requirements.

B. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 deg.F (10 deg.C) and 90 deg.F (32 deg.C).

C. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 deg.F (7 deg.C) and 95 deg.F (35 deg.C).

D. Do not apply paint in snow, rain, fog, or mist, when relative humidity exceeds 85 percent, at temperatures less than 5 deg.F (3 deg.C) above the dew point, or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

PART 2 – PRODUCTS

NOTE: SEE PAINT SCHEDULES AT THE END OF THIS SECTION.

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following, or approved substitute:

1. PPG Paints (PPG)
2. Glidden Professional (Glidden)
3. The Sherwin-Williams Company (S-W).

2.2 MASONRY BLOCK FILLER

A. High-Performance Block Filler: Heavy-duty block fillers used for filling open textured interior and exterior concrete masonry block before application of top coats:

1.	PPG:	6-7 Speedhide interior / exterior latex Masonry block filler.
2.	Glidden:	Equal
2.	S-W:	PrepRite ProBlock Interior / Exterior Block Filler, B25W25
	Option:	DU0008128 - Block-Kote Interior/Exterior Acrylic Latex Block Filler White

2.3 PRIMERS:

A. Exterior Primer: Exterior acrylic wood primer used for priming wood, gypsum board or cementitious siding under a flat acrylic emulsion finish:

1.	PPG:	17-921 Seal Grip Interior Exterior Universal Acrylic Primer.
2.	Glidden:	6001 HYDROSEALER Primer Sealer
3.	S-W:	B42W08041 Exterior Latex Primer.
	Option:	Multi-Purpose Interior / Exterior Latex Primer / Sealer, B51W00450

B. 100% Acrylic Interior Primer: 100% Acrylic primer-sealer for interior gypsum drywall:

1.	PPG:	17-921 Seal Grip Interior Exterior Universal Acrylic Primer.
2.	Glidden:	1010 High-Hide Interior Primer Sealer.
3.	S-W:	ProMar 200 Zero VOC Interior Latex Primer, B28W02600

C. Synthetic, Rust-Inhibiting Primer: Quick-drying, rust-inhibiting primer for priming interior and exterior ferrous metal surfaces:

1.	PPG:	6-208 Speedhide Rust Inhibitive Metal Primer.
2	Glidden:	4160 Devguard Multi Purpose Primer
3.	S-W:	Kem Kromik Universal Metal Primer B50WZ0001 – B50NZ0006.
	Option"	Pro Industrial Pro-Cryl Universal Acrylic Primer, B66W01310

D. Galvanized Metal Primer: Primer used to prime interior and exterior zinc-coated (galvanized) metal surfaces:

1.	PPG:	PPG 90-712 Pitt Tech DTM Acrylic Metal Primer.
2.	Glidden:	4020PF Devflex DTM Primer Finish.
3.	S-W:	Pro Industrial DTM Acrylic Primer / Finish, B66W00011
	Option:	Pro Industrial Pro-Cryl Universal Acrylic Primer, B66W01310

E. Epoxy Metal Primer: Primer used to prime ferrous metal handrails:

1.	PPG:	Amerlock 2 VOC High Build Epoxy..
2.	Glidden:	PPG 95-245 Pitt Guard DTR Rapid Coat Epoxy Mastic Primer.
3.	S-W:	Recoatable Epoxy Primer, B67 Series / B67V5 Catalyst
	Option:	MacroPoxy 646 Fast Cure Epoxy, B58W00610

2.4 EXTERIOR FINISH PAINT MATERIAL

A. Exterior Flat Acrylic Emulsion: Quick-drying, satin, acrylic paint for use on the exterior over concrete, stucco, masonry (including masonry block), primed gypsum board and cementitious siding:

1.	PPG:	6-610XI Speedhide Exterior Acrylic Satin.
2.	Glidden:	2200 Ultra Hide 150 Exterior Acrylic Satin.
3.	S-W:	A-100 Acrylic Latex Satin Exterior Finish A-6 Series.
	Option:	Loxon Self Cleaning Acrylic, Satin, LX13 Series.

B. Exterior Semi-Gloss Acrylic Emulsion: Semi-Gloss Acrylic paint for use over prime-coated ferrous or galvanized metal:

1.	PPG:	6-900XI Speedhide Acrylic Semi-Gloss Exterior Paint.
2.	Glidden:	2416 Ultra Hide 150 Exterior Acrylic Semi-Gloss
3.	S-W:	A-100 Exterior Acrylic Gloss A8W16.
	Option:	Pro Industrial DTM Acrylic Coating, Semi-Gloss, B66-1100 Series

C. Gloss Urethane Enamel: Urethane finish for ferrous metal handrails:

1.	PPG:	95-812 Pitthane Ultra Gloss Urethane Enamel.
2.	Glidden:	PPG 95-812 Pitthane Ultra Gloss Urethane Enamel.
3.	S-W:	Pro Industrial Waterbased Acrolon-100 Urethane, B65-700 Series
	Option:	Pro Industrial Pre-Cat Waterbased Urethane, B65-1100 Series

D. Waterbased Acrylic Coating: for pre-finished metal siding.

1. S-W: Bond-Plex Waterbased Acrylic Coating B71 Series

2.5 INTERIOR FINISH PAINT MATERIAL

A. Latex-Based Interior Flat Paint: Ready-mixed, latex-based paint for use as a flat finish over concrete and masonry surfaces, including filled concrete masonry block, mineral-fiber-reinforced cement panels, and plaster and over prime-coated gypsum drywall, ferrous metal, and zinc-coated (galvanized) metal surfaces:

1. PPG: 6-70 Speedhide Latex Flat Wall Paint
2. Glidden: 210 Ultra Hide Latex Flat Wall Paint
3. S-W: ProMar 200 Zero VOC Interior Latex Flat Wall Paint B30W201.

B. Latex-Based Interior Semi-Gloss Paint: Ready-mixed, latex-based paint for use as a finish over prime-coated gypsum drywall, concrete block, ferrous metal, and zinc-coated (galvanized) metal surfaces.

1. PPG: 6-500 Speedhide Interior Semi-Gloss Latex.
2. Glidden: 1416 Ultra Hide Latex Semi-Gloss Enamel.
3. S-W: ProMar 200 Zero VOC Interior Latex Semi-Gloss B31W12651.

C. Water Borne Polyamide Epoxy: Paint system for use over concrete masonry block, with manufacturer's recommended primer:

1. PPG: 98-1 Aquapon WB Gloss Polyamide Epoxy.
2. Glidden: 98-1 Aquapon WB Gloss Polyamide Epoxy.
3. S-W: Pro Industrial Waterbased Catalyzed Epoxy, B73W00311

D. Alkyd Gloss Enamel for use over a primer and undercoat on interior plaster surfaces, wood, and hardboard and ferrous and zinc-coated metal surfaces:

1. PPG: 7-282 Industrial Oil Base Gloss Enamel.
2. Glidden: 4308 Devguard Alkyd Gloss Enamel.
3. S-W: Industrial Enamel B-54 Series.

E. Concrete floor sealing for use in spaces indicated as “PC” floors in the Schedule of Finishes. Provide floor prep and primer as directed by manufacturer.

1. PPG: 4-4210XI Perma Crete Color Seal WB Interior/Exterior Concrete Stain .

2.6 MISCELLANEOUS WOOD FINISHING MATERIALS

A. Satin Polyurethane: Clear polyurethane with satin finish for use over wood surfaces.

1. PPG: DFT259 Deft Interior/Exterior Polyurethane Water Based Satin Varnish.
2. Glidden: 1902 Woodpride Satin Polyurethane Varnish.
3. S-W: MINWAX® FAST-DRYING POLYURETHANE, Satin

B. Gloss Polyurethane: Clear Gloss Polyurethane thinned per manufacturer’s recommendations as a sealer under satin finish coat.

1. PPG: DFT61 Deft Sanding Sealer Interior Water Based
2. Glidden: 1908 Woodpride Gloss Polyurethane Varnish. (Thin per mfg. recommendations)
3. S-W: MINWAX® FAST-DRYING POLYURETHANE, Gloss

(Thin per mfg. recommendations)

C. Oil-Type Interior Wood Stain: Slow-penetrating oil-type wood stain for general use on interior wood surfaces under varnishes or wax finishes:

1.	PPG:	DFT400 Deft Interior Oil Based Wood Stain.
2.	Glidden:	1700 Woodpride Oil Stain.
3.	S-W:	MINWAX® PERFORMANCE SERIES TINTABLE WOOD STAIN 550 VOC MINWAX® PERFORMANCE SERIES TINTABLE WOOD STAIN 250 VOC

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which painting will be performed for compliance with requirements for application of paint. Do not begin paint application until unsatisfactory conditions have been corrected.

1. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

3.2 PREPARATION

A. General Procedures: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items if necessary for complete painting of the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.

1. Clean surfaces before applying paint or surface treatments. Remove oil and grease prior to cleaning. Schedule cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

B. Surface Preparation: Clean and prepare surfaces to be painted in accordance with the manufacturer's instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime. Notify Architect in writing of problems anticipated with using the specified finish-coat material with substrates primed by others.
2. Concrete (Bare) – Interior – Concrete Stain (PC)
    a. Surface Preparation: All concrete surfaces must be sound, clean, dry, cured, and profiled. All concrete surfaces shall be free of surface hardeners, form release agents, curing compounds, laitance, efflorescence, chloride contamination, hydrostatic water pressure or excessive capillary water action, and/or water vapor emission. All concrete surfaces shall be cleaned first with a strong detergent to remove oils, grease, dirt and any other contamination before proceeding with acid etching to achieve a porous and coatable surface.

C. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation. All block surfaces shall be patched, cleaned, touched up prior to application of Blockfill.

1. Use abrasive blast-cleaning methods if recommended by the paint manufacturer.

2. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before

application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.

D. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

1. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer before application of primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.

E. Ferrous Metals: Clean nongalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council.

1. Apply alkyd metal primer over bare and shop primed metal. Prepare the surface to be painted according to manufacturers recommendation.

F. Galvanized Surfaces: Clean galvanized surfaces with non-petroleum-based solvents so that the surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

G. Materials Preparation: Carefully mix and prepare paint materials in accordance with manufacturers directions.

1. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.
2. Stir materials before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
3. Use only thinners approved by the paint manufacturer, and only within recommended limits.

3.3 APPLICATION

A. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

1. Paint colors, surface treatments, and finishes are indicated in "schedules".

2. Provide finish coats that are compatible with primers used.

3. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.

4. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

5. The term "exposed surfaces" includes surfaces visible when installed. Extend coatings in these areas as required to maintain the system integrity and provide desired protection.

6. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.

7. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.

8. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

9. Finish exterior doors on tops, bottoms, and side edges same as exterior faces.

10. Sand lightly between each succeeding enamel or varnish coat.

11. Omit primer on metal surfaces that have been shop-primed and touch up painted.

C. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure and where application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

D. Minimum Coating Thickness: Apply materials at not less than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire system as recommended by the manufacturer.

E. Mechanical and Electrical Work: Painting mechanical and electrical work is limited to those items exposed in mechanical equipment rooms and in occupied spaces.

F. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with all pores completely filled.

G. Prime Coats: Before application of finish coats, apply a prime coat of material as recommended by the manufacturer to material that is required to be painted or finished and has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to assure a finish coat with no burn through or other defects due to insufficient sealing.

H. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

I. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

3.4 CLEANING

A. Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

B. Upon completion of painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping, using care not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION

A. Protect work of other trades, whether to be painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.

B. Provide "wet paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINT SCHEDULE

A. General: Provide the following paint systems for the various substrates indicated.

1. Masonry, Trim and Accessories:

a. Exterior Satin Acrylic Finish: 2 finish coats over primer.

.1 Primer: High Performance Acrylic Primer.
.2 First Coat: Exterior Satin Acrylic Emulsion.
.3 Second Coat: Exterior Satin Acrylic Emulsion.

2. Ferrous Metal:

a. Exterior Semi Gloss Acrylic Finish: 2 finish coats over primer.

.1 Primer: Synthetic Rust-Inhibiting Primer.
.2 First Coat: Exterior SemiGloss Acrylic Emulsion.
.3 Second Coat: Exterior SemiGloss Acrylic Emulsion.

3. Zinc-Coated Metal:

a. Exterior Semi Gloss Acrylic Finish: 2 finish coats over primer.

.1 Primer: Galvanized Metal Primer.
.2 First Coat: Exterior SemiGloss Acrylic Emulsion.
.3 Second Coat: Exterior SemiGloss Acrylic Emulsion.

4. Ferrous Metal (Handrails only):

a. Exterior Gloss Urathane Finish: 2 finish coats over primer.

.1 Primer: Epoxy Metal Primer.
.2 First Coat: Exterior Gloss Urethane Enamel.
.3 Second Coat: Exterior Gloss Urethane Enamel.

5. Pre-finished Metal:

a. Exterior Low Sheen Acrylic Finish: 2 finish coats over primer.

.1 Primer: Synthetic Rust-Inhibiting Primer.
.2 First Coat: Exterior Waterbased Acrylic Coating.
.3 Second Coat: Exterior Waterbased Acrylic Coating.

3.7 INTERIOR PAINT SCHEDULE

A. General: Provide the following paint systems for the various substrates, as indicated.

1. Concrete Masonry Units:

a. Latex-Based Interior Semi-Gloss Paint

.1 Primer: High-Performance Block Filler
.2 Primer: High-Performance Block Filler
.3 First Coat: Latex-Based Interior Semi-Gloss Paint
.4 Second Coat: Latex-Based Interior Semi-Gloss Paint

2. Gypsum Drywall Systems:

a. Latex-Based Interior Semi-Gloss Paint: 2 finish coats over primer, at exposed gypsum drywall.

.1 Primer: 100% Acrylic Interior Primer.
.2 First Coat: Latex-Based Interior Semi-Gloss Paint.
.3 Second Coat: Latex-Based Interior Semi-Gloss Paint.

b. Primer Finish: Primer, at concealed gypsum drywall.

.1 Primer: 100% Acrylic Interior Primer.

3. Ferrous Metal:

a. Semi-Gloss Finish: 2 finish coats over primer.

.1 Primer: Synthetic Rust-Inhibiting Primer.
.2 First Coat: Alkyd Gloss Enamel.
.3 Second Coat: Alkyd Gloss Enamel.

4. Zinc-Coated Metal:

a. Semi-Gloss Finish: 2 finish coats over primer.

.1 Primer: Galvanized Metal Primer.
.2 First Coat: Latex-Based Interior Semi-Gloss Paint.
.3 Second Coat: Latex-Based Interior Semi-Gloss Paint.

5. Stained Woodwork:

a. Stained-Satin Finish: 2 finish coats over stain.

.1 Stain Coat: Oil-Type Interior Wood Stain.
.2 First Coat: Gloss Polyurethane (Thin per manufacturer recommendation).
.3 Second Coat: Satin Polyurethane.

5. Exposed Concrete Floors: (SC)

.1 Primer Coat: PPG Perma Crete Concrete Stain
.2 Finish Coat: PPG Perma Crete Concrete Stain

END OF SECTION 09900

SECTION 10350 - FLAGPOLES

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. Aluminum flagpoles.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for concrete footings for flagpoles, if any, and if not specified in this Section.
2. Division 7 Section "Sheet Metal Flashing and Trim" for flashing at roof-mounted flagpoles.
3. Division 7 Section "Joint Sealants" for elastomeric sealant filling the top of the foundation tube, if any.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide flagpoles capable of withstanding the effects of wind loads as determined according to the building code in effect for this Project or NAAMM FP 1001, "Guide Specifications for Design Loads of Metal Flagpoles," whichever is more stringent.

1. Base flagpole design on maximum standard-size flag suitable for use with pole or flag size indicated, whichever is more stringent.
2. Basic Wind Speed: For Project location, 80 mph (36 m/s).

1.4 SUBMITTALS

A. Product Data: For each type of flagpole required. Include installation instructions.

B. Shop Drawings: Show general layout, jointing, grounding method, and anchoring and supporting systems.

1. Include details of foundation system for ground-set poles.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each flagpole as a complete unit from a single manufacturer, including fittings, accessories, bases, and anchorage devices.

1.6 DELIVERY, STORAGE, AND HANDLING

A. General: Spiral wrap flagpoles with heavy kraft paper or other weathertight wrapping and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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:

1. Concord Industries, Inc.
2. Eder Flag Manufacturing Co., Inc.
3. Ewing: John Ewing & Co. Inc.
4. Morgan-Francis Div.
5. Kearney-National Inc.; American Flagpole Div.
6. Lingo, Inc.; Acme Flagpole Co. Div.
7. PLP Composite Technologies, Inc.

2.2 FLAGPOLES

A. Flag Pole to be one piece 40’-0” in height without seams.

B. Pole Construction, General: Construct poles and ship to Project site in one piece.

C. Aluminum Flagpoles: To be equal to Acme/Lingo Inc. Slimline Cone Tapered Flagpole.

D. Galvanized Corrugated Steel Tube: Galvanized Corrugated Steel Tube sleeve, made to fit flagpole and sized for installation, for casting into concrete foundation. Per manufacturer’s specifications.

1. Provide flashing collar of same material and finish as flagpole.
2. Provide steel ground protectors extending 12 inches (300 mm) aboveground and 6 inches (150 mm) belowground for steel flagpoles where flashing collars are not provided.

2.3 FITTINGS

A. Finial Ball: Manufacturer's standard flush-seam ball, sized as indicated or, if not indicated, to match pole-butt diameter.

1. 0.063-inch (1.6-mm) spun aluminum, finished to match flagpole.

B. External Halyard: Ball-bearing, nonfouling, revolving truck assemblies of cast metal with continuous 5/16-inch- (8-mm-) diameter, braided polypropylene halyards and 9-inch (225-mm) cast-metal cleats with fasteners. Finish exposed metal surfaces to match flagpole.

1. Provide 2 halyards and 2 cleats at each flagpole.

C. Halyard Flag Snaps: Provide 2 swivel snap hooks per halyard, as follows:

1. Provide with neoprene or vinyl covers.

2.4 FINISHES

A. Aluminum: Color to be Dark Bronze anodized finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Excavation: For foundation, excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete.

B. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure forms, foundation tube, fiberglass sleeve, or anchor bolts in position, braced to prevent displacement during concreting.

C. Place concrete immediately after mixing. Compact concrete in place by using vibrators. Moist-cure exposed concrete for not less than 7 days or use a nonstaining curing compound.

D. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to base perimeter.

3.2 FLAGPOLE INSTALLATION

A. General: Install flagpoles where shown and according to Shop Drawings and manufacturer's written instructions.

B. Foundation-Tube Installation: Install flagpole in foundation tube, seated on bottom plate between steel centering wedges. Plumb flagpole and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch (50-mm) layer of elastomeric sealant and cover with flashing collar.

END OF SECTION 10350

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SECTION 10425 - SIGNS

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 types of signs:

1. Interior Engraved Plastic Signage.
2. Exterior Cast Aluminum Signage.

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.

1. Provide message list for each sign required, including large-scale details of wording and lettering layout.
2. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed.
3. Furnish full-size rubbings for metal plaques.

1.4 QUALITY ASSURANCE

A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.

B. Design Concept: The Drawings indicate sizes, profiles, and dimensional requirements of signs and are based on the specific types and models indicated. Sign units by other manufacturers may be considered provided deviations in dimensions and profiles do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Exterior Signage shall be as manufactured by A. R. K. Ramos. Products by Andco Industries, Leeds Aluminum Letters, Metal Arts, Multi-graphics, Inc., Henry Graphics, Mills Aluminum Letters, and Serigraphics Sign Systems, Inc. meeting the requirements of these specifications are acceptable.

B. Interior Signage shall be thermoform products as manufactured by Best Manufacturing Sign System. Products by Andco Industries, Mohawk Sign Systems, American Graphics, Inc., Multi-graphics, Inc., Henry Graphics, ASI Sign Systems, Inc., Bayuk Graphic Systems, Inc. and Serigraphics Sign Systems, Inc. meeting the requirements of these specifications are acceptable.

2.2 MANUFACTURED UNITS

A. Exterior Signage:
   1. Exterior signage shall be cast aluminum, projected mounted with collars and threaded studs set in adhesive.
   2. Letter style shall be Futura No. 501, sizes and heights as indicated on drawings, as manufactured by A. R. K. Ramos Architectural Signage System.
   3. Finish to be a Kynar Finish.

B. Interior Signage:

   1. Interior signage shall be provided for each space and numbered/described as shown on drawings, however, Owner shall have final approval on space names and numbering prior to release for fabrication.
   2. Signage shall be mounted with vinyl foam mounting tape.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS

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 o the work of this Section.

3.2 PREPARATION

A. Surface Conditions: Examine the areas and conditions under which work of this Section will be performed. Clean surfaces to receive signage until free of all dirt and oil, which could hinder adhesion of signage. Do not proceed until unsatisfactory conditions are corrected.

3.3 INSTALLATION

A. Install the work of this Section in strict accordance with the manufacturers' recommendations as approved by the Architect, using only the approved mounting materials, and locating all components firmly into position, level and plumb.
B. Provide solid wood blocking in metal framing for anchorage of letters. Collar shall extend through installation system and shall have minimum ¼" sealant joint between collar veneer.

C. Location:

   1. All interior signage shall be wall mounted adjacent to the latch side of doors or nearest adjacent wall.
   2. Exterior signage shall be located as indicated on drawings.

3.4 SCHEDULE

1. Provide at each entrance to each room. See also drawings for further locations.

END OF SECTION 10425

SECTION 10520 - FIRE-PROTECTION SPECIALTIES

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. Portable fire extinguishers.
2. Fire-protection cabinets for the following:
    a. Portable fire extinguishers.
3. Fire-protection accessories.

B. Related Sections include the following:

1. Division 9 Section "Painting" for field-painting fire-protection cabinets.
2. Division 10 Section "Signs" for directional signage to out-of-sight fire extinguishers and cabinets.
3. Division 11 Section "Food Service Equipment" for fire extinguishing systems provided as part of exhaust hoods.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.

1. Fire Extinguishers: Include rating and classification.
2. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide extinguishers listed and labeled by FM.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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:

1. Portable Fire Extinguishers:

    a. Amerex Corporation.
    b. Ansul Incorporated.
    c. Badger; Div. of Figgie Fire Protection Systems.
    d. Buckeye Fire Equipment Company.
    e. Fire-End & Croker Corporation.
    f. J.L. Industries, Inc.
    g. Kidde: Walter Kidde, The Fire Extinguisher Co.
    h. Larsen's Manufacturing Company.
    i. Moon/American, Inc.
    j. Pem All; Div. of Pem Systems, Inc.
    k. Potter-Roemer; Div. of Smith Industries, Inc.
    l. Pyro-Chem; Tyco Safety Products

2.2 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.

B. Multipurpose Dry-Chemical Type: UL-rated 4-A:60-B:C, 10-lb (4.5-kg) nominal capacity, in enameled-steel container.

2.3 FIRE-PROTECTION CABINETS

A. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated, sized to fit specified extinguisher. Weld joints and grind smooth. Miter and weld perimeter door frames.

1. Cabinet Metal: Enameled-steel sheet.

B. Cabinet Type: Suitable for the following:

1. Fire extinguisher.

C. Cabinet Mounting: Suitable for the following mounting conditions:

1. Semirecessed: Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated.

D. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

1. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

    b. Rolled-Edge Trim: 4-inch (102-mm) backbend depth.

E. Cabinet Trim Material: Manufacturer's standard, as follows:

1. Same metal and finish as door.

F. Door Material: Manufacturer's standard, as follows:

1. Aluminum sheet.

G. Door Glazing: Manufacturer's standard, as follows:

1. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, as follows:

a. Class 1 (clear), 1/8” Thickness.

H. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

2.4 ACCESSORIES

A. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked-enamel finish.

1. Provide brackets for extinguishers located in cabinets.

2.5 COLORS AND TEXTURES

A. Colors and Textures: As selected by Architect from manufacturer's full range for these characteristics.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for hose valves, hose racks, and cabinets to verify actual locations of piping connections before cabinet installation.

B. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets are to be installed.

C. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged units.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing fire-protection specialties.

B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction. Mount cabinet so that top of extinguisher shall be no greater than 60" A.F.F.

1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust cabinet doors that do not swing or operate freely.

B. Refinish or replace cabinets and doors damaged during installation.

C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 10520

SECTION 12241 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manually operated roller shades with single rollers.
2. Provide all components necessary for a fully operational system.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Draper Inc.
2. Hunter Douglas Contract.
3. Insolroll Window Shading Systems.

B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Chain-Retainer Type: Chain tensioner, jamb mounted
2. Spring Lift-Assist Mechanisms: Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criterion is more stringent.

C. Rollers: Extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of interior face of shade
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

E. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

F. Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Extruded aluminum.

    a. Type: Enclosed in sealed pocket of shadeband material
    b. Color and Finish: As selected by Architect from manufacturer's full range

G. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
2. Endcap Covers: To cover exposed endcaps.
3. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.
4. Installation Accessories Color and Finish: As selected from manufacturer's full range

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701 Class A. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Source: Roller shade manufacturer.
2. Type: Woven PVC-coated polyester
3. Weave: Basketweave
4. Thickness: Manufacturer’s highest quality
5. Weight: Manufacturer’s highest quality.
6. Roll Width: 60 inches
7. Orientation on Shadeband: Up the bolt
8. Openness Factor: As Selected by Architect.
9. Color: As selected by Architect from manufacturer's full range.

2.4 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):

1. Between (Inside) Jamb Installation: Total width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch. Entire window shall be covered with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings. Units may span mullions not to exceed a total length of 10’-0”.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

C. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

D. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.2 Schedule

A. Install manually operated shades at all exterior windows.

END OF SECTION 12241

SECTION 12304 - GENERAL CASEWORK

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Applicable provisions of General Conditions, Special Conditions and General Requirements shall apply to this section as if repeated in full herein. Reference other Sections and Divisions for work in connection with this section.

1.2 INTENT

A. It is the purpose of this specification to establish requirements for casework to provide the purchaser with a durable and functional installation.

B. As the Casework has been designed to meet the functional requirements of each area, it is the desire of the purchaser that door and drawer arrangements, design of casework layouts and work surface materials must not be changed.

C. Construction methods, joinery, materials, and material thickness shall be strictly adhered to in order to provide the owner with a final installation capable of performing as those specified. Bids proposing to supply casework not meeting these requirements will be rejected.

1.3 WORK INCLUDED

A. Furnish, deliver, and install to owner's and architect's satisfaction, all casework as shown on drawings, schedules and equipment lists.

B. Furnish and install all fillers, scribes, finished ends, finished backs, work surfaces, backsplashes, and cutouts required to provide a complete and finished project.

C. Provide sinks and fittings, electrical outlets and fixtures when specifically stated as being part of this contract.

D. Provide locks where shown on casework drawings or described in equipment lists.

1.4 WORK IN OTHER SECTIONS

A. All sinks and fittings, couplings and connectors, piping, traps, supplies, shutoffs, and special plumbing fixtures to meet all applicable codes; all electrical fixtures and devices, conduit, wiring and connectors; and all fans, blowers, motors, ductwork, and metal grilles not specified as part of casework contract.

B. Installation, connection, and testing of all sinks, fittings, electrical fixtures; providing all rough-ins: mechanical piping: electrical runs; and connections required for a complete project.

C. Blocking, framing, and reinforcement in walls, ceilings, and floors for anchoring of cabinets and trim.

D. General millwork and running wood trim items.

E. Vinyl base molding.

1.5 MANUFACTURERS:

A. The casework shall conform to configuration, arrangement, design, material quality, joinery, panel thickness, and surfacing of that specified and shown on drawings. The following manufacturers are approved provided product is bid per specifications:

1. Advanced Cabinet Systems (ACS)
2. M&N Millwork
3. Sirius Millwork

1.6 SUBMITTALS

A. Shop drawings shall be submitted for approval within thirty (30) days after formal notification of award of contract. Drawings shall consist of floor plans indicating arrangement and relation to adjacent work and equipment, and complete elevations of casework. Centerline of service requirements shall be noted for use by other trades. A schedule of all sinks, fittings, and accessories that are part of this contract shall be provided.

B. Color samples shall be submitted for selection and coordination at time of contract award. Samples of actual material and color shall be available as required.

C. Additional catalog cuts, details and samples as requested by architect for evaluation and coordination.

1.7 PRODUCT DELIVERY AND STORAGE

A. Protect cabinet and countertops during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

B. Store cabinets and countertops at project site installation and storage areas with similar ambient conditions as final installation. Storage areas must be kept dry, heated with low relative humidity and away from construction work such as painting, wet work, grinding and similar operations.

1.8 WARRANTY

A. Casework manufacturer shall warrant for a period of three (3) years, the product manufactured by it to be free from defects in material and workmanship when properly installed under normal use.

B. Accessory equipment (sinks, fittings, etc.), if required, shall be warranted by appropriate manufacturer's guarantee.

PART 2 PRODUCTS

2.1 CORE MATERIAL

A. Cabinet Grade Hard Maple or Oak.

B. Cabinet components having particle board core material shall be of a minimum 45 lb. density, M-2 industrial grade. The particleboard used shall have been tested under ANSI A208.1 1993 standards and / or ASTMD 1037-91A.

C. Medium density fiberboard (MDF) shall be used in high stress areas as drawer members and shall be minimum 48 lb. density MD-21 grade and tested under ANSI A208.2 1994 Standards

D. Industrial hardboard shall be pre-finished 1/4" thickness composed of wood fibers, phenolic resin binders and moisture inhibitors that meet or exceed the hardboard product standard ANSI/AHA A135.4 1988.

2.2 SURFACE MATERIAL

A. Exposed exteriors shall be:
Cabinet grade hard maple or oak.

B. Exposed doors and drawer fronts shall be:
Cabinet grade hard maple or oak.

C. Exposed interiors shall be:
Cabinet grade hard maple or oak.

D. Concealed surfaces shall be cabinet grade hard maple, oak or permanently thermofused melamine laminate or high pressure decorative plastic laminate cabinet liner, 0.020" thickness for balanced construction. Thermofused melamine laminate shall meet the ALA 1996 specifications standards, as tested against the high pressure laminate NEMA LD 3-1995, VGS.028 specification standards.

2.3 EDGINGS

A. Adjustable shelves shall be banded with PVC extrusion, resistant to chip, crack, and high impact. Edging shall have a satin finish with a UV cured top coat for additional durability. Edging shall be applied with waterproof hot melt adhesive. 0.018" thick PVC edging shall be applied to front edge of adjustable shelf.

D. All other interior components, including drawers, shall be banded with a PVC extrusion, 0.018" in thickness, resistant to chip, crack, and high impact. Edging shall have a satin finish with a UV cured top coat for additional durability. Edging to be machine applied with waterproof hot melt adhesive.

2.4 COLOR SELECTIONS

A. Exposed cabinet exteriors shall be chosen from:
Manufacturer’s full range of stain colors and options.

B. Exposed doors and drawer fronts shall be chosen from:
Manufacturer’s full range of stain colors and options.

C. Semi-exposed surfaces, including drawer box components, shall be finished as selected from casework manufacturer's standard interior color selections.

D. Exposed interior components, including both faces of shelves and interior face of backs to be as selected from casework manufacturer's standard interior color selections.

E. Semi-exposed edges of cabinet components including drawers, shall be as selected in 0.018" thick PVC.

F. Samples will be reviewed by architect for color, texture, and pattern only.

2.5 HARDWARE

A. Hinges shall be:
Blum adjustable concealed hinge, with minimum110 degree swing, and soft close operation. Doors less than 48" in height shall have two (2) hinges per door. Doors exceeding 48" in height shall have three (3) hinges per door.

B. Door catches shall be a heavy-duty spring loaded, large diameter (17.5mm - 11/16") roller type catch mounted at bottom edge. All doors over 48" in height shall be provided with roller catch at both top and bottom of door.

C. Catch strike plate shall be injection molded ABS, with an integrally molded engagement ridge. Strike plate shall also provide a wide face bumper insuring a positive door stop.

D. Drawer and slide out shelves shall be suspended with bottom mount, side and bottom attached nylon roller epoxy coated steel slides to ensure quiet, smooth operation and a soft close. Lateral stability is achieved thru a special formed captive profile. Slides shall have 100 lb. load rating, with both in and out drawer stop, 3" self close feature and a side adjustment cam allowing 3mm side to side alignment.

E. Drawers specifically noted for full extension file use shall be suspended with bottom mount, side and bottom attached nylon roller epoxy coated steel slides to ensure quiet, smooth operation and a soft close. Lateral stability is achieved thru a special formed captive profile. Slides shall have 150 lb. load rating, with both in and out drawer stop, and 3" self close feature. File drawer shall include extruded top mounted molded side rails to accept standard hanging file folders.

F. Knee-space, pencil drawers, and keyboard trays, shall be designed to permit under counter or support frame mounting, with 100 lb. nylon roller epoxy coated steel slides.

G. Hanger rods shall be heavy chrome plated tubing. Rod shall be securely affixed to cabinet shelves.

H. Tote trays shall be of high impact polystyrene with smooth edges. Each tray to include an identification card holder and shall be suspended from rails securely attached to cabinet verticals.

I. Shelf support clips for (3/4” thick if less than 36” long, 1" thick if 36” long or above) adjustable shelves shall be injection molded clear polycarbonate. Support clips shall incorporate integral molded lock tabs to retain shelf from tipping or inadvertently being lifted out. Support clip shall have 5mm dia. double pin engagement into precision bored hole pattern in cabinet vertical members. Clips shall have a molded ridge which provide pressure against edge of shelving to maintain positive pin engagement. Clip shall be designed in such a manner to provide means for permanent retention to shelf. Static test load must exceed 200 lb. per clip.

J. Dividers that are 1/4" thick shall be fully adjustable and retained with injection molded clear polycarbonate clip.

2.6 COMPONENTS

A. Base, Wall and Tall cabinet ends shall be 3/4" thick cabinet grade hard maple or oak, stained and sealed.

B. Base and Tall cabinet tops and bottoms shall be 3/4" thick cabinet grade hard maple or oak, stained and sealed.

C. Wall cabinet top and bottom shall be 3/4" thick cabinet grade hard maple or oak, stained and sealed.

D. Concealed vertical cabinet members shall be 3/4" thick cabinet grade hard maple or oak, stained and sealed or particle board, laminated for balanced construction, surfaced as described in article 2.02.C, and edged as described in article 2.03.D.

E. Cabinet backs shall be 1/2" thick inset with 3/4” thick hanging strips of pre-finished industrial hardboard.

F. Frame rails shall be 3/4" thick x 3 3/4" wide wood or particle board, laminated for balanced construction, surfaced, as described in article 2.02.C, and edged as described in article 2.03.A.

G. Sub base shall consist of:

Two (2) toe kick support rails shall be 3/4" thick x 3 3/4" high wood or particle board and be inset from cabinet front and back edge, to give additional load support.

H. Mounting rails shall be 3/4" thick x 3 3/4" wide wood or particle board. Wall cabinets shall have rails positioned at the top and bottom. Tall cabinets shall have rails positioned at the top and intermediate location. Base cabinet shall have rails positioned at the top of unit.

I. Drawers shall be full box design with a separate front. Drawer sides and ends shall be constructed of 5/8" medium density fiberboard with thermofused melamine laminate and matching PVC top edges. Bottoms shall be 1/4" thick medium density fiberboard, thermofused melamine laminate.

J. Adjustable shelves shall be 3/4” thick if less than 36” long, 1" thick if 36” long or above. Edges of shelf shall be banded as described in article 2.03.C with a high impact, rigid PVC extrusion.

K. Solid hinged doors, sliding doors and drawer fronts shall be 3/4" thick cabinet grade hard maple or oak, stained and sealed.

2.7 CONSTRUCTION

A. Cabinet parts shall be accurately machined and precision bored for premium grade quality joinery construction, utilizing automatic machinery to ensure consistent sizing on modular cabinets. Cabinets shall be assembled under controlled case clamp conditions, assuring final cabinet squareness and proper joint compressions.

B. Cabinet ends shall be bored to receive 8mm, industrial grade hardwood laterally fluted dowels with chamfered ends. Cabinet ends shall be prepared to receive adjustable shelf hardware at 32mm (approximately 1 1/4") centers. Door hinges and drawer slides shall be machined drilled to maintain vertical and horizontal alignment of components. Inset grooving with chamfer shall be machined 3/4" from rear edge to accept the 1/4" back. Base and Tall units shall have one piece end panels continuous to floor for added load capabilities.

C. Tops and bottoms shall be joined to cabinet ends using a minimum of six (6) dowels at each joint for twenty-four (24) inch deep cabinets and a minimum of four (4) dowels at each joint, for twelve (12) inch deep cabinets. All dowels to be industrial grade hardwood, laterally fluted, with chamfered ends and 8mm in diameter. Top of base cabinet will be full depth. Inset grooving with chamfer shall be machined 3/4" from rear edge to accept the 1/4" back.

D. Vertical dividers shall be bored to receive adjustable shelf hardware at 32mm (approximately 1 1/4") centers. Dividers shall be joined to tops and bottoms with 8mm diameter hardwood dowels.

E. Frame rails shall be joined to ends with 8mm diameter hardwood dowels.

F. Two (2) toe kick supports shall be inset from cabinet front and back edges, and doweled into cabinet ends with 8mm hardwood dowels.

G. Mounting rails shall be fully concealed behind backs. Rails shall be 3/4" thick and fastened to cabinet ends with 8mm hardwood dowels. Wall and tall cabinet shall incorporate two mounting rails. Wall cabinets shall have rails positioned at top and bottom. Tall cabinets shall have rails positioned at top and intermediate location. Base units shall have rail positioned in the upper back area.

H. Back panels shall be 1/2" thick and inset 3/4" from rear edge of cabinet. Back shall be glued and continuously trapped in top, bottom, and ends of cabinets.

I. Drawer corner joints shall be interlocking dowel pin design. Hardwood dowel pins, 8mm diameter shall be inserted into drawer fronts and backs to fit into machined hole patterns in drawer sides. Bottoms shall be trapped into grooves on all four sides glued and mechanical fastened. Drawers shall be suspended on slides as described in article 2.05.E.

2.8 WORK SURFACES

A. Stainless Steel Products manufactured by Atlanta Custom Fabricator, Low Temp, Southern Equipment Fabricator's and Silvey Metal Company, modified to comply with specifications, are acceptable.

B. Stainless Steel Metal Tops and Tables:
1. Shall be constructed of 14 gauge stainless steel with butt joints welded, ground and polished smooth, resulting in a one piece top without joints and crevices. Tops are to be reinforced by means of 14 gauge stainless steel channel irons, 1 inch by 5 inches by 1 inch. Securely fastened to underside, on 30 inch centers, by studs or welding in a vermin-proof manner. Free standing ends are to be turned down 1-3/4 inch on bull-nose edge or 2 inch rolled down edge with all exposed corners rounded on a 2-1/2 inch radius, or bull-nose corner. Where table borders on or is adjacent to wall, there is to be a 4 inch high backsplash with 1 inch turn back to wall with welded enclosed ends, unless otherwise specified.

C. Insert Sinks:
1. Shall be welded into tabletops. All welds are to be ground and polished smooth. Provide with wastes as specified for sinks. Legs and gussets shall be furnished where sinks are set at end of tables.

D. Undershelves:
1. Undershelves are to be constructed in sections of 18 gauge stainless steel and notched out to fit around legs, and be fixed type.

E. Legs, Braces, Gussets, Feet:
1. Height of tables and other fabricated items of equipment shall be as specified. Legs shall be of 1-5/8 inch outside diameter, stainless steel 16 gauge tube spaced at intervals of 5 inch-6 inch centers.
2. Legs are to be braced by 1-5/8 inch outside diameter stainless steel 16 gauge tube undershelf, welded to legs, 10 inches above the floor. Weld all around periphery at joint to legs and grind smooth. The braces shall be constructed to form rectangular, or "H" frames, and there shall be at least one brace welded to each leg.
3. Gussets shall be stainless steel NSF approved, cylindrical type with setscrew. Leg gussets are to be welded to underside of tables, to reinforcing channels. Gussets shall be Model No. A20-0206 manufactured by Component Hardware Group inc. or comparable stainless steel gussets manufactured by Standard-Keil Hardware Manufacturing Company, United Showcase and Kason Food Service.
4. Feet shall be stainless steel adjustable bullet shape, fully enclosed, tightly fitting the leg. Provide 1 inch up and down adjustment from the central position, at no time exposing any threads. Adjustments are to be easily made by hand without the use of tools. Feet having comparable quality to Component Hardware Group, Inc. and Kason Food Service are approved. Freestanding sinks shall be supported on legs and feet as specified, with bracing from front to rear only.

F. Rough Edges:
1. All ends and edges which are rough or sharp shall be filed and ground to a safe smooth finish before delivery to job site.

G. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
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:
1. Corian
2. LG Chemical, Ltd.

3. Wilsonart International; Div. of Premark International, Inc.

Colors and Patterns: As selected by Architect from manufacturer's full range

PART 3 EXECUTION

3.1 INSTALLATION

A. The installer must examine the job site and the conditions under which the work in this section is to be performed, and notify the contractor in writing of any unsatisfactory conditions. Do not proceed with work under this section until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

B. Casework, countertops, and related materials to be conditioned to average prevailing humidity condition in installation areas prior to start of work.

C. Install casework and countertops with factory-trained supervision authorized by manufacturer. Casework shall be installed plumb, level, true and straight with no distortions. (Shim as required.) Securely attached to building structure with anchorage devices of appropriate type, size and quantity to meet applicable codes, specifications and safety conditions. Where laminate clad casework and countertops abuts other finished work, scribe and trim to accurate fit.

D. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by the manufacturer.

E. Repair, or remove and replace, defective work as directed upon completion of installation.

F. Clean plastic surfaces, repair minor damage per plastic laminate manufacturer's recommendations. Replace other damaged parts of units.

G. Advise contractor of procedures and precautions for protection of casework and countertops from damage by other trades until acceptance of work by owner.

H. Cover casework with 4-mil polyethylene film for protection against soiling and deterioration during remainder of construction period.

END OF SECTION - 12304

SECTION 13900 - FIRE SUPPRESSION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes complete fire suppression system including, as required, sprinkler system, fire department connections and fire pump system for sprinkling of the building.

B. The building design is shown on the project architectural drawings.

C. The intent of this specification is for the Contractor to determine, based on site visit(s) and the building drawings, the labor, materials, equipment, and other items necessary for a complete sprinkling of the building per NFPA 13. This determination includes, but is not limited to, the use of fire pumps, jockey pumps, fire hoses, stand pipes, and other fire suppression equipment for a complete sprinkling of the building. The Fire Suppression Contractor should base his bid on this determination.

D. The information contained in the specification on fire pumps is intended to be a guide in the selection and installation of such fire pumps. If, based on hydraulic calculations and hydrant testing, a pump is deemed to be necessary; it is the responsibility of the Contractor to coordinate with other applicable trades, e.g. the Division 16 contractor, to provide a complete and functional fire suppression system installation.

1.2 SYSTEM DESCRIPTION

A. Sprinkler System: Conform to the following criteria:
   1. Coverage for entire building.
   2. Design system hydraulically to achieve the hazard occupancy requirements set forth in NFPA 13.

B. Fire Pump (where applicable): Conform to the following criteria:
   1. Description: Electric motor driven.
   2. Design to NFPA 20.
   3. System to achieve performance required by NFPA 13.

C. The Contractor shall be responsible for coordinating with all other trades.

D. The Contractor shall be responsible for obtaining all necessary inspections, permits, utility connections, and paying all required fees.

E. Areas subject to freezing shall be provided with a dry pipe system.

1.3 SUBMITTALS

A. Shop Drawings: Indicate detailed fire pump and jockey pump layout, pipe layout, supports, components, accessories, sizes, and hydraulic calculations. Drawings to be on a scale of 1/8” = 1'-0” showing all equipment and piping installed under this section. Shop drawings shall be given drawing numbers, which shall be retained through all revisions.

B. All shop drawings submitted shall be approved by the Fire Marshall before submission to the Architect for approval. Submit sufficient prints for architect to retain three copies.

C. Product Data: Submit data for pipe materials used, valves, manufacturer's catalog sheet for equipment indicating rough-in size, finish, accessories, pump type, capacity, power requirements, certified pump curves, and NPSH.

1.4 CHARTS AND TAGS

A. Provide three (3) sets of charts or diagrams showing outline plan of the structures and the essential features of the systems including all piping, equipment, valves, and controls.

B. All valves, dampers, and controls shall be designated

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of sprinkler heads.

B. Operation and Maintenance Data: Submit description of components of system, servicing requirements, record drawings, inspection data, and parts lists.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with:
   1. Sprinkler Systems: NFPA 13.
   2. Standpipe and Hose Systems: NFPA 14.
   3. Fire Pump System: NFPA 20.

B. Design fire suppression system under direct supervision of a NICET qualified fire protection system designer experienced in design of this Work and licensed at Project location.

PART 2 PRODUCTS

2.1 PIPE AND TUBE

A. Steel Pipe: ASTM A135 black welded or seamless, schedule 40 or 10.
   1. Steel Fittings: ASME B16.9, wrought steel, butt welded; ASME B16.25, butt weld ends; ASTM A234/A234M, wrought carbon steel and alloy steel; ASME B16.5, steel flanges and fittings; ASME B16.11, forged steel socket welded and threaded.
   2. Cast Iron Fittings: ASME B16.1, flanges and fittings; ASME B16.4, threaded fittings.
   3. Malleable Iron Fittings: ASME B16.3, threaded type; ASTM A47/A47M.
   4. Water service underground pipe to building shall be as per site plans.

2.2 GATE VALVES

A. Up to and including 2 inches: Bronze body and trim, rising stem, hand wheel, solid wedge or disc, threaded ends.

B. Over 2 inches: Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, hand wheel, OS&Y, solid bronze or cast iron wedge, flanged or grooved ends.

2.3 BUTTERFLY VALVES

A. Bronze body, stainless steel disc, resilient replaceable seat, threaded ends, extended neck, hand wheel and gear drive and integral indicating device, tamper switch.

B. Iron body, iron or bronze disc, EPDM seat, wafer, lug, or grooved ends, extended neck, hand wheel and gear drive, integral indicating device, tamper switch.

2.4 CHECK VALVES

A. Up to and including 2 inches: Bronze body and swing disc, rubber seat, threaded ends.

B. Over 2 inches: Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends.

2.5 DRAIN VALVES

A. Bronze compression stop with hose thread nipple and cap.

B. Brass ball valve with cap and chain, 3/4 inch hose thread.

2.6 SPRINKLERS

A. Sprinkler brand: Viking, Tyco.

B. Suspended Ceiling Type: Semi-recessed pendant type with chrome plated finish and matching escutcheon.

C. Exposed Area Type: Standard upright type with brass finish.

D. Guards: Finish to match sprinkler head.

2.7 SPRINKLER PIPING SPECIALTIES

A. Wet Pipe Sprinkler Alarm Valve: Check type valve with electrically operated alarms, with pressure retard chamber and variable pressure trim.

B. Dry Pipe Sprinkler Alarm Valve: Check type valve with electrically operated alarms, with accelerator.

C. Flooding Deluge Valve: Gate type valve, actuated electrically with electrically operated alarms, with alarm testing trim.

E. Electric Alarm: Electrically operated red enameled gong with pressure alarm switch.

F. Water Flow Switch: Vane type switch with two contacts.

G. Pressure Maintenance Pump: Close coupled motor and pump unit, with open drip proof, permanently lubricated, 115 volt, single phase, 60 Hz, motor.

H. Air Compressor: Single unit, electric motor driven, ASME rated horizontal receiver tank, air pressure operated, safety valves, check valves, automatic tank drain, muffler-filter, belt guard, controls and 115 volt, single phase, 60 Hz motor.

2.8 STANDPIPE EQUIPMENT

A. Hose Cabinet: Formed steel construction, prime coated; recessed mounted; 16 gage thick with 12 gage thick door; glazed door style, hinged with positive latch device. Fire rated when installed within fire rated assemblies.

B. Hose Rack: Steel with polished chrome finish; swivel or stationary type with pins and water stop.

C. Hose: 100 feet of 1-1/2 inch synthetic hose.

D. Nozzle: Brass; combination fog-straight stream and adjustable shut-off nozzle.

E. Hose Station Valves: Angle type, 1-1/2 inch nominal size with ball drip.

F. Hose Connection Valves: Brass, chrome plated finish, 2-1/2 inch size, thread to match fire department hardware, threaded dust cap and chain.

2.9 FIRE DEPARTMENT CONNECTION

A. Type: Post mounted type in vault with brass finish.

B. Outlets: Two way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.

C. Drain: 3/4 inch automatic drip.

D. Label: “Fire Department Connection.”

E. Coordinate with local fire department on connection type before pricing job.

2.10 FIRE PUMP

A. Pumps
1. Type: UL 448 Centrifugal, direct connected.
2. Casing: Cast iron, split case, single or double suction, rated for 150 psig or 1.25 times working discharge pressure, renewable bronze wearing rings, flanged suction and discharge.
3. Impeller: Bronze, fully enclosed, keyed to shaft.
4. Shaft: High-grade alloy steel with copper, bronze or stainless steel shaft sleeves.
5. Bearings: Grease lubricated ball bearings.
6. Drive: Flexible coupling with coupling guard.
7. Seals: Packing gland with minimum four rings packing.
8. Baseplate: High grade heat-treated cast iron or reinforced steel with integral drain rim.

B. Accessories:
1. Check valve in discharge pipe.
2. OS&Y gate or butterfly valves on system side of check valve and on supply side of pump.
3. Fire pump bypass fitted with OS&Y gate or butterfly valves and check valve.
4. Relief valve.
5. Pressure gages, suction and discharge.
6. Temperature relief valve.
7. Umbrella cock, automatic air release.
8. Splash shield between pump and motor.
9. Manifold with hose gate valves.
10. Flow metering system for closed loop testing.

C. Electric Drive: Squirrel cage type in open drip proof NEMA MG 1 enclosure, 208 volt, three phase, 60 Hz.

D. Electric Motor Controls: Limited service type with reduced voltage starter.

1. Alarm circuit for power failure.

E. Operating Controls: Hand-off-automatic switch, fire water pressure switch to operate pump drive, fire water pressure switches for alarms, with indicating lights for low fire water pressure and high fire water pressure and contacts for remote circuits to indicate pump operational status and alarm status.

2.11 PRESSURE BOOSTER (JOCKEY) PUMP

A. Electrically operated, positive-displacement pressure booster pump, pressure switch operated.

2.12 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Per Division 16.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance NFPA 13, NFPA 14, NFPA 20.

B. Install Work in accordance with Fire Department, Fire Marshall, and local and state Building Inspection's standards.

C. Ream pipe and tube ends to full inside diameter. Remove burrs and bevel plain end ferrous pipe.

D. Remove scale and foreign material, inside and outside, before assembly.

E. Install sleeves where penetrating footings, floors, or walls. Seal pipe and sleeve penetration to maintain fire resistance equivalent to fire separation of footings, floors, or walls.

F. Install pipe runs to minimize obstruction to other work. Offset around ductwork.

G. Install piping in concealed spaces above finished ceilings.

H. Install gate valves for shut-off or isolating service.

I. Install drain valves at main shut-off valves, low points of piping and apparatus.

J. Connect system to water source ahead of domestic water connection with double check valve assembly.

K. Install heads to coordinate with reflected ceiling plan. Center in two directions in ceiling tiles.

L. Protection:
   1. Apply temporary tape or paper cover to sprinkler heads to protect from painting.
   2. Protect concealed sprinkler head cover plates from painting.

M. Install air compressor on vibration isolators.

N. Install drain piping from tank to nearest floor drain.

O. Interface sprinkler system with building fire and smoke alarm system.

P. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of fire department wrench handle.

Q. Install drain piping from pump bases, pump stuffing boxes, and pump casings to floor sinks or drains. Install air vents on pump cases.

R. Install long radius elbows on suction side of pump. Do not support piping from pump casing.

S. Align base mounted pumps. Install on vibration isolators.

T. On jockey pumps, install shut-off valves, check valve, and relief valves.

U. Flush entire piping system of foreign matter.

V. Hydrostatically test entire system. Schedule test to be witnessed by authority having jurisdiction.

END OF SECTION

SECTION 15010 – MECHANICAL GENERAL

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Specification: This specification is intended to cover all portions of this building.

B. Reference Codes: This installation shall comply with the following codes and regulations, latest accepted editions.
1. State Minimum Standard Mechanical Code.
2. NFPA No. 90A Installation of Air Conditioning and Ventilation Systems.
3. State Minimum Standard Plumbing Code.
4. State Minimum Standard Gas Code.
5. NFPA #54 National Fuel Gas Code.
6. NFPA No.70 with Amendments, National Electric Code.
7. NFPA 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
8. Life Safety Code.
9. State Handicapped Accessibility Code.
10. State Minimum Standard Fire Prevention Code.
11. State Energy Code for Buildings, with 2009 Supplements and Amendments.

C. Reference Standards: This installation shall comply with the following standards.
1. Manufacturers Standardization Society of the Valve and fittings Industry (1815 North Ft. Meyer Drive, Arlington, VA 22209). MSS-SP-58-2002, called MSS-SP-58. MSS-SP-69-2003, called MSS-SP-69.
2. American Society of Heating and Ventilating and Air Conditioning Engineers Guide, Fundamentals, 2009 Edition.
3. Sheet Metal and Air Conditioning Contractor National Association (SMACNA) HVAC Duct Construction Standards, Metal & Flexible, 2005 Edition. Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems. 1986 Edition. Seismic Restraint Manual Guidelines for Mechanical Systems, Second Edition.
4. American Society of Sanitary Engineers (ASSE) Standard, Latest Edition.
5. North American Insulation Manufacturers Association (NAIMA) Fibrous Glass Duct Construction Standards.

1.2 REGULATIONS

A. Attention is called to the fact that all work shall be done in accordance with all applicable City, County and State regulations, which regulations shall be considered as minimum requirements, and shall not alter the arrangement and pipe sizes indicated on the plans, except where they conflict.

1.3 DRAWINGS

A. The work is shown on the drawings.

1.4 PROTECTION OF PUBLIC

A. If the contractor must operate any potentially dangerous devices before all specified safety valves controls and devices are installed, he shall notify the Architect in writing. He shall not operate such devices under these conditions until arrangements for supervision by competent operators have been instituted and Architect’s written approval has been issued.

1.5 EXCAVATION, SHORING AND BRACING

A. Excavate and back-fill for the installation of all underground work.

B. Provide all shoring and bracing to prevent cave-ins during the construction period.

1.6 SHOP DRAWINGS

A. Shop drawings shall be submitted for but not limited to the following items:
   1. All Scheduled Equipment
   2. Ductwork & Accessories
   3. Hangers
   4. Piping & Accessories
   5. Supports
   6. Vibration Isolation
   7. Fixtures
   8. Roof Portals
   9. Control System
   10. Duct Systems
   11. Equipment Supports and Curbs
   12. Insulation
   13. Filters
   14. Access Panels
   15. Louvers
   16. Refrigerant Pipe Schematics Indicating Sizes and Fittings

B. Provide with the submittal package the proposed Test & Balance Company's credentials as described in Section 15950. Include a letter from the Test & Balance company indicating that they have read Section 15950 and will perform testing and balancing of the mechanical systems as described in that Section.

C. Provide a complete list of all accessories and options (indicate factory or field installed) for all scheduled mechanical equipment, including air distribution devices. Provide manufacturer generated specifications and ratings sheets for each individual piece of air conditioning and heating equipment. Generic photocopies from manufacturers catalog will not be accepted.

D. In addition to cut sheets, provide a summary sheet indicating exactly what pipe material joining methods, valves, etc. will be provided in the various piping systems.

E. The Contractor shall produce CAD-generated ductwork and piping shop drawing for every area of the building where new systems are installed. Contractor shall coordinate all new mechanical systems with other Divisions, specifically including piping, lights, the building structure, and ceiling heights. It shall be the Contractor's responsibility to ensure that the mechanical work is coordinated with all other trades. The shop drawings submitted shall reflect this coordination in its entirety, including location of piping 2" and larger, all ductwork (except runouts to diffusers), and all equipment by dimensions to column lines. Bottom of duct and bottom of pipe dimensions shall be taken from finished floor, and shall be recorded on the shop drawings for review. Any interferences or conflicts not resolved during normal shop drawing coordination between trades shall be specifically noted to the Architect for his instructions. Conflicts arising out of work installed (or ductwork already fabricated) without shop drawings or shop drawings that have no been completely coordinated, shall be the Contractor's responsibility and at his expense for any necessary changes.

F. The Contract Drawings are diagrammatic and indicated generally the size and location of ductwork and equipment. While duct sizes shall not be decreased, it is recognized that job site conditions may require re-routing or re-sizing of ductwork, and the Contractor shall be responsible for this coordination. Ductwork that has to be re-sized and/or re-routed as a result of this coordination effort shall be the

Contractor's responsibility and at his expense. Ductwork re-sized shall be equivalent to that shown on the drawings.

G. Steel fabrication shop drawings shall be coordinated with all Division 15 rooftop equipment and roof openings. The resulting coordination shall be confirmed and verification shall be submitted with associated equipment and roof curbs.

H. Division 15 shall coordinate with structural steel contractors to insure where ductwork is required to be routed within joist space that an alternate to x bracing is installed. Failure to coordinate shall subject the Contractor to full cost incurred to meet the design intent on the contract documents.

1.7 MOTORS, WIRING AND ELECTRICAL EQUIPMENT

A. All motors required for this work shall be built in accordance with the latest standards of National Electrical Manufacturer's Association, and shall be especially designed for quiet operation. All motors shall be selected for operation within their nameplate amperage. Adjustable bases shall be provided with motors and equipment which have belt drives.

B. All electrical materials shall comply with requirements of the National Electric Code. All contactors, starters, relays and panels used in this work, which are included in Underwriters Label Service, shall be new and bear the National Board of Fire Underwriters inspection label. Material not included in Underwriters Label service shall be new and conform to NEMA or other applicable industry standard.

C. Division 16, ELECTRICAL, provides for the furnishing of conduit and wire from electrical source to electrical use, called "path of power," and for the installation of certain line voltage devices specified in Division 15 which lie in the "path of power," including but not limited to:
1. Manual switches.
2. Line voltage thermostats.
3. Solid state speed controllers.
4. Operators for operable dampers.
5. Aquastats for domestic hot water circulating pumps.
6. Alarms for Flow Switches and Valve Supervisor Switches.

D. The "path of power" terminates at contactors or control panels of the following listed items of equipment. These control panels contain starters/contactors for the motors or heaters installed on or within the unit and are specifies in Division 15. Any wiring past the point of termination described above is Division 15 work.
1. Packaged Rooftop Units.
2. Domestic Water Heaters.
3. Condensing and/or Heat Pump Units.
4. Mini-split Systems.
5. Electric Heaters.

E. Division 16, ELECTRICAL, provides for electrical power to any given item of equipment at the voltage and phase required by the primary use only. If the item of equipment contains devices such as fans, thermostats, motorized dampers or other controls which require other than primary voltage for their proper function, then transformers shall be furnished under Division 15 for that purpose.

F. Voltage and phase for Division 15 equipment shall be as specified by Division 16. Division 15 Contractor shall submit a list of all mechanical equipment requiring electrical connections to the Contractor prior to release of any equipment, for coordination with the Division 16 contractor. A copy of this list that has been reviewed and approved by the General Contractor shall be submitted to the Architect with the submittal for mechanical equipment. Failure to include this list may result in the rejection of the entire mechanical equipment submittal.

G. The control power source (point of connection for control power) for major equipment except those single phase fans which are thermostatically controlled and those items listed in C above, are provided at the combination starters.

H. The automatic control of signal for STOP-START of major equipment is furnished and installed to and from combination starts as part of Division 15.

I. All other conduit and wire, not in “path of power” described above is included in Division 15.

J. If any Division’s Contractor makes a change by submittal, by delivery, by wiring rearrangement or power requirements, which results in increased costs, the Contractor initiating the change shall bear all cost increases.

K. All motors that are 1 HP and larger shall be high efficiency motors with nominal and minimum full load efficiencies equal to or greater than those specified by the State Energy Code. Specifications shall be submitted for each motor furnished.

1.8 MOTOR STARTERS

A. Existing wall mounted motor starters serving existing air handling units in the mechanical rooms shall remain and be reused except for AH-20 and AH-22 where new motor starters shall be installed. Contractor shall verify that each existing motor starter indicated to be reused is appropriate for the motor in the new equipment. Notify engineer if existing motor starter not correct. The air handling units are indicated on the AIR HANDLING UNIT SCHEDULE on drawing M0-1.

B. Starters or contractors shall be furnished in Division 15 for each motor.
   1. Magnetic starters shall be NEMA standard sizes adequate for the load served, Size 00, 1, 2, 3, 4. Half sizes and/or quarter sizes are not acceptable.
   2. Overload relays shall be unit constructed, hand reset melting alloy type, and shall be provided for all ungrounded legs.
   3. Units shall have NEMA-3R enclosures, three thermal overloads in three-phase starts, HAND-OFF-AUTO switches or as required by the “controls” specification section.
   4. All fractional HP single-phase motors shall have internal thermal overload protection except where starters are scheduled.
   5. All motor starters shall be of the same manufacturer and shall be General Electric Type CR-306, or equal by Square-D, Westinghouse, Allen-Bradley, Furnas, Siemens, or Cutler-Hammer subject to full compliance with all criteria.

1.9 ROOF PORTALS

A. Where power wiring to Division 15 equipment is not within the equipment curb, contractor shall install new roof portals if required to run power conduit to the equipment. The portal location shall be coordinated with Division 15 equipment power inlet requirements, and located not to block access for equipment servicing.

B. New roof portals shall be installed if required to run control system conduit to roof mounted equipment.

1.10 ACCESS PANELS

A. Shall be provided to permit operation of concealed valves, dampers, or equipment. The following table lists types of Bilco access frames and doors. Panels of equivalent construction by Titus, Milcor, Hohmann, and Barnard or Zurn are acceptable.

B. Wall:
   1. Sheetrock Style G

2. Plaster Style A
3. Masonry Style C

C. Ceiling:
1. Sheetrock Style G
2. Plaster Style A
3. Concealed spline Style D
4. Lay-in tile None

D. Fire Rated Wall or Ceiling Style F (U.L Listed)

E. Sizes shall be: Small valves – 12” x 12”. Multiple valves and dampers – 24” x 24”

F. Access panels shall be insulated for sound barrier equal to wall in which it is installed.

G. Acoustical Tile: Coordinate with tile installed to provide a removal tile at access point. Install a colored thumb tack to mark the access panel of above ceiling equipment, control instrument, valves or relay.

1.11 WARRANTY

A. The Contractor shall operate the air conditioning, heating and ventilating systems and plumbing systems for a period of one week to the satisfaction of the Architect. Thereafter, the Contractor shall guarantee and be responsible for all materials and workmanship (parts and labor) for a period of one (1) year following the date of acceptance by the Architect.

B. The Contractor shall also provide maintenance for the one (1) year period by providing four (4) periodic inspections at approximately three-month intervals, which shall include the following.
1. Check all bearing, align and oil or grease.
2. Check belt tensions and pulley adjustment and adjust as necessary.
3. Check filters and advise Owner when change is necessary.
4. Check refrigerant charges and oil levels and replenish as necessary.
5. Check and re-calibrate controls as necessary.

C. Any required maintenance for the above shall be performed and materials needed shall be furnished by the Contractor. Not included in the materials to be furnished by the Contractor are fuel, electricity, water and filters. Provide the Owner with four (4) copies of the inspection reports indicating all items checked and adjustment or repairs performed.

D. Water heaters shall be guaranteed for five years; parts and labor.

E. All equipment compressors shall be guaranteed for five years; parts and labor.

1.12 CUTTING AND PATCHING

A. The Contractor shall set sleeves for pipes, ducts and equipment accurately before the concrete walls and floors are poured.

B. Should the contractor neglect to perform this preliminary work and should cutting and patching be required in order to install the piping, ductwork or equipment, then the expense of the cutting and restoring of surfaces to their original condition shall be borne by the Contractor.

1.13 BASIS OF DESIGN

A. When brand, trade or manufacturer’s names are used for basis of design, they are used in the interest of brevity to describe the style, type, size, quality or arrangement of articles of equipment and are not

intended to limit competition. If articles of equipment by manufacturers other than basis of design are submitted for installation, the Architect shall compare them with specified articles of equipment on basis of qualities mentioned. The size, weight and arrangement of other equipment shall be checked by the Contractor to ascertain that it can be installed, connected, operated, and serviced successfully, and that walking space and service space can be maintained without altering equipment space or enclosures or the work of other trades. Manufacturers not listed as "Acceptable Manufacturers" will not be considered.

B. If any Division's Contractor makes a change by submittal, by delivery or by wiring rearrangement which results in increased costs, the Contractor initiating the change shall bear all cost increases.

1.14 AS-BUILT DRAWINGS

A. The Contractor shall produce and submit to the Architect, "As-Built" drawings, four (4) copies, as described below.

B. As work progresses, neatly and clearly record on four (4) sets of mechanical plans (in red) all changes and deviations from the contract drawings in size, locations, etc., of all piping, ductwork terminal units and other equipment. Record (in red) final location of piping, ductwork, starts, valves, thermostats, etc., by dimensions to adjacent walls and floors. Make sufficient measurement to accurately locate all equipment. Locate underground lines by dimension from building walls.

1.15 OPERATION AND MAINTENANCE MANUALS

A. Operation and Maintenance manuals (6 sets) shall be provided to the Owner or the Owners designated representative. Manuals shall be in accordance with the Georgia State Energy Code for Buildings.
   1. Manuals shall include as a minimum the following:
      a. Final, corrected submittal data with equipment sizes and selected options for each piece of equipment, including Engineer's submittal review comments.
      b. Current manufacturer's published operation and maintenance manuals for each piece of equipment.
      c. Name, address and phone number of at least one LOCAL service agency.
      d. HVAC controls system maintenance and calibration information including wiring diagrams, schematics, and control drawings.
      e. Complete narrative of how each system is intended to operate, including suggested set-points.
      f. Copy of the final Test & Balance report.
      g. Copy of the final As-built drawings.
      h. Controls certification letter.
      i. Copy of Engineer's final punch list items, with each item checked off when completed or an explanation of why the item was not completed.

1.16 INTERFACES WITH OTHER WORK

A. There are many interfaces between the work involved with Division 15 and the work involved with other Sections and Divisions, particularly with Division 16. Contractor shall be aware of the requirements of these other Sections or Divisions and his responsibilities at the interfaces.

B. No mechanical equipment, piping, or ductwork shall be places within 42" of switchboards and/or panel boards.

C. No water piping (domestic, storm, sanitary, etc., except sprinkler piping when required) shall be located above electrical switchboards and/or panel boards. When sprinklers are required, shields must be provided over the panels.

1.17 EQUIPMENT IDENTIFICATION

A. Equipment Identification:
   1. All items of equipment shall be identified with engraved tags. Tags shall be 1/8" thick plastic stock with adhesive backing, and shall be permanently secured to the equipment that they identify.
   2. All tags shall be of uniform 2" high x 4" wide with 1" high letters and numbers. Tags can be wider if required to accommodate the equipment number. All tags shall be black with white lettering.
   3. Equipment Identification numbers shall be the same as those scheduled on the design drawings. Identification shall be located where it can be conveniently read, and shall be located in the same relative position on like equipment.
   4. In addition to the above ID tags, all scheduled equipment shall be provided with permanent factory installed engraved nameplate labels listing complete model and serial numbers, unit voltage, motor sizes, etc.
   5. Identify all disconnect switches and motor starters that are not directly attached to the equipment that they serve, with identical ID tags as specified above for the equipment. Size of ID tag may be smaller to fit on enclosure.

1.18 PIPE IDENTIFICATION

A. All piping systems shall be identified.
   1. All piping systems within the building except as noted herein shall be identified with clear block letters and number stenciled on the outside surface of the pipe or insulation, indicating the system contents by abbreviated letters and direction of the flow.
   2. This identification marking shall be applied to the pipe systems where pipe enters or leaves a wall or floor, and item of equipment such as pumps, fan coil units and tanks, and at tees. Identification shall be applied no less than 50 feet apart on horizontal pipe; and one identification per floor on vertical pipe.
   3. Letters and numbers shall be high on pipe 2" and smaller.
   4. Letters and numbers shall be 1" high on pipe 3" and larger.
   5. Directional arrows shall be 4" long and "wide.
   6. Letters and numbers shall be black on white pipe or insulation.
   7. Letters and number shall be white on dark pipe or insulation.
   8. Pipe identification symbols shall be the same as shown on the drawings.
   9. Soil, vent and refrigerant piping shall not be identified.

1.19 PERMITS AND INSPECTIONS

A. The Contractor shall secure and pay for all permits, fees, inspections, and utility connection costs.

1.20 EQUIPMENT & MATERIAL PROTECTION

A. All equipment and material shall be kept clean and free of debris as construction progresses. Closures shall be provided over duct, piping and major equipment openings during storage, erection and prior to connection. Material finishes shall be protected by covers to prevent impingement of corrosive, abrasive and disfiguring foreign matter. Accidental finish damage shall be repaired equivalent to original finish.

1.21 TEST, BALANCE AND REPORT

A. See Section 15950.

1.22 PROHIBITED MATERIALS

A. All products, materials or assemblies which contain asbestos or polychlorinated biphenyl (PCB) in any form or in any concentration whatsoever, are expressly forbidden from being used on this project.

1.23 SITE VISIT AND FAMILIARIZATION

A. Contractors proposing to undertake work under this Division shall visit the site of the work and fully inform themselves of all conditions that effect the work or cost thereof, examine the drawings and specifications as related to the site conditions, and acquaint themselves with the utility companies from whom services will be supplied; verify locations of utility services and determine requirements for connections.

B. Consideration will not be granted for any alleged misunderstanding of the amount of work to be performed. Tender of proposal shall convey full agreement to all items and conditions specified, indicated on the drawings, and/or required by nature of the site.

C. Attention is called to the fact that this scope of work includes renovation to an existed facility and/or an addition to an existing building. When the work is finished, the mechanical systems shall be complete in every respect, and completely integrated with all affected mechanical and control systems.

D. Existing mechanical systems in the existing facility shall not be interrupted without prior approval of the Owner or Architect.

END OF SECTION 15010

SECTION 15010 – HANGERS AND SUPPORT FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe hangers and supports, Hanger rods, Inserts, Flashing, Equipment curbs, Sleeves, Mechanical sleeve seals, Formed steel channel, Firestopping relating to HVAC work, Firestopping accessories, Equipment bases and supports.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B31.1 - Power Piping.
2. ASME B31.5 - Refrigeration Piping.
3. ASME B31.9 - Building Services Piping.

B. ASTM International:
1. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
2. ASTM E814 - Standard Test Method for Fire Tests of Through Penetration Fire Stops.
3. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:
1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc.:
1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

G. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: ASTM E119, ASTM E814, UL 263, UL 1479 to achieve fire ratings as noted on architectural drawings for adjacent construction, but not less than 1 hour fire rating.

B. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to applicable code and UL listings for fire resistance ratings and surface burning characteristics.

1.6 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
   1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
   2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
      a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.
   1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
   2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

F. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Acceptable Manufacturers: Carpenter & Paterson, Creative Systems, Flex-Weld, Globe Pipe Hanger Products, Michigan Hanger, Superior Valve Co.

B. Condensate Piping:

1. Conform to ASME B31.1, ASME B31.9, ASTM F708.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or carbon steel, adjustable swivel, split ring.
3. Multiple or Trapeze Hangers for Pipe Sizes 4 inches and Smaller: Steel channels with welded spacers and hanger rods.
4. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.
5. wrought steel clamp; adjustable steel yoke and cast iron roll.
6. Vertical Support: Steel riser clamp.
7. Copper Pipe Support: Copper-plated carbon-steel ring.

C. Refrigerant Piping:
1. Conform to ASME B31.5, ASTM F708.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes 3 inches and Smaller: Unistrut type formed steel channel supports.
6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Unistrut type formed steel channel supports. Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Copper-plated carbon-steel ring.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

A. Metal Flashing: 26 gage thick galvanized steel.

B. Metal Counterflashing: 22 gage thick galvanized steel.

C. Lead Flashing:
1. Waterproofing: 5 lb./sq. ft sheet lead.
2. Soundproofing: 1 lb./sq. ft sheet lead.

D. Flexible Flashing: 47 mil thick sheet; compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.5 EQUIPMENT CURBS

A. Fabrication: Welded 18 gage galvanized steel shell and base, mitered cant, variable step to match roof insulation, 1-1/2 inch thick insulation, factory installed wood nailer.

2.6 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sleeves for Round Ductwork: Galvanized steel.

D. Sleeves for Rectangular Ductwork: Galvanized steel or wood.

E. Sealant: Acrylic.

2.7 MECHANICAL SLEEVE SEALS

A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.8 FORMED STEEL CHANNEL

A. Acceptable Manufacturers: Allied Tube & Conduit Corp., B-Line Systems, Midland Ross Corporation, Unistrut Corp.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.9 FIRESTOPPING

A. Acceptable Manufacturers: Dow Corning Corp., Fire Trak Corp., Hilti Corp., International Protective Coating Corp., 3M Fire Protection Products, Specified Technology Inc.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
   1. Silicone Firestopping Elastomeric Firestopping: Single or Multiple component silicone elastomeric compound and compatible silicone sealant.
   2. Foam Firestopping Compounds: Single or Multiple component foam compound.
   3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
   4. Fiber Stuffing and Sealant Firestopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
   5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
   6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
   7. Firestop Pillows: Formed mineral fiber pillows.

2.10 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent Mineral fiberboard or fiber matting, sheet metal, plywood or alumina silicate fire board.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:
1. Furnish UL listed products.
2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:
1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.
2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install damming materials to arrest liquid material leakage.

D. Do not drill or cut structural members.

3.3 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME B31.1, ASME B31.5, ASME 31.9, ASTM F708.

B. Support horizontal piping as scheduled.

C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2 inch minimum vertical adjustment.

F. Support vertical piping at every floor.

G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Provide copper plated hangers and supports for copper piping.

J. Design hangers for pipe movement without disengagement of supported pipe.

K. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

L. Provide clearance in hangers and from structure and other equipment for installation of insulation.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members, formed steel channel, steel pipe and fittings. Brace and fasten with flanges bolted to structure.

3.6 INSTALLATION - FLASHING

A. Provide flexible flashing and metal counter-flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms for sound control.

C. Provide curbs for roof installations 14 inches minimum high above roofing surface. Flash and counter-flash with sheet metal; seal watertight. Attach counter-flashing to equipment and lap base flashing on roof curbs. Flatten and solder joints.

D. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.7 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with stuffing insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel escutcheons at finished surfaces.

3.8 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.

D. Fire Rated Surface:
1. Seal opening at floor, wall, partition, ceiling, and roof as follows:
   a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
   b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
   c. Pack void with backing material.
   d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
2. Where cable tray, conduit, wireway, and piping penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.

E. Non-Rated Surfaces:
1. Seal opening through non-fire rated wall, partition floor, ceiling, and roof opening as follows:
   a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
   b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
   c. Install type of firestopping material recommended by manufacturer.
2. Install escutcheons, floor plates, or ceiling plates where conduit or piping, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
3. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.

4. Interior partitions: Seal pipe penetrations at locations where partitions run to structure. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.9 SCHEDULES

A. Copper and Steel Pipe Hanger Spacing:

PIPE SIZE Inches (mm)	COPPER TUBING MAXIMUM HANGER SPACING Feet (m)	STEEL PIPE MAXIMUM HANGER SPACING Feet (m)	COPPER TUBING HANGER ROD DIAMETER Inches (mm)	STEEL PIPE HANGER ROD DIAMETER Inches (mm)
1/2 (12)	5 (1.5)	7 (2.1)	3/8 (9)	3/8 (9)
3/4 (20)	5 (1.5)	7 (2.1)	3/8 (9)	3/8 (9)
1 (25)	6 (1.8)	7 (2.1)	3/8 (9)	3/8 (9)
1-1/4 (32)	7 (2.1)	7 (2.1)	3/8 (9)	3/8 (9)
1-1/2 (38)	8 (2.4)	9 (2.7)	3/8 (9)	3/8 (9)
2 (50)	8 (2.4)	10 (3)	3/8 (9)	3/8 (9)
2-1/2 (65) (Note 2)	9 (2.7)	11 (3.4)	1/2 (13)	1/2 (13)
3 (75)	10 (3)	12 (3.7)	1/2 (13)	1/2 (13)
4 (100)	12 (3.7)	14 (4.3)	1/2 (13)	5/8 (15)
5 (125)	13 (4)	16 (4.9)	1/2 (13)	5/8 (15)
6 (150)	14 (4.3)	17 (5.2)	5/8 (15)	3/4 (19)
8 (200)	16 (4.9)	19 (5.8)	3/4 (19)	3/4 (19)
10 (250)	18 (5.5)	22 (6.1)	3/4 (19)	7/8 (22)
12 (300)	19 (5.8)	23 (7)	3/4 (19)	7/8 (22)
14 (350)	22 (6.1)	25 (7.6)	7/8 (22)	1 (25)
16 (400)	23 (7)	27 (8.2)	7/8 (22)	1 (25)
18 (450)	25 (7.6)	28 (8.5)	1 (25)	1 (25)
20 (500)	27 (8.2)	30 (9.1)	1 (25)	1-1/4 (32)
24 (600)	28 (8.5)	32 (9.8)	1-1/4 (32)	1-1/4 (32)

B. Plastic and Ductile Iron Pipe Hanger Spacing:

PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
ABS (All sizes)	4	3/8
FRP (All Sizes)	4	3/8
Ductile Iron (Note 2)		
PVC (All Sizes)	4	3/8

C. Note 1: Refer to manufacturer's recommendations for grooved end piping systems.

D. Note 2: 20 feet maximum spacing, minimum of one hanger for each pipe section close to joint behind bell. Provide hanger at each change of direction and each branch connection. For pipe sizes 6 inches and smaller, subjected to loadings other than weight of pipe and contents, limit span to maximum spacing for water service steel pipe.

END OF SECTION 15061

SECTION 15080 - PLUMBING INSULATION

PART 1 GENERAL

1.1 GENERAL

A. Section 15010 applies.

PART 2 PRODUCTS

2.1 BASIS OF DESIGN

A. Manufacturers shown below as Basis of Design
   1. Acceptable Manufacturers for Glass Fiber and Mineral Fiber Insulation Products: CertainTeed, Knauf, Johns Manville, Owens-Corning.

2.2 PIPE INSULATION

A. Domestic Hot Water Supply and Recirculation
   1. ASTM C547, molded glass fiber pipe insulation.
   2. Thermal Conductivity: 0.23 at 75 degrees F.
   3. Operating Temperature Range: 0 to 850 degrees F.
   4. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.
   5. Jacket Temperature Limit: minus 20 to 150 degrees F.
   6. Thickness: 1” thickness for 1-1/2” pipe and smaller. 1-1/2” thickness for pipes larger than 1-1/2”.

B. Domestic Cold Water Supply and Condensate Piping
   1. ASTM C547, molded glass fiber pipe insulation.
   2. Thermal Conductivity: 0.23 at 75 degrees F.
   3. Operating Temperature Range: 0 to 850 degrees F.
   4. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.
   5. Jacket Temperature Limit: minus 20 to 150 degrees F.
   6. Thickness: 1/2” thickness for all pipes.

C. Pipe Insulation Jacket
   1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.
   2. Water vapor transmission: ASTM E96/E96M; 0.02 perm-inches.

PART 3 EXECUTION

3.1 INSTALLATION – PIPING SYSTEMS

A. Paint insulation to match ceiling where piping and pipe insulation are exposed to view.

B. Verify piping and equipment has been tested before applying insulation materials. Verify surfaces are clean and dry, with foreign material removed. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.

C. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide expanding fire stopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions.

D. Any piping run in attic spaces shall be completely tented with batt insulation with the same insulation level as req'd. for roof, in addition to insulation called out in Sec. 2.2.

E. Any piping run in un-heated areas shall be heat traced inside insulation, min. 7 Watts/ft.

F. Hot and Cold Piping Systems:
1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
2. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
3. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
4. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations. For hot piping systems above 140 degrees F, insulate unions and flanges at equipment.

G. Inserts and Shields:
1. Piping 1-1/2 inches Diameter and Smaller: Install steel shield between pipe hanger and insulation.
2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
    a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
    b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.
    a. Condensate Piping: Insulate entire piping system and components inside the building space to prevent condensation.
    b. Pipe exposed in Mechanical Equipment or Finished Spaces: Finish with PVC jacket and fitting covers. Labels on exterior covers should be oriented so as to be easily readable and shall have directional flow arrows.

END OF SECTION

SECTION 15100 - PLUMBING PIPING AND ACCESSORIES

PART 1 GENERAL

1.1 GENERAL

A. Section 15010 is applicable.

1.2 PRESSURE

A. The working pressure of all pipes, fittings, valves, and joints shall be in excess of the maximum system pressure and maximum system temperature at the point of installation.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Conform to ASME B31.9, ASTM F708.

B. Hangers for Non Insulated Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or carbon steel, adjustable swivel, split ring.

C. Hangers for Insulated and Non Insulated Pipe Sizes ½" to 30 inches: Carbon steel, adjustable, clevis.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

E. Vertical Support: Steel riser clamp.

F. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

G. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

H. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.

I. Floor Support for horizontal Pipe Sizes to 4 inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

J. Floor Support for horizontal Pipe Sizes 6 inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

K. Ground support for exterior horizontal Pipe: Adjustable stainless steel roll and stand, and concrete pier support.

2.2 PIPE SLEEVES

A. Sleeves are defined as holes that are provided to permit the passage of pipe (and insulation) through walls or floors. Soil, waste, vent, and domestic water pipes stubbed through walls and floors for plumbing fixture connections do not require sleeves.

B. Masonry: Sleeves shall be schedule 40 steel pipe and shall be large enough to accommodate continuous passage of pipe plus insulation through the wall or floor system. Pipe sleeves shall extend 1" on both sides of a wall or floor.

C. Concrete:
   A. Sleeves through concrete walls and floor shall be formed by any device that forms a neat circular hole, of proper size, through the wall or floor system. Sleeves shall be schedule 40 black steel pipe.
   B. Structural floor sleeves require extension above the floor surface to prevent water passage down the sleeves, and shall be made of schedule 40 black steel pipe extended 1" above the floor.

D. Other Sleeves: Where sleeves pass through wood, drywall, plaster partitions, or suspended ceilings, sleeves shall be neatly cut holes sealed with caulk, finished with chrome plated escutcheon where exposed in visible areas.

E. Sealing of annular space: For sleeves in masonry and concrete walls and elevated floor slabs, non-rated, annular spaces shall be packed with silicone RTV foam. Sleeves in exterior walls shall be sealed with a "Link Seal" assembly or packed with fiberglass and sealed at both ends with weather-resistant, non-hardening caulk. Where escutcheons are not required, the annular space shall be neatly sealed at the sleeve end. Pipes passing through ducts and plenums shall be sealed air tight. Annular spaces that pass through fire resistive or fire rated partitions, or ceilings shall be closed with a 3M Fire Barrier Penetration Sealing System. Manufactured pipe penetration systems for use in rated floors, ceilings, or partitions are allowed provided they are UL listed for such application.

F. Unused holes in floors made for duct or pipe penetrations shall be sealed neatly to match existing wall or floor.

G. All sleeves shall be sized for full pipe size plus pipe insulation thickness through the entire length of the sleeve.

2.3 ESCUTCHEONS

A. Escutcheons are annular shaped metal plates installed to cover annular spaces around pipes entering walls, floors, or other partitions. They are installed for decorative purposes in areas where these penetrations are visible. Escutcheons shall be chrome plated steel, fastened to remain secure and in position at all times.

B. Escutcheons for water closets, plated supply pipes, and shower heads shall be chrome plated brass with setscrew.

C. Escutcheons are not to be installed on the bell of any soil or drain pipes, on any pipe larger than 4", on insulated pipe if exterior diameter of insulation is larger than 4", or on pipes which do not enter the wall or floor at right angles.

2.4 FLASHING

A. Flashing shall be sheet lead, 4 lbs. per square foot, and shall extend out from pipe and edge of drain a minimum of 12".

B. Roof drains, floor drains, area drains, and equipment room drains installed where membrane water-proofing is installed shall be flashed.

C. Vent stacks and other pipes through roof shall be flashed. Flashing may be caulked into pipe bell if flush with finished roof, or on 3" and larger may employ 4 lb. boot flashing. Vents shall extend a minimum of 12" above finished roof elevation at penetration. Refer to roof pipe portals for piping through roof other than sanitary vents or overflow drains.

2.5 PIPES AND TUBES

A. Sanitary Sewer (SS), Vent Piping (V)
   A. Sanitary Sewer (SS) and Vent Piping (V): PVC, schedule 40, with PVC fittings and elastomeric gasket joints. Solvent weld with ASTM D2564 solvent cement.
   B. When located in HVAC plenums, completely wrap with 3M Fire Wrap 5A+ per manufacturer's instructions.

B. Domestic Water Piping, Cold water (CW), Hot water (HW) & Hot water return (HWR)
   A. Underground: Type K Copper Tubing ASTM B42, Tempered O61 annealed without fittings.
   B. Above ground: Type L copper tubing, ASTM B88, drawn with wrought copper fittings and grade 95TA solder joints.
   C. Exposed fixtures: Chrome plated brass and copper tubing with threaded plated brass fittings.

C. HVAC Condensate Piping: Type L copper tubing, ASTM B88, drawn with wrought copper fittings and grade 95TA solder joints.

D. TPR Drain Piping:
   A. PVC, Schedule 40, with PVC fittings and elastomeric gasket joints. Solvent weld with ASTM D2564 solvent cement.
   B. When located in HVAC plenums: Type L copper tubing, ASTM B88, drawn with wrought copper fittings and grade 95TA solder joints.

E. Trap Primer piping (TP):
   A. Type K Copper Tubing ASTM B42, Tempered O61 annealed without fittings.

2.6 VALVES

A. For drinking water service, valves and equipment shall comply with NSF 61.

B. Gate Valves:
   A. Up to 2 inches: Bronze body, bronze trim, non-rising stem, hand wheel, inside screw, double wedge disc, soldered or threaded.
   B. Over 2 inches: Iron body, bronze trim, rising stem, hand wheel, OS&Y, solid wedge, flanged or grooved ends.

C. Ball Valves:
   A. Up to 2 inches: Bronze or stainless steel one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle, solder or threaded ends.
   B. Over 2 inches: Cast steel flanged body, chrome plated steel ball, Teflon seat and stuffing box seals and lever handle.

D. Relief Valves:
   A. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

E. Swing Check Valves:
   A. Up to 2 inches: Bronze body and swing disc, solder or threaded ends.
   B. Over 2 inches: Iron body, bronze trim, swing disc, renewable disc and seat, flanged ends.

F. Spring Loaded Check Valves:
   A. Iron body, bronze trim with threaded, wafer or flanged ends and stainless steel spring with renewable composition disc.

G. Relief Valves:
   A. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

2.7 METERS AND GAGES

A. Thermometers:
   A. Scale Range: Temperature ranges for services listed are as follows:
      a. Domestic Hot Water: 30 to 240 deg F, with 2-degree scale divisions
      b. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions

B. Liquid-In-Glass Thermometers Description: ASTM E 1.
      a. Case: Die cast and aluminum finished in baked-epoxy enamel, glass front, spring secured, 9 inches (230 mm) long.
      b. Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.
      c. Tube: Red or blue reading, organic-liquid filled with magnifying lens.
      d. Scale: Satin-faced nonreflective aluminum with permanently etched markings.
      e. Stem: Copper-plated steel, aluminum, or brass for separable socket; of length to suit installation.

C. Thermometer Wells: Fitting with protective well for installation in threaded pipe fitting to hold test thermometer.
      a. Material: Brass, for use in copper piping.
      b. Material: Stainless steel, for use in steel piping.
      c. Material: Steel, for use in steel piping.
      d. Extension-Neck Length: Nominal thickness of 2 inches but not less than thickness of insulation. Omit extension neck for wells for piping not insulated.

D. Pressure Gages
   A. Description: ASME B40.1, phosphor-bronze bourdon-tube type with bottom connection; dry type, unless liquid-filled-case type is indicated.
   B. Cases are also constructed of molded aluminum and phenolic plastic. Lenses are also made of clear acrylic plastic.
   C. Case: Drawn steel, brass, or aluminum with 4-1/2-inch diameter, glass lens.
   D. Connector: Brass, NPS 1/4.

E. Scale: White-coated aluminum with permanently etched markings.
F. Range: 0-100 PSI.

E. Test Plugs
A. Description: Nickel-plated, brass-body test plug in NPS 1/2 fitting.
B. Body: Length as required to extend beyond insulation.
C. Pressure Rating: 500 psig minimum.
D. Core Inserts: One or two self-sealing valves, suitable for inserting 1/8-inch OD probe from dial-type thermometer or pressure gage.
E. Test-Plug Cap: Gasketed and threaded cap, with retention chain or strap.
F. Test Kit: Pressure gage and adapter with probe, two bimetal dial thermometers, and carrying case.

F. Calibrated Flow Balancing Valves
A. Furnished with calibrated nameplate and memory stop.
B. Fitted with capped readout fittings.

G. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Dresser, Trerice, Weiss, Wika, Noshok, Watts, Taco, Bell & Gossett, Grundfos

2.8 PIPING SPECIALTIES

A. Flanges, Unions, and Couplings:
A. Pipe Size 2 inches and Under: Malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.
B. Pipe Size Over 2 inches: Forged steel flanges for ferrous piping; bronze flanges for copper piping; preformed neoprene gaskets.
C. Grooved and Shouldered Pipe End Couplings: Malleable iron housing, C-shape elastomer composition sealing gasket, steel bolts, nuts, and washers.
D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier. Dielectric unions shall be used for joining ferrous and non-ferrous metals to prevent galvanic corrosion.

B. Strainers:
A. Size 2 inches and Under: Threaded brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.
B. Size 2-1/2 inch to 4 inch: Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

C. Flexible Connectors:
A. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure 300 psig.

D. Water Hammer Arrestors:
A. Install on all fixture branches having quick-closing valves and at the tops of all risers to prevent water hammer. Each water hammer arrestor shall be sized and certified according to the Plumbing and Drainage Institute standard - WH201.

2.9 CLEANOUTS (CO)

A. Cleanouts shall be provided at the base of each stack, and at each change in direction greater than 45 degrees. Cleanouts shall be of the same nominal size as the connected pipe up to and including 4" and not less than 4" in larger pipe.

B. The distance between cleanouts in horizontal soil and waste lines shall not be greater than 50 feet for pipes up to and including 3", 80 feet for lines 4" and larger.

C. All cleanouts shall be made with a caulking cast ferrule having a cast brass cleanout screw plug, having a raised nut not less than 1" high, except that cleanouts underground under floor slabs shall be extended through the slabs, flush with the floor line, provided with countersunk caps.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify excavations are to required grade, dry, and not over-excavate.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside piping before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.4 INSTALLATION - PIPING SYSTEMS

A. Install dielectric connections wherever joining dissimilar metals.

B. Label all piping with labels and directional flow arrows.

C. Install unions downstream of valves and at equipment or apparatus connections.

D. Route piping parallel to building structure and maintain gradient.

E. Install piping to maintain headroom. Group piping to conserve space. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

H. Sleeve pipe passing through partitions, walls and floors.

I. Install piping system allowing clearance for installation of insulation and access to valves and fittings.

J. Install identification on piping systems including underground piping.

K. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

3.5 INSTALLATION - VALVES

A. Install valves with stems upright or horizontal, not inverted.

B. Install ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.

C. Install ball or butterfly valves for throttling, bypass, or manual flow control services.

D. Provide lug end butterfly valves adjacent to equipment when functioning to isolate equipment.

E. Install plug valves for throttling service. Install non-lubricated plug valves only when shut-off or isolating valves are also installed.

F. Install 3/4 inch drain ball valves at main shut-off valves, low points of piping, bases of vertical risers, and equipment drains. Pipe to nearest drain.

3.6 INSTALLATION - PIPING SPECIALTIES

A. Do not leave “dead legs” in piping if possible. No dead leg shall exceed 12 inches long.

B. Install pressure gages with pulsation dampers. Provide ball valve to isolate each gage. Extend nipples and siphons to allow clearance from insulation.

C. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.

D. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

E. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate.

F. Provide drain and hose connection with valve on strainer blow down connection.

G. Test backflow preventers in accordance with ASSE.

3.7 INSTALLATION - PLUMBING SUPPLY PIPING

A. Install water piping in accordance with ASME B31.9.

B. Insulate all domestic hot water (and recirculating) pipes and domestic cold water pipes per specs.

C. Establish elevations of buried piping outside to obtain not less than two (2) ft of cover.

D. Provide support for utility meters in accordance with requirements of utility companies.

E. Slope water piping and arrange to drain at low points.

F. Install piping from relief valves, back-flow preventers and drains to nearest drain.

G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatories, sinks, washing machine outlets, and other fixtures and equipment with quick acting valves.

H. Provide water service complete with approved reduced pressure back-flow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer.

I. Disinfecting of Domestic Water Systems:
   A. New potable water systems shall be purged of deleterious matter and disinfected prior to utilization per IPC 610.

3.8 INSTALLATION - PLUMBING DRAINAGE PIPING

A. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Install with clearance at cleanout for rodding of drainage system.

B. Encase exterior cleanouts in concrete flush with grade.

C. Install floor cleanouts at elevation to accommodate finished floor with no trip hazards.

D. Establish elevations of buried piping outside building to provide not less than 2 ft of cover.

E. Install piping penetrating roofed areas to maintain integrity of roof assembly.

F. Establish invert elevations, slopes for drainage per plumbing plan notes. Maintain gradients.

3.9 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as scheduled.

B. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

C. Place hangers within 12 inches of each horizontal elbow.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

H. Design hangers for pipe movement without disengagement of supported pipe.

I. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.10 SERVICE CONNECTIONS

A. Install sanitary sewer services. Before pricing this work, check invert elevations required for building sewer connections, confirm inverts and verify proper slope for drainage and proper cover to avoid freezing.

3.11 PIPE CLEANING

A. Flush piping with clean water. Where temporary construction strainers are installed, remove and install permanent strainer. Remove and clean or replace other strainer screens.

END OF SECTION

SECTION 15195 – FACILITY FUEL GAS PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fuel gas piping buried within 5 feet of building.
2. Fuel gas piping above grade.
3. Unions and flanges.
4. Valves.
5. Pipe hangers and supports.
6. Strainers.
7. Fuel gas pressure regulators.
8. Fuel gas pressure relief valves.
9. Underground pipe markers.
10. Bedding and cover materials.

B. All general conditions of the contract apply.

C. Related Sections:
1. Section 15010 – Mechanical General
2. Section 15061 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports for placement by this section.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI Z21.15 - Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.

B. American Society of Mechanical Engineers:
1. ASME B16.3 - Malleable Iron Threaded Fittings.
2. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
3. ASME B16.33 - Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psig (sizes 1/2 - 2).
4. ASME B31.9 - Building Services Piping.
5. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

C. ASTM International:
1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
4. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric).
5. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
6. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.

7. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

D. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

E. American Water Works Association:
1. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.

F. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 67 - Butterfly Valves.
3. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
4. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
5. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
6. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

G. National Fire Protection Association:
1. NFPA 54 - National Fuel Gas Code.

H. Underwriters Laboratories Inc.:
1. UL 842 - Valves for Flammable Fluids.

1.3 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.

B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves, equipment.

C. Provide pipe hangers and supports in accordance with ASME B31.9, ASTM F708.

D. Use plug, ball, or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.

1.4 QUALITY ASSURANCE

A. Perform Fuel gas Work in accordance with NFPA 54, local gas company requirements

B. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

1.5 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 FUEL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASTM A234/A234M forged steel welding type.
   2. Joints: ASME B31.9, welded.
   3. Jacket: AWWA C105 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2.2 FUEL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M forged steel welding type.
   2. Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

B. Corrugated Stainless Steel Tubing: ANSI LC 1.

2.3 REGULATOR VENT PIPING, ABOVE GRADE

A. Indoors and outdoors: Same as Fuel gas piping, above grade.

2.4 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
   1. Ferrous Piping: Class 150, malleable iron, threaded.
   2. Copper Piping: Class 150, bronze unions with [soldered] [brazed joints].
   3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Flanges for Pipe 2-1/2 inches and Larger:
   1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
   2. Copper Piping: Class 150, slip-on bronze flanges.
   3. Gaskets: 1/16 inch thick preformed neoprene gaskets.

2.5 BALL VALVES

A. Acceptable Manufacturers: Crane Valve, Hammond Valve, Milwaukee Valve, NIBCO, Stockham Valves & Fittings.

B. 1/4 inch to 1 inch: MSS SP 110, Class 125, two piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids and LPG, full port.

C. 1-1/4 inch to 3 inch: MSS SP 110, Class 125, two piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids and LPG, conventional port.

2.6 PLUG VALVES

A. Acceptable Manufacturers: DeZURIK, Unit of SPX Corp., Flow Control Equipment, Inc., Homestead Valve.

B. 2 inches and Smaller: MSS SP 78, Class 150 construction, round port, full pipe area, pressure lubricated, teflon packing, threaded ends. Furnish one plug valve wrench for every ten plug-valves with minimum of one wrench.

C. 2-1/2 inches and Larger: MSS SP 78, Class 150 construction, round port, full pipe area, pressure lubricated, teflon packing, flanged ends.

2.7 BUTTERFLY VALVES

A. Acceptable Manufacturers: Crane Valve, Hammond Valve, Milwaukee Valve, NIBCO, Stockham Valves & Fittings.

B. 2 inches and Smaller: MSS SP 67, 175 psi, bronze body, Viton seals, stainless steel trim, lever or tee handle UL 842 listed for gas service, threaded ends, full port.

2.8 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
1. Carpenter & Paterson, Creative Systems Inc., Flex-Weld, Inc., Glope Pipe Hanger, Michigan Hanger Co., Superior Valve Co.,Cooper B-Line

B. Conform to NFPA 54, ASME 31.9.

C. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or carbon steel adjustable swivel, split ring.

D. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.

E. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

F. Wall Support for Pipe 3 inches and Smaller: Cast iron hook.

G. Vertical Support: Steel riser clamp.

H. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

I. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

J. Sheet Lead: ASTM B749, 2.5 lb/sq ft, 0.039 inch thick.

2.9 STRAINERS

A. Acceptable Manufacturers:
1. Mueller Steam Specialty, O.C. Keckley Co., Spirax Sarco

B. 2 inch and Smaller: Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

C. 2-1/2 inch to 4 inch: Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

D. 5 inch and Larger: Flanged iron body for 175 psig working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

2.10 FUEL GAS PRESSURE REGULATORS

A. Product Description: Spring loaded, general purpose, self-operating service regulator including internal relief type diaphragm assembly and vent valve. Diaphragm case can be rotated 360 degrees in relation to body.
   1. Comply with ANSI Z21.80.
   2. Temperatures: minus 20 degrees F to 150 degrees F.
   3. Body: Cast iron or Steel.
   4. Spring case, lower diaphragm casing, union ring, seat ring and disk holder: Aluminum.
   5. Disk, diaphragm, and O-ring: Nitrile.
   6. Maximum inlet pressure: 150 psig.
   7. Furnish sizes 2 inches and smaller with threaded ends. Furnish sizes 2-1/2 inches and larger with flanged ends.

2.11 FUEL GAS PRESSURE RELIEF VALVES

A. Product Description: Spring loaded type relief valve.
   1. Body: Aluminum.
   2. Diaphragm: Nitrile.
   3. Orifice: Aluminum, brass, or stainless steel.
   4. Maximum operating temperature: 150 degrees F.
   5. Inlet Connections: Threaded.
   6. Outlet or Vent Connection: Same size as inlet connection.

2.12 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

B. Trace Wire (for non-metallic pipe): Magnetic detectable conductor, brightly colored plastic covering, imprinted with “Fuel gas Service" in large letters.

2.13 BEDDING AND COVER MATERIALS

A. Site specifications override this section as applicable.

B. Excavation: Excavate trenches by open cut. Pavement removal and replacement required by the excavation of trenches shall be done in accordance with the requirements of section 02150, Removing and Replacing Pavement. Perform all excavation in accordance with the latest accepted Occupational Safety and Health Act of 1970 as amended. The Developer shall pay particular attention to Safety & Health Regulations Part 1926, subpart P “Excavations, Trenching & Shoring.”

C. Bedding:
   1. General: Compact stone bedding material by tamping or slicing with a flatblade shovel. Prepare the trench bottom to support the pipe uniformly throughout its length. Provide bell holes to relieve pipe bells of all loads. If the trench is excavated to excessive width or depth, provide the next better class of bedding.
   2. Materials: Bedding materials shall be crushed stone unless shown or specified otherwise. Crushed stone bedding material shall meet the requirements of Georgia Department of Transportation Specification 800.01 for No. 57 stone, Group II (quartzite granite).
   3. Bedding: Excavate the bottom of the trench flat at a minimum 36" depth or as shown on the Site Plans below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Bedding shall then be carefully placed by hand and compacted to provide full support under and up to the crown of the pipe.

D. Cover and Backfill: Place initial backfill material carefully around the pipe above bedding in uniform six (6) inch layers to a depth of at least eighteen (18) inches above the pipe bell. Compact each layer thoroughly with suitable hand tools. Do not disturb or damage the pipe. Backfill on both sides of the pipe simultaneously to prevent side pressures. Initial backfill material shall be clean and free of rock, stumps, limbs or other unsuitable material.

PART 3 EXECUTION

3.1 EXAMINATION

A. 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION - INSERTS

A. Provide inserts for placement in concrete forms.

B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install hangers and supports in accordance with ASME B31.9, ASTM F708.

B. Support horizontal piping hangers as scheduled.

C. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Install hangers to allow 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

F. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

G. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.

H. Finish paint exposed steel hangers and supports to match ceiling or wall color. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

J. Install pipe hangers and supports in accordance with Section 15061.

3.5 INSTALLATION - BURIED PIPING SYSTEMS

A. Site specifications override this section as applicable.

B. Install Fuel gas piping in accordance with NFPA 54.

C. Verify connection to existing piping system size, location, and invert are as indicated on Drawings.

D. Establish elevations of buried piping with not less than 2 ft of cover.

E. Establish minimum separation from other services piping in accordance with local codes.

F. Remove scale and dirt on inside of piping before assembly.

G. Excavate pipe trench in accordance with Site Plans or methods utilized by the local AHJ.

H. Install pipe to elevation as indicated on Drawings.

I. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density.

J. Install pipe on prepared bedding.

K. Route pipe in straight line.

L. Install pipe to allow for expansion and contraction without stressing pipe or joints.

M. Install plastic ribbon tape or trace wire continuous over top of pipe.

N. Pipe Cover and Backfilling:
1. Backfill trench in accordance with Site Plans or methods utilized by the local AHJ.
2. Maintain optimum moisture content of fill material to attain required compaction density.
3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inch compacted layers to 12 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
5. Do not use wheeled or tracked vehicles for tamping.

3.6 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. Install Fuel gas piping in accordance with NFPA 54.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient.

D. Where required, bend pipe with pipe bending tools in accordance with procedures intended for that purpose.

E. Install piping to conserve building space and not interfere with use of space.

F. Size and install gas piping to provide sufficient gas to supply maximum appliance demand at pressure higher than appliance minimum inlet pressure.

G. Group piping whenever practical at common elevations.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

I. Sleeve pipe passing through partitions, walls and floors. Refer to Section 15061.

J. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping.

K. Provide clearance for installation of insulation and access to valves and fittings.

L. Provide access where valves and fittings are not exposed.

M. Where pipe support members are welded to structural building framing, scrape, brush clean, weld, and apply one coat of zinc rich primer.

N. Provide support for utility meters in accordance with requirements of utility company.

O. Install vent piping from gas pressure reducing valves to outdoors and terminate in weatherproof hood. Protect vent against entry of insects and foreign material.
1. Minimum Vent Size: Connection size at regulator vent connection.
2. Run individual vent line from each relief device, independent of breather vents.

P. Breather vents may be manifolded together with piping sized for combined appliance vent requirements.

Q. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting.

R. Install identification on piping systems including underground piping.

S. Install valves with stems upright or horizontal, not inverted.

T. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

U. Install gas pressure regulator with independent vent full size opening on regulator and terminate outdoors.

V. Provide new gas service complete with gas meter and regulators. Gas service distribution piping to have initial minimum pressure of 2 psi, 5 psi, or as indicated on plans. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

3.7 FIELD QUALITY CONTROL

A. Where gas appliance will be damaged by test pressure, disconnect appliance and cap piping during pressure test. Reconnect appliance after pressure test and leak test connection.

B. Where gas appliance is designed for operating pressures equal to or greater than piping test pressure, provide gas valve to isolate appliance or equipment from gas test pressure.

C. Pressure test Fuel gas piping in accordance with NFPA 54.

D. Where new branch piping is extended from existing system, pressure test new branch piping only. Leak test joint between new and existing piping with noncorrosive leak detection fluid or other approved method.

E. When pressure tests do not meet specified requirements, remove defective work, replace and retest.

F. Immediately after gas is applied to a new system, or a system has been restored after gas service interruption, check pipe for leakage.
1. Where leakage is detected, shut off gas supply until necessary repairs are complete.

3.8 SCHEDULES

A. Pipe Hanger Spacing:

PIPE SIZE Inches	COPPER TUBING MAXIMUM HANGER SPACING Feet	STEEL PIPE MAXIMUM HANGER SPACING Feet	COPPER TUBING MINIMUM HANGER ROD DIAMETER Inches	STEEL PIPE MINIMUM HANGER ROD DIAMETER Inches
1/2	4	6	3/8	3/8
3/4	6	7	3/8	3/8
1	6	7	3/8	3/8
1-1/4	8	7	3/8	3/8
1-1/2	8	9	3/8	3/8
2	8	10	3/8	3/8
2-1/2	8	10	1/2	1/2
3	8	10	1/2	1/2
4	8	10	1/2	5/8
5	8	10	1/2	5/8
6	8	10	5/8	3/4
8	8	10	3/4	3/4

END OF SECTION 15195

SECTION 15410 - PLUMBING FIXTURES

PART 1 GENERAL

1.1 GENERAL

A. Section 15010 is applicable.

PART 2 PRODUCTS

2.1 BASIS OF DESIGN

A. Fixture and accessory brands and model numbers shown below are intended to establish minimum acceptable quality. Models deemed by the engineer to be of inferior quality as compared to the Basis of Design will not be accepted. Equivalent fixtures and accessories by the manufacturers noted below are acceptable unless noted otherwise.
   1. Fixtures: Kohler, Zurn, American Standard
   2. Flush Valves: Sloan, Zurn, Kohler
   3. Sinks: Zurn, Just, Moen, Kohler, Advance Tabco, Elkay
   4. Faucets: Zurn, Just, Moen, Delta, Kohler, Symmons
   5. Shower Valves: Symmons, Delta, Moen
   6. Supplies: Brasscraft, McGuire, ProFlo
   7. Water Closet Seats: Kohler, Zurn, American Standard, Bemis
   8. Drinking Fountains: Elkay, Kohler, Oasis
   9. Fixture Carriers: J.R. Smith, Zurn, Josam
   10. Drainage Products: Watts, J.R. Smith, Josam, Woodford, Sioux Chief

B. Fixtures: See schedules on plans for basis of design.

PART 3 EXECUTION

3.1 INSTALLATION

A. Verify adjacent construction is ready to receive rough-in work of this section. Review final millwork shop drawings before ordering fixtures. Confirm location and size of fixtures and openings before rough in and installation.

B. All fixtures shall be installed straight, level, and plumb. When three or more of the same fixture are installed adjacent to each other, use equal spacing between fixtures.

C. All fixtures and equipment shall be installed with all accessories required for a complete and fully functional installation, regardless of whether all equipment and accessories are listed on the plans or in the specifications.

D. All vitreous china fixtures shall be bright white in color unless otherwise noted. Faucets shall be polished chrome unless otherwise noted. If these colors are unavailable, contact Engineer for approved alternatives.

E. Install each fixture with chrome plated rigid or flexible supplies with screwdriver stops, reducers, and escutcheons. All water and drain piping exposed to view shall be chrome plated. Piping underneath counters with closing doors need not be chrome plated.

F. All handicapped fixtures shall be installed according to ADA and local code requirements. All handicapped sink drains and supplies shall be covered.

G. All floors where floor drains are installed shall slope to drain, minimum 1/16" per foot. This contractor shall coordinate with the applicable trades to ensure that the proper slope is achieved.

H. Water closets shall be installed with flush handles away from room corners.

I. All pressure operated fixtures and equipment shall be furnished with water stops. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

J. All fixtures shall have a delivered water temperature limit of 110 degrees F. This may be accomplished with a tempering valve at each device, through a central tempering valve, or by setting water heater thermostats to maintain delivered temperature below 110 F. See plans for location of tempering valves.

END OF SECTION

SECTION 15700 – HVAC INSULATION

PART 1 GENERAL

1.1 GENERAL

A. Section 15010 applies.

PART 2 PRODUCTS

2.1 BASIS OF DESIGN

A. Manufacturers shown below as Basis of Design
1. Acceptable Manufacturers for Glass Fiber and Mineral Fiber Insulation Products: CertainTeed, Knauf, Johns Manville, Owens-Corning.
2. Acceptable Manufacturers for Closed Cell Elastomeric Insulation Products: Aeroflex Aerocell, Armacell Armaflex, Nomaco K-flex.

2.2 DUCT INSULATION

A. Supply, Return, Exhaust, and Outdoor Ventilation Ducts
1. Duct liner: NO DUCT LINER IS ALLOWED IN PROJECT. ALL INSULATION SHALL BE EXTERNAL
2. Externally insulated: Formaldehyde-free, flexible glass fiber blanket. Insulation shall have a minimum installed R-value of R-8 and have a Type 75 facing. Insulation shall be provided with a factory-applied facing with a composite UL HFC rating of 25/50. Basis of Design: Johns-Manville Microlite XG Formaldehyde-free Fiber Glass Duct Wrap. Foil faced Rigid board fiberglass insulation of equal R-value may be used for externally insulated duct exposed to the weather.
3. The new exterior return duct running from RTU-3 to the building side wall shall be completely insulated on the outside. The insulation exterior surface of that return duct shall be completely wrapped with weatherproof duct wrap VENTURECLAD 1577CW as manufactured by Venturetape. Approved equal may be used.
4. Where new roof top units connect to existing-exterior supply or return ducts that are internally lined then any new duct transition sections connecting the new roof top unit to the existing duct shall be internally lined.
5. Where new roof top units connect to existing-exterior supply or return ducts that are externally insulated then any new duct transition sections connecting the new roof top unit to the existing duct shall be externally insulated and the insulation shall be covered completely with weatherproof duct wrap VENTURECLAD 1577CW as manufactured by Venturetape.
6. Exhaust ducts shall be insulated within 10 feet of exterior openings.

2.3 PIPE INSULATION

A. Condensate Piping
1. ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
2. Thermal Conductivity: 0.27 at 75 degrees F.
3. Operating Temperature Range: Range: Minus 70 to 180 degrees F.
4. Thickness: 1/2” thickness for all pipe sizes.

B. Refrigerant Piping

1. Suction piping shall be insulated with Johns-Manville Aerotube II pipe insulation slid over tubing without cutting, min. R-3. All joints and seams shall be sealed with adhesive.

PART 3 EXECUTION

3.1 INSTALLATION – DUCT SYSTEMS

A. Verify all surfaces are clean and dry before applying insulation.
B. Butt joints of insulation together to obtain total coverage. Do not compress the insulation. Tape all joints.
C. Mechanical fasteners: weld or adhesive applied pins shall be used to secure insulation to bottom of ducts 20” wide or wider. Install 18” on centers, both directions.
D. Place holding washers over weld pins firmly, do not compress insulation, clip of excessive length of pin, cover with 4” length of tape.
E. Where 2” flaps are provided, use adhesive to obtain full 2” coverage in lieu of tape.
F. Repair breaks, holes, and perforations to full thickness flush with adjoining surface, with new sections if large, with tape on small areas so that 2” of tape or replacement foil-kraft project away from the imperfection.
G. Insulation on round ducts may be wired in place with soft monel wire, 12” O.C., with joints taped and vapor sealed.
H. Cover flexible equipment connections on air conditioning units with specified supply/return duct insulation. Lap connection 6” and secure 2” edge flap with adhesive.
I. Taper insulation on top of exterior ducts to prevent water ponding.

3.2 INSTALLATION – PIPING SYSTEMS

A. Verify piping has been tested before applying insulation materials. Verify surfaces are clean and dry, with foreign material removed. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.
B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions.
C. Piping Systems Conveying Fluids Below Ambient Temperature:
    1. Insulate entire piping system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
    2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
    3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.
D. Inserts and Shields:
    1. Piping 1-1/2 inches Diameter and Smaller: Install steel shield between pipe hanger and insulation.
    2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
        a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
        b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
    3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.
E. Condensate Piping: Insulate entire piping system and components inside the building space to prevent condensation.

F. Closed Cell Elastomeric Insulation:
   1. Push insulation on to piping, miter joints at elbows.
   2. Seal seams and butt joints with manufacturer's recommended adhesive.
   3. When application requires multiple layers, apply with joints staggered.
   4. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

G. Refrigeration suction piping shall be insulated through pipe clamps and hangers, provide insulation shields when insulation passes through clamps and hangers.

H. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket and fitting covers. Labels on exterior covers should be oriented so as to be easily readable and shall have directional flow arrows.

I. Buried Piping: Insulate only where insulation manufacturer recommends insulation product may be installed in trench, tunnel or direct buried. Install factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1 mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.

END OF SECTION 15700

SECTION 15730 – UNITARY HVAC EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section 15010 applies.

B. Section Includes:
   1. Split system gas furnaces

1.2 QUALITY ASSURANCE

A. Split System Gas Furnace Units:
   1. Cooling Capacity: Rate in accordance with ARI standards.
   2. Sound Rating: Measure in accordance with ARI 270.
   3. Performance Requirements: Conform to minimum EER prescribed by ASHRAE 90.1 when tested in accordance with ARI standards.

B. Perform Work in accordance with state and local Building Inspection Department, and customer's standards.

PART 2 PRODUCTS

2.1 BASIS OF DESIGN

A. Manufacturers shown below as Basis of Design
   1. Acceptable Manufacturers: Split gas furnace system: Carrier, or approved equal. Must be approved prior to submittals
   2. Acceptable Manufacturers: Mini-split systems: Carrier, or approved equal. Must be approved prior to submittals

2.2 SPLIT SYSTEM GAS FURNACE UNITS – 95% CONDENSING FURNACES

A. Equipment is scheduled on the drawings.

B. General: Factory assembled and tested air cooled condensing units and heat pumps, consisting of casing, compressors, condensers, coils, condenser fans and motors, and unit controls.

C. Unit Casings: Exposed casing surfaces constructed of galvanized steel with manufacturer's standard baked enamel finish. Designed for outdoor installation and complete with weather protection for components and controls, and complete with removable panels for required access to compressors, controls, condenser fans, motors, and drives.

D. Compressor: Single and dual refrigeration circuits (per plans) with compressors, resiliently mounted, with positive lubrication, and internal motor overload protection.

E. Condenser Coil: Constructed of copper tubing mechanically bonded to aluminum fins, factory leak and pressure tested.

F. Furnish operating and safety controls including high and low pressure cutouts. Control transformer. Furnish magnetic contactors for compressor and condenser fan motors.

G. Condenser Fans and Drives: Direct drive propeller fans statically and dynamically balanced. Wired to operate with compressor. Permanently lubricated ball bearing type motors with built-in thermal overload protection. Furnish high efficiency fan motors.

H. Condensing Unit Accessories:
   1. Controls to provide low ambient cooling, time delay relay, anti-short cycle timer, vibration isolators on all equipment supported by structure or upper floor slabs, condenser coil guard, suction and discharge pressure gauge connections.

I. Refrigeration specialties: Furnish the following for each circuit:
   1. Charge of compressor oil, Holding charge of refrigerant, Replaceable core type filter drier, liquid line sight glass and moisture indicator, shut-off valves on suction and liquid piping, liquid line solenoid valve, charging valve, oil level sight glass, crankcase heater, hot gas muffler, pressure relief device, P-traps (as needed).

J. Refrigerant: Furnish full charge of refrigerant R-410A.

K. Electrical characteristics: see Div. 16.

L. Fan Coil Configuration: As indicated on Drawings.

M. Fan Coil Cabinet:
   1. Panels: Constructed of galvanized steel with baked enamel finish. Access Panels: Located on both sides of unit. Furnish with duct collars on inlets and outlets.
   2. Insulation: Factory applied to each surface to insulate entire cabinet. One inch thick aluminum foil faced glass fiber with edges protected from erosion.

N. Evaporator Fan: Forward curved centrifugal type, resiliently mounted with adjustable belt drive (for belt drive units) and high efficiency motor. Motor permanently lubricated with built-in thermal overload protection.

O. Evaporator Coil: Constructed of copper tubes expanded onto aluminum fins. Factory leak tested under water. Removable, PVC construction, double-sloped drain pan with piping connections on both sides.

P. Refrigeration System: Single and dual refrigeration circuits, as per plans, controlled by factory installed thermal expansion valve.

Q. Air Filters: 1 inch thick glass fiber disposable media in metal frames. 30 to 35 percent efficiency based on ASHRAE 52.1.

R. Furnace Unit Accessories:
   1. Discharge Plenum: with construction and finish matching unit casing.
   2. Mounting Sub-base with construction and finish matching unit casing.
   3. Vibration Isolators: Neoprene-in-shear type.
   4. Condensate Neutralization kit
   5. Flue/Combustion air piping kit

2.3 MINI-SPLIT SYSTEM HEAT PUMPS

A. Equipment is scheduled on the drawings.

B. Air cooled split system outdoor section shall be suitable for ground or rooftop installation. Unit shall consist of a hermitic reciprocating scroll or rotary compressor, an air cooled coil, propeller type blow thru outdoor fans, reversing valve, accumulator, refrigerant charge, heating mode metering device, and control box. Unit shall discharge air horizontally. Unit construction shall comply with ANSI/ASHRAE

15 and NEC. Units shall be constructed in accordance with U.L standards. Air cooled condenser coils shall be leak tested at 350 psig air pressure. Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a baked enamel finish. Outdoor fans shall be direct drive propeller type, and shall discharge air horizontally. Outdoor fan motors shall be totally enclosed, single phase motors with Class B insulation and permanently lubricated sleeve bearings, and shall be protected by internal thermal overload protection. Fan blades shall be corrosion-resistant and shall be statically and dynamically balanced. Outdoor fan openings shall be equipped with PVC coated protection grille over fan and coil. Compressor shall be equipped with oil system, operating oil charge, and motor. Internal overloads shall protect the compressor from over-temperature and over-current. Scroll compressors shall also have high discharge gas temperature protection if required. Reciprocating compressors shall be equipped with crankcase heaters. Compressor assembly shall be installed on rubber vibration isolators and shall have internal spring isolation. Coil shall be constructed of aluminum fins mechanically bonded to internally enhanced, seamless copper tubes. Refrigerant circuit components shall include brass external liquid line service valve with service gage port connections, suction line service valve with service gage connection port service gage port connections on compressor suction and discharge lines with Schrader type fittings with brass caps, accumulator, bi-fold filter drier, and pressure relief.

C. Outdoor unit operating controls and safeties shall be factory selected, assembled, and tested. The minimum control functions shall include time delay restart, automatic restart on power failure, safety lockout, a time delay control sequence, high pressure and liquid line low pressure switches, and start capacitor and relay on single phase units without scroll compressors. Safeties shall include: System diagnostics, compressor motor current and temperature overload protection, high pressure relief and outdoor fan failure protection. Unit electrical power shall be single point connection. Unit shall have high and low voltage terminal block connections. Liquid solenoid valve shall be included on heat pumps where required for excessive heights where recommended by manufacturer.

D. Indoor direct expansion fan coil units shall be complete with cooling/heating coil, fan, fan motor, piping connectors, electrical controls, microprocessor control system, and integral wall mounting bracket, mounting hardware, and thermistor interconnection cable. The unit shall be matched with outdoor unit as scheduled on drawings. Cabinet discharge and inlet grilles shall be attractively styled, high impact polystyrene. Cabinet shall be fully insulated for improved thermal and acoustic performance. Fans shall be tangential direct drive blower type with air intake and discharge. Vertical and horizontal air sweep shall be provided. Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion. A drip pan under the coil shall have a drain connection. Condensate pan shall have internal trap and auxiliary drip pan under coil header. The units shall use Accurater piston refrigerant metering device in the indoor unit and outdoor unit liquid line service valve. Unit shall have filter track with factory supplied cleanable filters. Motors shall be open drip proof, permanently lubricated ball bearing with inherent overload protection. Fan motors shall be 3-speed. Controls shall consist of a microprocessor based control system which shall control space temperature, determine optimum fan speed, and run self diagnostics. Controls shall include a minimum of the following features: an automatic restart, timer function, temperature sensing controls, high discharge temperature shutdown, fan speed control, time delay to prevent compressor restart in less than 3 minutes, automatic heating to cooling changeover and demand defrost. Indoor coil high temperature protection shall be provided to detect excessive indoor discharge temperature when unit is in heat pump mode. All units shall have rotatable refrigerant lines for penetration through the wall using flare connections. All units shall have flare connections and line-hide devices. Units shall be provided with a condensate pump as scheduled on the drawings.

E. Control or safety devices furnished for field installation shall be installed and wired under Section 15900.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install Work in accordance with state and local Building Inspection Department's standards.

B. Do not place units on roof before roof curbs are installed.

C. Install roof mounted units on roof curb providing watertight enclosure to protect ductwork and utility services. Install roof curb level.

D. Install components furnished loose for field mounting.

E. Install remote panels and control wiring between remote control locations and unit. Install in accordance with Section 15900.

F. Install electrical devices downstream of contactors furnished loose for field mounting. Division 16 contractor is responsible for providing remote disconnects for all mechanical equipment under this contract. Division 16 contractor is responsible for providing and installing power wiring to terminals on all mechanical equipment.

G. Install flexible connections at supply and return ductwork connections.

H. Install condensate drain piping from drain pan to nearest floor drain or to condensate drainage system provided.

I. Furnish units fully charged with refrigerant and filled with oil.

J. Furnish initial start-up and shutdown during first year of operation, including routine servicing and checkout.

END OF SECTION 15730

SECTION 15750 – Major HVAC Equipment

PART 1 GENERAL

1.1 GENERAL

A. Section 15010 applies.

1.2 BASIS OF DESIGN

A. Acceptable manufacturers for products specified under this section are listed below.
   1. Exhaust Fans: Greenheck, Cook, Broan, Penn

PART 2 PRODUCTS

2.1 EXHAUST FANS (EF)

A. General
   1. Fans are scheduled on the drawings.
   2. All fans shall bear the AMCA Certified Performance Rating seal and UL label. Sone ratings shall be in accordance with AMCA Bulletin 300. Fans shall have published ratings certified by AMCA Standard 210 and Class established by AMCA 2408-69. Fan BHP and RPM shall be selected to produce specified capacity when installed in system with accessories as indicated. Fan wheels shall be statically and dynamically balanced.
   3. Belt drive fan motors shall have bases which permit adjustment of belt tension, belt guards with tachometer hole for fan shaft, and variable pitch diameter sheaves.
   4. Bearings for fan shafts, other than propeller type, shall have an average service life of 100,000 hours. Bearings shall be factory lubricated and shall have grease fittings for lubrication as recommended by bearing manufacturer. Grease lines shall extended to outside of casing where fittings are inaccessible during fan run time.
   5. Solid state speed controllers for direct drive fans shall be provided and wired under Division 15 for initial balancing of fan air quantity.
   6. Motors shall be provided as specified in Section 15010 and shall be readily accessible. Motors 1 hp and larger shall be premium efficiency type.

B. Ceiling/Cabinet Type
   1. Housing shall be reinforced phosphatized steel. Wheels shall be true centrifugal, forward curved in design, and shall be statically and dynamically balanced.
   2. Where grilles are required, they shall be aluminum with white baked enamel symmetrically finished appearance. Interior of housings shall be lined with dark acoustical insulation permanently attached in place. Interior of installed unit shall not be visible when grille is installed.
   3. Motors shall be shaded pole type with sleeve bearings supported by one piece die formed steel suspension brackets with rubber isolation dampers.
   4. Terminal box shall be mounted in the housing with receptacle, plug and cord inside of the cabinet. All motors shall be suitably grounded. Motor and fan assembly shall be removable from installed ceiling ventilator.
   5. Where duct flanges are required on one or both ends of the fan, they shall be pre-assembled to housings.
   6. Backdraft dampers shall be of integral design with aluminum damper on steel spring and foam rubber seal to eliminate chatter.

7. A speed controller on direct drive fans shall be shall be mounted at the fan and factory wired or field wired under Division 15 between the fan and fan energizer.

2.2 WALL MOUNT PROPELLER FANS (WEF)

A. General Description:
1. Fan arrangement shall be either supply or exhaust, see plans.
2. Sidewall mounted application.
3. Maximum continuous operating temperature 130 Fahrenheit (54.4 Celsius)
4. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number

B. Wheel:
1. Material type: steel blades and hubs.
2. Securely attached to fan shaft by welding or with standard square key and set screw or tapered bushing.
3. Statically and dynamically balanced in accordance with AMCA Standard 204-05.
4. The propeller and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency.

C. Motors:
1. Motor enclosures: Totally enclosed fan cooled.
2. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and furnished at the specific voltage and phase.
3. Accessible for maintenance.

D. Shafts and Bearings:
1. Fan Shaft shall be ground and polished solid steel with an anti-corrosive coating
2. Bearing shall be cast iron pillow block with grease fittings
3. Bearings shall be selected for a minimum L10 life in excess of 100,00 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed
4. Bearing shall be air handling quality and 100% factory tested by bearing manufacturer
5. Fan Shaft first critical speed is at least 25 percent over maximum operating speed

E. Drive Frame:
1. Drive frame assemblies shall be galvanized steel, and bolted construction
2. Drive frame shall have formed channels and fan panels shall have prepunched mounting holes, formed flanges and a deep formed one piece inlet venturi

F. Disconnect Switches:
1. NEMA rated: 3R
2. Positive electrical shut-off
3. Wired from fan motor to junction box

G. Drive Assembly:
1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower
2. Belt: Static free and oil resistant
3. Fully machined cast iron pulley, keyed and securely attached to the wheel and motor shafts
4. The motor pulley shall be adjustable for final system balancing
5. Readily accessible for maintenance

H. Options/Accessories:
1. Dampers:
   a. Type: Gravity
   b. Prevents outside air from entering back into the building when fan is off

c. Balanced for minimal resistance to flow
d. Galvanized frames with prepunched mounting holes

2. Finishes:
   a. Types: Primer
3. Wall Housing:
   a. Constructed of galvanized steel with heavy gauge mounting flanges and pre-punched mounting holes
   b. Housing shall include OSHA approved motor guard
   c. Reduces installation time and provides maximum installation flexibility
4. Motor Side Guard:
   a. Guard type: OSHA Guard
   b. Protective guard completely enclose the motor and drive side of the fan
5. Weatherhood:
   a. Shall shield wall opening and dampers from rain and snow
   b. Material type: Galvanized
   c. Turndown Angle: 90 degrees
   d. Screen: Birdscreen
   e. Finish: Primer

PART 3 EXECUTION

3.1 INSTALLATION

A. Field coordinate power requirements with Division 16 contractor before ordering any equipment.

B. Do not place equipment on roof before roof curbs are installed. All roof-mounted equipment shall be mounted on curbs. Install roof mounted units on roof curb providing watertight enclosure to protect ductwork and utility services. Install roof curb and equipment level.

C. Install components furnished loose for field mounting.

D. Install electrical devices downstream of contactors furnished loose for field mounting. Division 16 contractor is responsible for providing remote disconnects for all mechanical equipment under this contract. Division 16 contractor is responsible for providing and installing power wiring to terminals on all mechanical equipment.

E. Furnish initial start-up and shutdown during first year of operation, including routine servicing and checkout.

END OF SECTION 15750

SECTION 15850 – AIR DISTRIBUTION

PART 1 GENERAL

1.1 GENERAL

A. Section 15010 is applicable.

1.2 BASIS OF DESIGN

A. Acceptable manufacturers for products specified under this section are listed below.
   1. Flexible duct: Thermaflex, Flexmaster, Clecon
   2. Flexible equipment connections: Durodyne, Ventafabrics
   3. Volume control dampers: Ruskin, Greenheck, Nailor, United, Price
   4. Fire/Smoke dampers: Ruskin, Greenheck, Nailor, United
   5. Air diffusers and grilles: Price, Titus, Nailor, Metalaire

1.3 PRESSURE

A. All new supply, return, outdoor air, and exhaust air ducts are to be STD, 1" static pressure type, class "A" seal, ASHRAE/SMACNA.

PART 2 PRODUCTS

2.1 METAL DUCTWORK

A. Duct work shall be rectangular, oval, or round as shown on plans, and shall be fabricated from ASTM A653/A653M galvanized steel sheet, lock-forming quality. All fasteners shall be galvanized steel.

B. Fabricate and support rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Fabricate and support round ducts with longitudinal seams in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible (Round Duct Construction Standards). Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
   1. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.
   2. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
   3. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
   4. Provide standard 45-degree branch takeoffs per plans. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.
   5. Seal ducts to ASHRAE/SMACNA Class A standard. No cloth duct tape will be allowed.

2.2 FLEXIBLE DUCTWORK

A. Flex ducts connections are for connecting round galvanized duct to air distribution devices. Maximum allowed length of any flex duct section shall be 5'-0". Flex duct shall be two ply vinyl film supported by helical wound spring steel wire; fiberglass insulation; vapor barrier film. Minimum R-8, max velocity 4000 fpm, pressure rating 10 iwg positive and 1 iwg negative. Temperature rating -20 degrees F to 200 degrees F.
Basis of design is Thermaflex MK-E.

2.3 FLEXIBLE EQUIPMENT CONNECTIONS

A. Flexible connections shall be used for all duct connections to HVAC equipment and fans. Flexible connections shall be per SMACNA chapter 7, Figure 7-7 and 7-8. Flexible material for indoor installation shall be airtight heavy glass fabric, double coated with neoprene.

2.4 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

B. Fabricate splitter dampers of material matching duct gage to 24 inches size in each direction, and two gages heavier for larger sizes. Secure with continuous hinge or rod. Operate with minimum 1/4 inch diameter rod.

C. Fabricate single blade dampers for duct sizes to 12 x 30 inch. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

D. Furnish locking, indicating quadrant regulators on single and multi-blade dampers with 2" standoff brackets. Where width exceeds 30 inches, furnish regulator at both ends.

2.5 FIRE DAMPERS

A. Damper shall be UL 555 listed and labeled as a 1-1/2 hour static fire damper. UL approved for dual directional air flow. Integral Sleeve Frame: Minimum 20 gage by 12 inches roll formed, galvanized steel. Apply factory sealant to dampers in HVAC systems with pressures to maximum 4 inches wg. Mill galvanized finish.
   1. Blades:
      a. Style: Curtain type, out of airstream.
      b. Action: Spring or gravity closure upon fusible link release.
      c. Orientation: Horizontal or vertical as indicated on plans.
      d. Material: Minimum 24 gage roll formed galvanized steel.
   2. Closure Springs: Type 301 stainless steel, constant force type, if required.
   3. Temperature Release Device: fusible link, 165 degrees F.

B. Type "B" fire dampers shall have no less than 90% free area, shall have 160 degree F fusible link, and integral 12" long 20 gauge integral sleeve and preformed picture frame mounting angles. Basis of design is Ruskin IBD2 Style B.

C. For applications where damper is in wall without interconnecting duct, or where noted as such, damper frame shall be size shown on drawing and shall be type A.

D. For applications where damper is in wall with a grille on both sides or on one side, use thin line type A damper, Ruskin IBDT or approved manufacturer listed above.

E. Provide hinged, insulated access panels with part turn latches in ductwork to all fire dampers where access is not otherwise possible. Duct access panels shall be insulated and stenciled “F.D.” with 2” high black letters on light surfaces, light letters on dark surfaces.

F. Picture Frame Mounting Angles:
1. One-piece, roll formed retaining angles 1-1/2 x 1-1/2 inches.
2. Factory matched and shipped attached to damper.

2.6 TURNING DEVICES AND EXTRACTORS

A. Multi-blade device with blades aligned in short dimension; steel or aluminum construction; with individually adjustable blades, mounting straps.

B. Multi-blade device with radius blades attached to pivoting frame and bracket, steel or aluminum construction, with push-pull operator strap.

2.7 INSPECTION PANELS

A. Inspection panels shall be installed in plenums and ductwork in order to facilitate inspection of filters, fans, dampers, and coils. Panels into spaces large enough for a person to enter shall be 24”x24” minimum. Panels into smaller spaces shall be 12”x12” minimum. Panels in insulated metal duct shall be 22 gauge galvanized frame with 24 gauge galvanized steel door panel and shall be gasketed, double wall insulated with 1” fiberglass insulation. Panels shall be piano hinged on one side with galvanized cam lock on the other. Inspection panels with sheet metal screw fasteners are not acceptable.

2.8 AIR OUTLETS AND INLETS

A. Air diffusers and grilles are scheduled on the plans. No on-board dampers shall be allowed for ceiling mounted diffusers and grilles. Dampers should be purchased and installed separately at the point of each branch take-off from trunk ducts.

2.9 FILTERS

A. Normal operating filters for all systems shall be disposable pleated media type filter of a size standard for the unit(s) installed.

B. Construction phase filters shall be dry fiberglass media, double wall box panel type, of a size standard for the unit(s) installed. Only construction phase filters shall be used during construction, and normal operating filters shall be installed by contractor after final punch-out. Construction phase filters shall be checked regularly as the project progresses and changed as needed. Units shall not be run without filters.

C. For projects with DDC systems, dirty filter switches shall be installed on equipment filters to indicate, through the DDC, when these filters are dirty.

2.10 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical characteristics of powered equipment are shown on the Div. 16 plans.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify sizes of equipment connections before fabricating transitions.

B. Verify rated walls are ready for fire damper installation.

C. Verify ducts and equipment are ready for installation and accessories.

D. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.2 FIRE DAMPERS

A. Install fire dampers at locations shown on drawings. Installation of fire dampers shall comply with SMACNA Fire, Smoke, and Radiation Damper Installation Guide for HVAC systems.

1.	Basic installation	Figure 1
2.	Breakaway connections	Figure 2
3.	Specific Installation	Figure 5
4.	Damper out of wall	Figure 12
5.	Opening protection	Figure 15

B. Fire damper openings in metal stud walls shall be internally framed on four sides from vertical members for rigid support of opening with internal gypsum board liner per SMACNA installation guide or manufacturer's guidelines for installation in metal stud walls.

3.3 METAL DUCTS

A. Install in accordance with SMACNA Duct Construction Standards – Metal and Flexible, for pressures and seal as specified herein.

B. During construction install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

C. Seal water-tight all new exterior ducts exposed to weather. Slope top of duct to prevent ponding.

3.4 FLEXIBLE DUCTS

A. Flex duct connections shall be made with a band on inner liner and another band to secure vapor jacket. Max length of any flexible duct section is 5'-0". Tape all loose ends with foil tape, no cloth duct tape is allowed.

3.5 FLEXIBLE EQUIPMENT CONNECTIONS

A. Install on inlets and outlets of all powered equipment prior to any duct hangers. Manufacturer shall provide with equipment where option is available. Install connecting duct in a straight line with equipment connection, and prevent flexible connection from being in tension while equipment is running.

3.6 DUCT SMOKE DETECTORS

A. Shall be provided and wired by Division 16, installed in duct by Division 15.

3.7 FILTERS

A. Prevent passage of unfiltered air around filters by installing felt, rubber, or neoprene gaskets.

B. Install filter gage static pressure tips upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum, in accessible position. Adjust and level.

3.8 INSPECTION PANELS

A. Install inspection panels at the following locations and as indicated on drawings:
1. Before and after each automatic control damper.
2. Before and after each fire, smoke, and/or combination fire and smoke damper.

B. Access Door Sizes: Install minimum 12 x 12 inch size for hand access, 18 x 18 in. size for shoulder access. Review locations prior to fabrication.
1. Mark access doors for fire and smoke dampers on outside surface, with minimum 2 in. high letters reading: FIRE/SMOKE DAMPER, SMOKE DAMPER, OR FIRE DAMPER.

3.9 AIR DIFFUSERS AND GRILLES

A. Install balancing dampers for diffusers and grilles at branch take-off from main trunk, no dampers allowed on-board diffusers or grilles unless explicitly specified on plans. Do not install manual volume dampers next to grilles unless required by field conditions.

B. Do not locate air registers, diffusers or grilles in floors of toilet or bathing rooms.

C. Paint ductwork, cans, and plenums visible behind air outlets and inlets matte black.

D. Install safety screen where fan inlet or outlet is exposed.

3.10 EXTERIOR DUCT

A. Slope top of ducts to prevent ponding of water.

B. Seal all joints and equipment connections watertight.

END OF SECTION 15850

SECTION 15950 – TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Testing, adjusting, and balancing of air systems.

B. The Contractor shall obtain the services of an independent test, adjustment, and balance (TAB) agency to test, adjust, and balance:
   1. Each supply, return, exhaust, relief, and outdoor air distribution systems.

C. The Contractor and the TAB Agency shall review the proposed system installations and determine all measuring and balancing devices required for proper test and balance of the systems. These shall include, but not be limited to, manual air volume balancing dampers, etc. The Contractor shall be responsible for providing these in the locations recommended by the TAB Agency, in addition to any shown on the drawings. These devices shall be provided under the Contract.

D. Instruments used for testing and balancing shall have been calibrated within a period of six months of the time of the testing and balancing and such instruments shall be checked for accuracy prior to the start of the work. Submit verification for certification to the Architect and the Owner.

E. Perform Work in accordance with AABC National Standards, latest addition. TAB shall include all equipment and distribution systems and shall be reported, as a minimum, on forms as published by the AABC, NEBB, or approved equal. Report shall include a diagram(s) of each system showing all devices in the system.

F. The TAB Agency shall, unless approved by the Owner, be an AABC or NEBB member and the work shall be done by an AABC or NEBB certified TAB Technician and Commissioning Agent.

G. All corrections required by the report shall be executed by the Contractor to the satisfaction of the Owner, Architect, Engineer, and TAB agency. All costs associated with testing and balancing, as well as costs of any necessary re-testing, shall be borne by the Contractor.

H. Testing and Balancing Agency shall be kept informed of any major changes made to the systems during construction, and shall be provided with a complete set of contract documents, as-built drawings, approved submittals, applicable specification sections, addenda and change orders.

1.2 SUBMITTALS

A. Draft Reports: Submit for review prior to final acceptance of Project.

B. Test Reports: Submit prior to final acceptance of Project and for inclusion in operating and maintenance manuals. Assemble in soft cover, letter size, 3-ring binder, with table of contents page and tabs, and cover identification. Include reduced scale drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

PART 2 EXECUTION

2.1 EXAMINATION

A. Before starting work, verify systems are complete and operable.

B. The TAB Agency shall check refrigerant superheat settings.

C. The TAB Agency shall test drain pans for proper drainage under operating conditions.

D. Report defects, deficiencies, or abnormal conditions in mechanical systems preventing system balance to Owner, Architect, and Engineer.

E. Beginning of work means acceptance of existing conditions.

2.2 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

2.3 AIR SYSTEM PROCEDURE

A. Examine all air handling systems to see that they are free from obstructions that may prevent proper balancing of system.

B. Ensure that all dampers, grilles, and registers are open or in normal positions, that moving equipment is lubricated, filters are installed and clean, and perform other inspection and maintenance activities to ensure that the operation of the system is as specified.

C. Adjust air handling and distribution systems to deliver design supply, return, outdoor air, and exhaust air quantities within previously stated tolerances.

D. Make air quantity measurements in ducts by traverse of entire cross sectional area of duct.

E. Measure air quantities at air inlets and outlets only as needed for verification of air handling system air quantities.

F. Use volume control devices to regulate air quantities only to extent those adjustments do not create objectionable air motion or sound levels. Change volume using dampers mounted in ducts, not dampers on ceiling diffusers. Leave dampers on ceiling diffusers open for seasonal adjustment by Owner.

G. Vary total system air quantities by adjustment of fan speeds.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Allow for pressure drop equivalent to 50 percent loading of filters.

I. Adjust automatic outside air, return air, and exhaust air dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust air dampers to check leakage.

K. At modulating damper locations, take measurements and balance at extreme conditions.

L. The TAB Agency shall check all the systems operating together to ensure that the air conditioning spaces are under an overall positive pressure.

2.4 FIELD QUALITY CONTROL

A. Verify recorded data represents actually measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices. Set and lock memory stops.

END OF SECTION 15950

SECTION 16010 - GENERAL REQUIREMENTS - ELECTRICAL

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. The Plans and Specifications are intended to be complementary. Work shall be performed and materials shall be furnished if shown on the Plans but not specified or vice-versa; or if reasonably implied; or if usually included; or if necessary for the proper execution and completion of the work.

B. Execute the work in the best and most thorough manner, under the direction of and to the satisfaction of the Architects and Engineers, who will interpret the meaning of the drawings and specifications.

C. Be responsible for material and workmanship until completion and final acceptance. Replace any of the same which may be damaged lost or stolen, without additional cost to the Owner, the Architects and the Engineers.

D. Provide and maintain a safe place to work and comply with all laws and regulations of any governmental authority having jurisdiction thereof, and indemnify, defend and hold harmless the Owner, the Architects and the Engineers, from and against any liability, loss, damage or expense, including attorneys' fees.

E. Indemnify, defend and hold harmless the Owner, the Architects and the Engineers against any liability, loss, damage or expense, including attorneys' fees, arising from a failure or alleged failure on the part of this Contractor and his Sub-Contractors. To properly discharge the obligations assumed by him or them in the performance of the work, including any act of omission allegedly resulting in death or personal injury or property damage or improper construction, construction techniques, or the use of improper or inappropriate material or tools.

F. Work shall be put in place as fast as reasonably possible. At all times, keep a competent foreman in charge of the work and facilitate its inspection by the Architects and Engineers.

G. Except for such changes as may be specifically approved by the Architects and Engineers, in accordance with alternates or options stated hereinafter, all work must be in full accordance with the intent of the plans and specifications, complete in every way and ready for satisfactory and efficient operation when delivered to the Owner.

H. Guarantee that the materials and workmanship supplied under these Specifications will be of the best grade, that the apparatus will be erected in a practical and first-class manner, that it will be complete in operation, nothing

being omitted in the way of labor and material required to make it so, although not specifically shown or mentioned herein and that it will be delivered in well-working order, complete and perfect in every respect, without additional cost to Lundy Engineering Group whether or not shown in detail on the drawings or described in detail in this Specification.

I. Become thoroughly acquainted with the work involved. Obtain and verify at the building all measurements necessary for the proper installation of work. Furnish to other contractors any information relating to work of this Section necessary for the proper execution of their Contracts. Confer with other contractors for finish adjacent to work of this Section and arrange to have visible portions of the work fit in and harmonize with the finish in a manner satisfactory to the Architect.

J. Make every effort to furnish all equipment of any equipment type from one manufacturer.

K. Where discrepancies occur between the plans and the specifications or within either document itself, the item or arrangement of better quality or higher cost shall be included in the base bid.

M. The drawings show the various piping, electrical and duct systems schematically. No added compensation will be permitted for variations due to field conditions. Installation shall follow drawings where practicable and not be in conflict with other trades installation.

N. Provide all rigging required for complete installation and furnish drawings showing necessary points of support, reactions and supplementary bracing.

O. Equipment and materials shall be new and listed by the Underwriters Laboratories, Inc., Factory Mutual and manufactured in accordance with ASME, NEMA, ANSI, or IEEE Standards, and approved by the local authorities having jurisdiction.

P. Before deviating in any way from the work as defined by the Contract Documents, obtain written approval from the Owner, the Architects, and the Engineers.

Q. Areas in which welding or burning is to be performed shall first be cleared of all extraneous flammable materials. This Contractor shall see that a fire watch is maintained at all times during welding or burning work, and that at least two fire extinguishers of the proper type of not less than ten pounds charged capacity, at least one of which shall be fully charged, and maintained at the immediate site of such activity.

R. Submit a time schedule with the bid, indicating duration of time required to complete the entire installation as shown on plans and specified herein. Submit to Lundy Engineering Group a monthly progress report indicating work performed status of the job, and time of completion.

S. Obtain all necessary allowances, pay all royalties, and the like, in connection with the use of any patented devices or systems, and hold the Owner, Architects and Engineers harmless from any claims or lawsuits arising from such use.

T. Secure and pay for necessary approvals, permits, inspections, etc., and deliver the official records of the granting of permits to the Architects without additional cost to Lundy Engineering Group. Secure and pay for the services of an Independent Engineer where required, for Controlled Inspection and/or such approvals (Seismic, Fire Protection, etc.).

1.3 NOTICE TO BIDDERS

A. Before submittal of bid, examine all drawings, specifications, addenda, alternates, special conditions, and all other bidding documents of all Sections of this project, verify all governing conditions at the site, and become fully informed as to the extent and character of the work required, as well as its relation to other work in the building. Submittal of a bid is an agreement to all requirements of the Contract Documents, and no consideration will be granted for any claimed misunderstanding thereof.

B. Submittal of a bid is deemed a representation by the bidder that he is qualified in all respects to properly perform the work for which he is bidding and has experience with similar work. Bidders are deemed to be aware, on the basis of their background and experience, of materials which may be required in the discharge of their responsibilities, even though unspecified.

1.4 DESCRIPTION

A. Work Included:

The work to be performed under this Contract shall consist of all labor, materials, equipment, and appliances necessary and required for the complete execution of all electrical work indicated on the Plans and/or called for in this Specification. Any omission of such specific reference does not relieve the Contractor of his obligation to perform such work as herein specified or indicated on the Contract Drawings.

Specification Sections: The Contract comprises work which is described in the Specifications under the following headings:

Section 16010 - General Requirements – Electrical
Section 16050 - Common Work Results for Electrical
Section 16120 - Low-Voltage Electrical Power Conductors and Cables
Section 16130 - Raceway and Boxes for Electrical Systems
Section 16140 - Wiring Devices
Section 16195 - Identification for Electrical Systems
Section 16410 - Enclosed Switches and Circuit Breakers
Section 16450 - Grounding and Bonding for Electrical Systems
Section 16510 - Led Lighting
Section 16520 - Lighting Control Devices

Drawings: Electrical work is shown on Drawings E1.0 through E3.0 inclusive. Consult relevant drawings in other contracts for coordination and equipment layout.

B. Related Work Specified in Other Contracts:

1. Equipment in Other Contracts: This Contractor shall cooperate and be present in the testing of electrical equipment furnished under other Contracts.

2. Temporary light and power.

3. Controllers for plumbing motors and packaged equipment, specified to be furnished under other Divisions, shall be installed and connected by this Contractor.

4. Furnishing and installing of electric motors.

5. Telephone instruments, wire and connections.

6. Security System instruments, wire and connections.

7. Waterproofing around sleeves, etc., passing through waterproofed floors etc. This Contractor shall provide all sleeves and flashings required to make the openings absolutely watertight.

8. Finish painting work as otherwise specified.

9. Fire protection system.

1.5 DEFINITIONS

A. "This Contractor": is the individual, partnership or corporation to whom has been awarded the contract for providing Heating, Ventilation and Air Conditioning Work, Plumbing Work, Fire Protection or Electrical Work.

B. "Owner":

C. "Architects": KRH Architects.

D. "Engineers": Lundy Engineering Group, LLC

E. "Provide": to supply, install and connect up complete and ready for safe and regular operation of particular work referred to unless specifically otherwise noted.

F. "Install": to erect, mount and connect complete with related accessories.

G. "Furnish" or "Supply": to purchase, procure, acquire and deliver complete with related accessories.

H. "Work": labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.

I. "Piping": pipe, tube fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation and related items.

J. "Wiring": raceway, fittings, wire, boxes and related items.

K. "Concealed": embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures.

L. "Exposed": not installed underground or "concealed" as defined above.

M. "Indicated", "Shown", or "Noted": as indicated, shown or noted on drawings or specifications.

N. "Similar" or "Equal": of base bid manufacture, equal in materials, weight, size, design, and efficiency of specified product, as determined by the Architect or Engineer.

O. "Reviewed", "Satisfactory", "Accepted", or "Directed": as reviewed, satisfactory, accepted, or directed by the Architect or Engineer.

P. "Motor Controllers": manual or magnetic starters (with or without switches), individual push-buttons or hand-off-automatic (HOA) switches controlling the operation of motors.

Q. "Control or Actuating Devices": automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.

1.6 VERIFYING EXISTING CONDITIONS

A. Before commencing work, examine all adjoining work on which this work is in any way dependent for perfect workmanship according to the intent of this Specification, and report to the Architect any condition which prevents performance of this first-class work. No "waiver of responsibility" for incomplete, inadequate or defective adjoining work will be considered unless notice has been filed before submittal of a proposal.

1.7 COORDINATION

A. Certain materials will be furnished, installed, or furnished and installed, under other Sections and Contracts. Examine the Contract Documents to ascertain these requirements.

B. Carefully check space requirements with other Trades to insure that all material can be installed in the spaces allotted thereto. Finished suspended ceiling elevations are as indicated on the architectural drawings.

C. Transmit to Trades doing work of other Sections all information required for work to be provided under their respective Sections in ample time for installation.

D. Wherever this Contractor's work interconnects with work of other Contractors, this Contractor shall coordinate his work with these Contractors to insure that all Contractors have the information necessary so that they may properly install all necessary connections and equipment. Identify all work items needing access concealed above hung ceilings by permanent colored pins/tabs in the ceiling directly below the item.

E. Caution men both verbally and in writing as to the dangers involved in doing work within or adjacent to Electrical Closets, Mechanical Rooms and the Electrical Rooms, due to dangers caused by the presence of high voltages and currents in these spaces.

F. Furnish and set all sleeves for passage of conduits through structural masonry and concrete walls and floors and elsewhere as will be required for the proper protection of each pipe and duct passing through building surfaces.

G. The locations of lighting fixtures, outlets, panels, and other equipment indicated on the drawings are approximately correct, but they are understood to be subject to such revision as may be found necessary or desirable at the time the work is installed in consequence of increase or reduction of the number of outlets, or in order to meet field conditions or to coordinate with modular requirements of ceilings, or to simplify the work, or for other legitimate causes.

H. Provide required supports and hangers for lighting, raceway, cable tray and equipment, so that loading will not exceed allowable loadings of structure. Submittal of a bid shall be deemed a representation that the Contractor submitting such bid has ascertained allowable loadings and has ascertained allowable loadings and has included in his estimates the cost associated in furnishing required supports.

I. Field drilling and cutting of holes in structural decks, roofs, walls, etc., required for work under this Section shall be coordinated through various trades in their respective materials and approved by the Architects and Engineers. All such drilling, cutting and reinforcing costs shall be borne by this Contractor.

J. Due to the type of the installation, a fixed sequence of operation is required to properly install the complete systems. It shall be the responsibility of this Contractor to coordinate, protect, and schedule his work with other Trades in accordance with the construction sequence.

K. Cooperate with all other Contractors and Subcontractors to facilitate the completion of the work as a whole, subject to the direction of the Architect.

L. Exercise particular caution with reference to the location of panels, outlets, switches, etc., and have precise and definite locations approved by the Architect before proceeding with the installation.

M. The drawings show only the general run of conduits, bus ducts, under-floor ducts, cable trays and approximate location of outlets. Any significant changes in

location of outlets, cabinets, etc., necessary in order to meet field conditions shall be brought to the immediate attention of the Architect and receive his approval before such alterations are made.

N. Obtain from the Architect in the field the location of such outlets or equipment not definitely located on the drawings.

O. Circuit "tags" in the form of arrows used where shown to indicate the home runs of conduits to electrical panels, motor control centers and switchboards. These tags show the circuits in each home run and the panel designation. Show the actual circuit numbers on the finished record drawings and on panel directory card. Where circuiting is not indicated, this Contractor may provide required circuiting in accordance with the loading indicated on the drawings.

P. Required anchor bolts, sleeves, inserts and supports shall be furnished under the same section of the specifications as the respective items to be supported. Location of anchor bolts, sleeves, inserts and supports shall be directed by the trade requiring them to insure that they are properly installed. Any expense resulting from the improper location or installation of anchor bolts, sleeves, inserts and supports shall be paid for by this Contractor under the applicable section of the specification.

Q. Adjust location of conduits, wireways, panels, equipment, pull boxes, bus ducts, fixtures, etc., to accommodate the work to prevent interferences both, anticipated and encountered. Determine the exact route and location of each pipe and duct prior to fabrication.

1. Right of Way: Lines which pitch to have the right-of-way over those which do not pitch. For example, steam, condensate, and plumbing drains normally have the right-of-way. Lines whose elevations cannot be changed to have right-of-way over lines whose elevations can be changed.

2. Make offsets, transitions and changes in the direction of conduits and cable trays as required to maintain proper head room in pitch of sloping lines whether or not indicated on the drawings.

R. Wherever the work is of sufficient complexity, prepare additional detailed drawings of scale similar to that of the bidding drawings prepared on tracing medium of the same size as contract drawings. With these layouts, coordinate the work with the work of other trades. Such detailed work to be clearly identified on the drawings for approval. At completion, however, include a set of such drawings with each set of as-built drawings.

1.8 SUBCONTRACTS

A. Where Contract Documents require manufacturer's services, and wherever the staff of the Trade performing the work of this Section cannot adequately perform such services, that Trade shall stipulate such performance in its contracts with its Sub-Contractors and Sub-Sub-Contractors, vendors, manufacturers, and the like, or else subsequently pay them any additional fees required thereafter to accomplish the necessary services.

1.9 CODES, REGULATIONS AND STANDARDS

A. The electrical installation shall be in compliance with the requirements of the National Electrical Code, OSHA, ADA, and the rules, regulations and requirements of the electric utility company to the buildings. Where applicable, comply with ASHRAE energy conservation code and the Energy Policy Act.

B. All installation shall comply fully with all the latest city, county and state laws, ordinances and regulations.

C. All equipment shall be equal to or exceed the minimum requirements of NEMA, ANSI/ IEEE, and Underwriters' Laboratories and Factory Mutual. Standardize single manufacturer for the same item (i.e. fuses, etc.) throughout project.

D. Should any change in plans or specifications be required to comply with governmental regulations, this Contractor shall notify the Engineer at the time of submitting his bid.

1.10 SHOP DRAWINGS AND APPROVALS

A. This Contractor shall submit shop drawings, cuts, bulletins, etc., of all materials, equipment, and methods of installation shown or specified in this Contract, and as required or directed.

B. This Contractor shall submit drawings for approval within thirty (30) days after the award of the Contract, if so ordered, and in any case, at least sixty (60) days prior to the date of the manufacture of the materials of the installation of the work involved.

C. Wherever the words "for approval" or "approved" are used in regard to manufactured specialties, or wherever it is desired to substitute a different make or type of apparatus for that specified, all information pertinent to the adequacy and adaptability of the proposed apparatus shall be submitted to the Architects and Engineers, and their approval secured before apparatus is ordered.

D. Wherever operating results (such as quantity delivered, pressure obtained, or the like) are specified -- or a definite make and size of apparatus is specified, for make and size of apparatus proposed for use must conform substantially (in regard to such operating shall apply) to important dimensions of apparatus. Any substitution of equipment or apparatus shall include all necessary revisions, pipe connections, bases, and adjustments to electrical power supply, as required for a complete installation.

E. Approvals for equipment specified herein will not be given merely upon submission of manufacturers' names, notwithstanding anything to the contrary in this Specification; approvals for equipment will be given only after receipt of complete and satisfactory performance data (covering the complete range of operating conditions) in tabular and graphical form as required by the Engineers. Complete and satisfactory information shall also be furnished relative to equipment dimensions, weight, etc. It is to be understood, however that approvals for all equipment specified or shown on the drawings, or substitutions

submitted by this Contractor for that specified or shown on the drawings, will be granted if such equipment, in the opinion of the Architects and Engineers, conforms to the performance requirements, space conditions, weight requirements and quality requirements. Any additional construction and/or design costs incurred as a result of any approved substitution shall be borne by this contractor. The opinion and judgment of the Architects and Engineers shall be final, conclusive and binding and shall not be subject to question in any other place.

F. Prepare and submit detailed shop drawings including detailed locations and sizes of all openings in walls and floors.

G. The work described in any shop drawing submission shall be carefully checked by this Contractor for all clearances (including those required for maintenance and servicing), field conditions, maintenance of architectural conditions and proper coordination with all Trades on the job. Each submission shop drawing shall include a certification by this Contractor that all related job conditions have been checked and that no conflict exists. No shop drawing submission will be reviewed without such certification.

H. Subsequent to approval, this Contractor shall issue a copy of his shop drawings to Contractors of other trades for resolution of any conflicts between the trades. Certification from the other trades that coordination has been established shall be obtained prior to installation of the work. All shop drawings shall be stamped and certified that coordination with other trades has been established and said shop drawings shall be submitted for the record as required or directed.

I. All drawings, etc., shall be submitted sufficiently in advance of field requirements to allow ample time for checking, and no claim for extension of contract time will be granted this Contractor, by reason of his failure in this respect. All submittals shall be complete and shall contain all required and detailed information. Shop drawings with multiple parts shall be submitted as a package.

J. If submittals differ from the Contract Document requirements, make specific mention of such difference, substitution, together with reasons for same. Otherwise this Contractor will not be relieved of responsibility for executing work in accordance with contract drawings.

K. Approval of any submitted data or shop drawings for material, equipment, apparatus, devices, arrangements and/or layout shall not relieve this Contractor from the responsibility of furnishing the same with proper dimensions and weight, capacities, sizes, quantity, quality and installation details to efficiently perform the requirements and intent of the Contract. Such approval shall not relieve this Contractor from responsibility for errors, omissions or inadequacies of any sort on submitted data of shop drawings.

L. Each shop drawing shall contain the job title and reference to the applicable drawing and/or specification article.

M. Within one week after award of the contract, submit for approval a list of all material and equipment manufacturers whose products are proposed, as well as names of all Sub-Contractors whom this Trade proposes to employ.

N. Drawings to be submitted: This Contractor shall submit, for approval, among others, shop drawings of the following equipment:

1. Lighting fixtures
2. Wiring devices
3. Pull boxes, cabinets, conduits
4. Fire Alarm equipment and wiring diagrams, wiring plans
5. Exposed raceway layout and underground conduit routing
6. Grounding System installation drawing
7. Other systems, details and devices as required by the Engineer

1.11 SAMPLES

A. Samples of any equipment may be required if deemed necessary to establish compliance with the intent of the Specifications.

1.12 RECORD DRAWINGS

A. During construction, keep an accurate record of all deviations between the work as shown on drawings and that which is actually installed. This record set of prints shall be kept at job site for inspection by the Architects and Engineers.

B. As part of the required electrical work, a complete set of "as-built" or record electrical drawings shall be made-up and delivered to the Architect. This Contractor shall bear all costs for the "as-built" process, as described herein.

C. The drawings shall show:

1. All electrical work installed exactly in accordance with the original design.

2. All electrical work installed as a modification or addition to the original design.

3. The dimensional information necessary to delineate the exact location of all circuitry and wiring runs (other than lighting and appliance branch circuitry and small control, signal and communications circuitry runs) which are so buried or concealed as to be untraceable by inspection through the regular means of access established for inspection and maintenance.

4. The numbering information necessary to correlate all electrical energy consuming items (or outlets for same) to the panel or switchboard circuits from which they are supplied.

D. This Contractor shall obtain from Architect, a complete set of Architectural and Electrical CADD Drawings. Enter on these CADD drawing files in a neat and accurate manner, a complete record of all revisions of the original drawings, as actually installed, and submit the following:

1) CD-ROM of all "as-built" CADD drawing files.

2) One (1) set of reproducible as-built drawings for review by Architect and Engineers.

a) CADD drawing files on the CD ROM disks shall be formatted as directed by Architect. This Contractor shall bear all costs for making these changes on the reproducible and the conversion of CADD drawing files to the above mentioned format. The intent is to produce a final "as-built" set that includes all field revisions, now inserted onto the contract drawings.

E. The design tracings and CD ROM disks will be made available for copying into reproducible should it be determined that such reproductions would serve as suitable backgrounds for the "as-built" drawings. The quantity of design drawings shall be interpreted as the minimum number of drawings necessary to show the required "as-built" information, as approved by the Architect.

F. Progress prints of record drawings shall be submitted monthly during the construction period for Architect's approval.

1.13 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Deliver materials (except bulk materials) in manufacturer's unopened container fully identified with manufacturer's name, trade name, type, class, grade, size and color.

B. Storage of Materials, Equipment and Fixtures: Store materials suitably sheltered from the elements, but readily accessible for inspection by the Engineer until installed. Store all items subject to moisture damage in dry, heated spaces.

1.14 EQUIPMENT ACCESSORIES

A. Establish sizes and location of the various concrete bases required and provide all necessary anchor bolts together with templates for holding these bolts in position.

B. Provide supports, hangers and auxiliary structural members required for support of electrical work.

1.15 NOMINAL VOLTAGES (UNLESS OTHERWISE NOTED)

A. Primary Distribution: 12.470 KV, 3-phase, 4-wire plus ground.

B. Secondary Distribution: 120/208 Volt, 3-phase, 4-wire plus ground

C. Convenience Outlets: 120 Volt, single phase, 2-wire plus ground.

D. Lighting: Incandescent 120 Volt for fluorescent and HID-source, single phase, 2-wire.

E. Motors 1/2 Horsepower and Larger: 208 Volt, 3-phase, 3-wire, plus ground.

F. Motors smaller than 1/2 Horsepower: 120 Volt, single phase, 2-wire plus ground.

G. Provide equipment of sufficient poles and voltage rating to correctly function at the above voltage.

1.16 SPARES, SPARE PARTS, SPECIAL TOOLS

A. Provide to Owner as specified in other sections of the specifications and as required below.

B. Obtain receipts and include copy with Operations and Instruction Manual.

C. Provide lists of each category describing type, rating and use and include lists with Operations and Instruction Manual.

1. Breakers as specified in the panel schedules.

2. Receptacle Plugs: One for each receptacle excluding NEMA 5-15R and 5-20R types.

4. Device Plates: Two for each type of device used in excess of twenty.

5. Fuses: One set for each type used.

6. Special Tools: Provide, as standard accessories, tools not readily available in commercial market required for assembly, adjustment and/or maintenance of equipment provided under this section.

7. Lighting Fixtures: Spare lamps and ballasts as specified in other sections.

1.17 OPERATING AND MAINTENANCE DATA

A. General: As a condition for final acceptance of the system, submit to the Architect four copies of each of the following documents, complete and at one time, in loose-leaf three ring binders with permanent covers, identified, indexed, and cross referenced with specifications. Where practical, data may be combined in common manual.

B. Maintenance Instruction Manual to Include:

1. Complete as-built material list.

2. Catalog brochures for all components.

3. Motor starter overload schedules.

4. Test reports required.

5. Manufacturer's directions and conformance certificates.

6. Guarantee and warranties.

7. Inspection certificates.

8. Spare parts lists.

9. Reports on instructions of Owner's personnel.

10. Wiring and block diagrams, where applicable.

11. Detailed check-out procedures to insure operation of systems and major equipment.

12. Diagnostic and troubleshooting procedures for systems and major equipment.

13. Recommended preventive maintenance program, including a list of mechanical items requiring inspection and servicing.

14. Short circuit study.

15. Circuit protective device coordination and arc flash report.

C. Parts List to include the following for Replaceable Parts:

1. Description of part, manufacturer's part number and source to obtain part.

2. Quantity of each replaceable part in the system.

3. Estimated mean time between failures of major parts.
4. Recommendation of how many, if any, should be kept in inventory at the site.

D. Shop Drawing Manual to include complete set of as-built shop drawings, cuts and brochures.

E. Verbal Instruction:

1. Upon completion of the work, provide an engineer from each supplier of major equipment or system to instruct Owner's designated operating personnel. Include both classroom instruction and on-the-job training, conducted before and during the system test period. Provide instruction proportional to the complexity of the system, but not less than three days.

2. Submit written report to Owner with copy to Architect, for each instruction period indicating date and time of instruction, and personnel participating.

F. Inspection:

1. In addition to required service calls, make a minimum of two inspections accompanied by operating personnel, within the warranty period, at no expense to the Owner, to insure that all systems are maintained properly and in satisfactory operating condition.

2. Submit written reports to Owner with copy to Architect, signed by operating personnel witnessing inspection, indicating inspection.

1.18 INSPECTION, TESTS AND GUARANTEE

A. After the electrical installation is completed and at such times as the Engineer may direct, this Contractor shall conduct an operating test for approval. The installation shall be demonstrated to be in accordance with the requirements of this specification. Any defects revealed shall be corrected promptly at this Contractor's expense and the tests re-conducted.

B. All electrical work and all items of equipment and materials shall be guaranteed for a period of one year (365 days) from the date of acceptance of the work, or acquisition of certificate of occupancy whichever is later. This Contractor shall be notified in writing of any defective items and shall repair or replace such items promptly without cost to Lundy Engineering Group.

C. Provide testing as specified under individual equipment and system specifications and as follows:

1. Upon completion of the work, and as a condition for acceptance, test all components and systems in the presence of the Owner's representatives to demonstrate compliance with the specifications. Provide tests as specified and as required by the code of enforcing authorities.

2. Provide supervisory personnel experienced with the particular systems involved, and where specified, arrange for the presence of factory representatives to direct indicated testing. Check all field connections prior to testing.

3. Provide all required testing instruments and pay all costs for testing and for any resulting repair or replacement.

4. Tabulate all test data and prepare typewritten report covering all testing performed and include in Operation Instruction Manual.

5. Test and Measurements: Include all required factory service engineering time to cover the outline testing.

D. Test Items:

1. Grounding Test: Perform test in accordance with the latest edition of James G. Biddle manual on "Earth Resistance Testing" and describe tests and results in the test report. Where ground resistance is in excess of 25 ohms, add ground electrodes as required to meet specifications.

a. Test bolted connections with torque wrench with minimum 50 ft.-lbs. setting for bolts 3/8 inch diameter and larger.

b. Perform ground resistance measurement on each individual ground rod and bare copper conductor prior to connections to other grounding system components.

c. Perform ground resistance measurement on cold water piping system prior to interconnection to other grounding system components.

d. Perform insulation resistance test on neutral wires prior to connection to system neutrals to determine isolation from ground.

e. Test ground resistance at each ground loop for transformer and at the secondary of each transformer.

f. Perform insulation resistance test on low-frequency signal reference ground system to determine isolation from ground.

2. Tighten all required connections.

3. Insulation resistance test shall be performed on all equipment and cable conductors.

a. For medium voltage power cables, perform high potential, direct current test in accordance with the latest IPCEA Standards witnessed by cable manufacturer's representative. Provide certified test report and certified letter from cable manufacturer, confirming witnessing of test and approval of test data.

b. For low voltage power and control cables, the test shall be performed with a voltage source (Megger) capable of providing a constant direct voltage for the time intervals as specified below. Hand cranked megger shall not be used for direct voltages greater than 500 bolts.

System Voltage	Test Voltage
150 and under	500
151-600	1000

1000 volt and 500 volt insulation resistance tests shall be held for a minimum of one minute and until the reading reaches a constant value for 15 seconds unless specified otherwise.

Tests shall be applied from phase to ground with the other phases grounded. Each phase shall be tested in a similar manner.

4. Conductor Field Tests: Test for continuity, short circuit and improper ground. Megger all feeders with switchboards and/or panels connected, but with branch loads disconnected, and megger circuits for 20 HP and larger motors. Insulation resistance is not to be less than cable manufacturer's recommendation.

5. Switchboard and Panel Field Tests:

a. Provide mechanical inspection and operation to determine that the equipment performs mechanically as specified.

b. Verify circuit breakers are as specified.

c. Provide Insulation Resistance Test on the bus system.

d. Set zero adjustment of metering.

e. Verify proper connection of wire termination.

6. Motor Control Center and Starter Field Tests:

a. Provide mechanical inspection and operation to determine that the equipment performs mechanically as specified.

b. Verify that relays, fuses and circuit breakers are as specified.

c. Provide Insulation Resistance Test on the bus system.

d. Check for proper rotation and connection of wire terminations.

e. Verify proper alignment.

f. Verify equipment nameplate information with drawings and specifications and report.

g. Test overload relays to prove that they function as specified.

7. Protective Relays and Solid State Trip Units Tests:

a. Determine the time-current characteristics by direct injection of operating current (current transformer is to be used where current transformer is an integral part of unit).

b. Obtain time-current characteristics for each setting or connection. For trip units with long time, short time and/or instantaneous setting, test each mode at all settings with the other mode(s) set at the specified set point.

c. Verify each time-current curve by testing at least 2 points on that portion of the curve that can be altered.

8. Transformer Tests:

a. Measure primary and secondary voltages.

b. Insulation Resistance Test: Each primary and secondary winding shall be tested.

9. Lighting System Tests:

a. After the fixtures are connected to the wiring system, the wiring system and fixtures must test free from short circuits and grounds and must show an insulation resistance between conductor's and ground on maximum load not less than the requirements of the National Electrical Code.

b. Operating Tests: Operate lighting switch.

c. Perform fluorescent troffer test prior to installation.

10. Ground Fault Interrupting Receptacle:

a. Verify that receptacle is installed per manufacturer's instructions and terminal connections are secure and clean.

b. With the Aid of a GFI Tester, such a Hubbell #GFT2-G, Verify:

1) Hot - neutral - ground connections.

2) At two and three milliamps respectively, GFI shall not trip within 10 seconds.

3) At five milliamps, GFI shall trip within one second.

11. Adjustments: After project loads are in full operation and at a time acceptable to the Owner:

a. Take voltage readings at each transformer. Where voltage on secondary of building transformers is above or below required rating in excess of 2 1/2 percent at full load, make appropriate tap changes.

b. Take current readings on each phase at each panel. Adjust branch circuiting between phases where required to balance phase currents within 10 percent. Reflect revisions in panel schedules. Circuit revisions shall not compromise multi-wire circuits sharing a common neutral.

12. Fire Alarm Tests:

a. The completed system shall be fully tested under the supervision of a trained manufacturer's representative. The system shall be demonstrated to perform all the functions as specified.

b. Provide Insulation Resistance Tests zone by zone.

13. Paging System Tests:

a. The completed system shall be fully tested under the supervision of a trained manufacturer's representative. The system shall be demonstrated to perform all the functions as specified.

b. Provide Insulation Resistance Tests zone by zone.

1.19 EXCAVATION AND TRENCHING

A. Provide excavation for electrical systems. Remove from the site excavated materials not required or suitable for back-fill. Provide grading as may be necessary to prevent surface water from flowing into trenches or other excavations. Remove any water accumulating therein. Provide sheeting and storing as may be necessary for the protection of the Work and for the safety of personnel.

B. Provide trenches of widths necessary for the proper laying of the conduit. Grade bottom of the trenches accurately to provide uniform bearing and support for each section of the pipe and conduit on undisturbed soil at every point along its entire length. Do not excavate below the depths indicated. Back-fill unauthorized over-depths with loose, granular, moist earth, thoroughly tamped. Whenever unstable soil that is incapable of properly supporting the pipe, as determined by the Architect, is encountered in the bottom of the trench, remove soil to the depth required and back-fill the trench to the proper grade with coarse sand, fine gravel or other suitable material.

C. Conduit Trenches: Provide minimum cover over buried conduit as follows: 42 inches over primary conduit outside building; 36 inches over primary conduit within building; 36 inches over 2 inch and larger secondary and signal conduits outside building; 30 inches for 1 1/2 inch and smaller outside building; 24 inches for 1 1/2 inch and larger secondary and signal conduit within building footprint. Cut trenches to bottom of conduit, allowing for concrete encasement where specified, and make cuts as narrow as possible. For nonmetallic conduit without encasement, excavate 4 inches below conduit and back-fill with sand. In rock, excavate 6 inches below conduit and back-fill with gravel for encased conduit and sand for direct buried conduit. Separate signal and power conduit in a common trench by 12 inches of tampered earth or 6 inches of concrete.

D. Conduits with diameter less than 1/3 of slab thickness may be run in slab where practical.

1.20 BACK-FILLING OF TRENCHES

A. Do not back-fill trenches until all required tests have been performed. Comply with the requirements of other sections of these specifications. Deposit in 6 inch layers and thoroughly and carefully tamp until the pipe has a cover of not less than 1 foot. Back-fill remainder of trench by machine. Uniformly grade the finished surface.

B. All back-fill material shall be clean, free of large stone, cinders and ashes. Back-fill material within 6 inches of the conduit shall be free of stones greater than 4 inches on their maximum diameter and shall not contain rock with sharp edges likely to damage the conduit. Other back-fill material shall be free of stones greater than 12 inches on their maximum diameter.

C. Back-fill material shall be placed and tamped by methods which will insure a well compacted road subbase.

1.21 SEPARATION OF WORK BETWEEN TRADES

A. The specifications for the overall construction delineate various items of work under separate trade headings. Except as specifically noted otherwise, the list below sets forth this delineation to the extent that it affects Mechanical, Plumbing, Fire Protection and Electrical Work.

B. Indications that any trade is to perform an item of work means that it is to perform the work for its own accommodation only, except as specifically noted otherwise.

C. Each Trade is required to supply all necessary supervision and coordination information to any of the other trades who are to supply work to accommodate that trade's installation.

D. Where any of the trades are required to install items which they do not purchase, it shall include for such items as:

1. The coordination of their delivery.

2. Their unloading from delivery trucks driven in to any designated point on the property line at grade level.

3. Their safe handling and field storage up to the time of permanent placement in the project.

4. The correction of any damage, defacement or corrosion to which they may have been subjected.

5. Their field assembly and internal connection as may be necessary for their proper operation.

6. Their mounting in place including the purchase and installation of all dunnage supporting members and fastening necessary to adapt them to architectural and structural conditions.

7. Their connection to building systems including the purchase and installation of all terminating fittings necessary to adapt and connect them to the building systems.

E. Items which are to be installed but not purchased as part of the work of any of the trades shall be carefully examined by each trade upon delivery to the project. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of work of the trades will be considered only if presented in writing within one week of the date of delivery to the project of the items in question. The work of the trades shall include all procedures, regardless of how extensive, necessary to put into satisfactory operation, all items for which no claims have been submitted as outlined above.

F. Legend:
Plb = Plumbing and Fire Protection

Mech	=	Mechanical
Elec	=	Electrical
Oth	=	Other than electrical or mechanical
s	=	Supply
I	=	Install
p	=	Provide (supply and install)
f	=	Furnish to Owner

Item	Plb	Mec	Elec	Oth	Notes
Motors for packaged mechanical equipment	p	p		p	
Motors for mechanical equipment (pump, fan, etc.)	p	p		p	
Motors controllers for packaged mechanical equipment	s	s	I	s	Furnishing of loose mechanical controllers for HVAC motors to be included in the Electrical Contract
Power wiring for mechanical equipment			p		
Control, interlock and alarm devices	p	p			Complete wiring diagrams and termination points for control and monitoring shall be prepared by mechanical contractor
Control, interlock and alarm wiring for mechanical equipment	p	p			Complete wiring diagrams and termination points for control and monitoring shall be prepared by mechanical contractor
Hoisting and Rigging	p	p	p		
Cutting, chasing & rough patching	p	p	p		Cost where due to late installation or improper coordination of work is the responsibility of the delinquent trade.
Finish patching				p	
Framed slots and openings in walls, decks and slabs				p	Coordination drawings are required from mechanical / electrical trades.
Sleeves through membraned and non-membraned	p	p	p		

Item	Plb	Mec	Elec	Oth	Notes
slabs, decks, and walls.					
Waterproof sealing of sleeves through membraned decks and walls	p	p	p		
Fireproof sealing of excess openings in slabs, decks, & fire rated walls	p	p	p		
Drilling & cutting of all holes in steel decks and precast slabs required for sleeves and supports	p	p	p		
Excavation and backfill inside building (up to 5'-0" outside wall)	p	p	p		
Excavation and backfill outside building			p	p	
Wells or openings in piping for pressure, temperature flow, devices etc.	p	p			Wells and fittings furnished by Temperature Control Subcontractor
Fastenings	p	p	p		
Supports	p	p	p		
Roof vent pipe cap flashing	p	p			
Roof vent pipe base flashing				p	
Roof curb cap flashing	p	p			
Roof curb base flashing				p	
Concrete foundations, pads and bases inside building				p	Furnishing of anchors and vibration mounts included in the mechanical/electrical trades
Concrete foundations, pads and bases outside building			p	p	Furnishing of anchors and vibration building mounts included in the mechanical trade providing the associated equipment
Field touch-up painting of damaged shop coats	p	p	p		
Rust-proofing field cut and	p	p	p		

Item	Plb	Mec	Elec	Oth	Notes
assembled iron supporting frames and racks					
Finish painting of exposed work				p	Primary insulation or coatings are by mechanical/plumbing trades
Ladders to mechanical equipment other than cooling towers				p	Supplying list of locations where required included in mechanical
Ladders to cooling towers		p			
Steel dunnage for cooling towers				p	
Gas service to heating equipment	p				Final piping to connections included in Heating, Ventilation and Air Conditioning Contract
Domestic make-up water piping for Heating, Ventilation and Air Conditioning System	p				Final piping to connections included in Heating, Ventilation and Air Conditioning Contract
Special tools for equipment maintenance	f	f	f		
Temporary power for construction				p	See General Conditions Specifications

PART 2 - PRODUCTS

2.1 If products and materials are specified or indicated on the drawings for a specific item or system, use those products or materials. If products and materials are not listed in either of the above, use first class products and materials, subject to approval of shop drawings.

2.2 All products and materials to be new, clean, free of defects and free of damage and corrosion.

2.3 Ship and store all products and materials in a manner which will protect them from damage, weather and entry of debris. If items are damaged, do not install, but take immediate steps to obtain replacement or repair.

2.4 Ship and store all products and materials in a manner which will protect them from damage, weather and entry of debris. If items are damaged, do not install, but take immediate steps to obtain replacement of repair.

PART 3 - EXECUTION

3.1 Follow manufacturer's instructions for installing, connecting, and adjusting all equipment. Provide one (1) copy of such instructions to the Architect/Engineer before installing any equipment. Provide a copy of such instructions at the equipment during any work on the equipment. Provide all wiring and accessories.

3.2 Use mechanics skilled in their trade for all work.

3.3 Keep all items protected before and after installation. Clean up all debris.

3.4 Perform all tests required by local authorities in addition to tests specified herein, such as life safety system.

3.5 Applicable equipment and materials shall be listed by Underwriters' Laboratories, Factory Mutual and manufactured in accordance with ASME, NEMA, ANSI or IEEE standards, and as approved by local authorities having jurisdiction.

3.6 Deliver to Architect's representative all special tools needed for proper operation, adjustment and maintenance of equipment.

3.7 Prior to final acceptance of project, furnish and deliver to Owner four bound manuals of instructions for operation and maintenance of all pieces of equipment and systems furnished under this Division of Specifications. Manuals to include all submittal data for all equipment. Clearly indicate items furnished on this project. A list giving names and addresses of nearest supply house carrying spare parts for all equipment and verbally instruct owner in such operation in addition to manuals mentioned above. Obtain a letter from Owner stating that manuals and instructions as mentioned above have been given to him. Supply a copy of this letter for Architects/Engineers files.

END OF SECTION

SECTION 16050 - COMMON WORK RESULTS FOR ELECTRICAL

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. The work under this Section shall consist of furnishing all labor, materials, equipment, and appliances necessary and required to furnish and install all basic materials and methods as shown on Drawings and as specified herein.

B. Related Sections include the following:

1. Division 01 Finish Painting.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Catalog Cuts:

1. Submit manufacturer's catalog cuts for the following items:

a. Approved Fire Stop.

b. Raceway.

c. Switch, wiring devices and plate.

d. Equipment supports.

e. Pull Boxes

C. Samples: Cable, wireway and wiring devices as required by the Engineer.

1.4 QUALITY ASSURANCE

A. Electrical Metallic Tubing: Comply with the latest edition of Underwriters' Laboratories Standard UL-797 and American National Standards Institute C80.3.

B. Rigid Conduit: Comply with the latest edition of Underwriters' Laboratories Standard UL-6 and American National Standards Institute C80.1.

C. Flexible Steel Electrical Conduit: Comply with the latest edition of Underwriter's Laboratories Standard UL-1.

D. Liquid-Tight Flexible Electrical Conduit: Comply with the latest edition of Underwriters Laboratories Standard UL-360.

E. Schedule 40, PVC Conduit: Comply with the latest edition of Underwriters Laboratories Standard UL-651.

F. Electrical Wireways, and Associated Fittings: Comply with the latest edition of Underwriters Laboratories Standard UL-870.

G. Electrical Metallic Outlet Boxes: Comply with the latest edition of Underwriters Laboratories Standard UL-514A.

H. Conductors: Comply with American Society of Testing Materials and International Power Cable Engineering Associations.

I. American National Standards Institute, Institute of Electrical and Electronic Engineers, National Electrical Manufacturers Association and Underwriters' Laboratories.

J. 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.

K. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 RACEWAY SYSTEM, SEE 16130

A. Provide raceways for wiring systems. Where non-metallic raceways are utilized, provide sizes as required with the grounding conductor considered as an additional insulated conductor. Provide conduits whose sizes are not noted on the drawings in accordance with the requirements of the National Electrical Code (including required ground conductor), minimum size 3/4 inch.

B. Provide electric metallic tubing manufactured of steel, galvanized on the outside and coated on the inside with a smooth hard finish of lacquer, varnish or enamel. Use steel pressure-connection compression type fittings. Set screw type fittings maybe used for 2 inch or larger.

C. Provide rigid conduit manufactured of hot-dipped galvanized rigid steel. Provide double locknuts and bushing on conduits terminating at outlet boxes, gutters, etc.

D. Provide wireways where indicated on the drawings, of the hinged or screw cover type of sizes indicated or as required by the National Electrical Code for the quantity and size of wires contained within, complete with elbow, tees, connectors, adapters, etc.,

with all parts factory-fabricated and of the same manufacturer. Acceptable wireways are Square D "Square Duct", or Hoffman.

E. Rigid, heavy wall, Schedule 40, polyvinyl chloride (PVC) plastic conduit, suitable for direct burial and Underwriters' Laboratories listed. Acceptable manufacturers are: Arnco Corp., ElecSYS Inc., Raco, Carlon, or Thomas & Betts Corp. Provide offsets and 90 degrees ells of rigid steel plastic coated or painted (2 coats) conduit. Utilize rigid steel conduit bends and elbows where exiting from slab. AFC Cable Systems, Inc.

F. Fittings:

1. Cast or malleable iron, cadmium or zinc-plated, per UL 514B, with tapered threaded hubs and screw attached, stamped metal covers or screw attached, heavy cast metal with gaskets as required for the installation.

2. Polyvinyl chloride to mate and match to conduit type and material per NEMA TC3 for Schedule 40, polyvinyl chloride.

G. Expansion Fittings:

1. Cast or malleable iron, with threaded hubs, metallic pressure packing and copper grounding jumper, allowing a minimum of two inches of conduit movement.

H. Locknuts:

1. Malleable iron or steel, zinc- or cadmium-plated.

I. Bushings:

1. For conduit sizes one inch and smaller, provide flame-retardant, insulating, grounding type; for sizes greater than one inch, provide malleable iron or steel, zinc- or cadmium-plated, grounding type with insulating insert, molded and locked into bushing edge.

J. Tubing:

1. Zinc Coated Steel Tubing per UL 797 and ANSI C80.3.

K. Connectors and Couplings:

1. Zinc-plated steel, pressure-connection compression-type, per UL 514B. Indenter types are not acceptable. Set-screw types may be used on conduit sized two inches or larger only.

L. Flexible Steel Conduit:

1. Maximum length 6 feet, single strip, continuous, flexible interlocked double-wrapped steel, galvanized inside and outside forming smooth internal wiring channel, as manufactured by Adalet, Alflex Corp., Electri-Flex Co. or

Steelflex Electro Corp. Each section of raceway must contain a bonding wire bonded at each end and sized as required, except for lighting fixtures. Provide connectors with insulating bushings.

2. Fittings:
Malleable iron or steel, zinc- or cadmium-plated, clamp type female end and threaded male end with locknut. Set-screw securing type is not acceptable.

M. Liquid-Tight Flexible Electrical Conduit:

1. Same as flexible steel conduit except with tough, inert watertight plastic outer jacket, "Seal-Tite" Type Anamet Inc., Anaconda liquidtight, Electri-Flex Co. or AFC Div., Nortek Inc.

2. Fittings: Cast malleable iron body and gland nut, cadmium plated with one-piece brass grounding bushings which thread to interior of conduit. Spiral molded vinyl sealing ring between gland nut and bushing and nylon insulated throat, as manufactured by Gedney, Appleton, or Thomas & Betts.

N. Intermediate Metal Conduit: Shall be hot dipped galvanized type and also conform to US Standard #1242. All threads are hot dipped galvanized and shall have an acceptable zinc coating.

O. Sleeves through Fire Rated Floors and Walls: Conform to applicable building codes to prevent fire spread. Refer to Architectural Drawings for fire walls.

P. Special Seals: Shall be provided where penetrating floor slab. A malleable iron, watertight entrance sealing device, gland sealing assembly shall be pressure type permitting tightening by wrench after concrete has been poured. Unit to be similar to OZ type FSK of equivalent. Install copper tubing or brass pipe sleeve through the roof. Sleeve shall extend at least 1" below and 2" above roof. Solder 20 oz. copper or 6 lb. lead plate to the sleeve and mount on roof membrane waterproofing. Plate shall extend a minimum of 12" all around from the outside of the sleeve. After conduit is installed, fill space between conduit and sleeve with thermal fiber and seal the top and bottom to a depth of at least 1 1/2" with "Special Condensed" Duxsealer 4951 or other compound as acceptable.

Q. Malleable Iron Watertight Entrance Sealing Device: Shall be provided where conduits penetrate exterior walls. Unit shall be gland sealing assembly on inside and outside of wall of pressure type capable of being tightened with wrench after concrete is poured. Unit is to be similar to OZ type WSK.

2.2 OUTLET, JUNCTION AND PULLBOXES

A. Provide zinc-coated or cadmium-plated sheet steel outlet boxes not less than 4 inches octagonal or square, unless otherwise noted. Equip fixture outlet boxes with 3/8 inch no-bolt fixture studs where required. Where fixtures are mounted on or in an accessible type ceiling, provide a junction box and extend flexible conduit to each fixture. Fit outlet boxes in finished ceilings or walls with appropriate covers, set flush with the

finished surface. Where more than one switch or device is located at one point, use gang boxes and covers, unless otherwise indicated. Sectional switch boxes or utility boxes will not be permitted. Provide Series "GW" (Steel City) tile box, or as accepted, or a 4-inch square box with tile ring in masonry walls which will not be plastered or furred. Where drywall material is utilized provide plaster ring. Provide outlet boxes of the type and size suitable for the specific application.

B. Construct junction or pullboxes not over 150 cubic inches in size as standard outlet boxes, and those over 150 cubic inches the same as "cabinets", with screw covers of the same gauge metal.

C. Plug any open knockouts not utilized.

D. Provide surface mounted outlet and junction boxes indoor area and outdoor locations of cast metal with threaded hubs.

2.3 600 VOLT WIRE AND CABLE, SEE 16120

A. Provide wire with a minimum insulating rating of 600 volts, except for wire used in low voltage (below 50 volts) control of signal systems, use 300 volt minimum or 600 volt where permitted to be incorporated with other wiring systems.

B. Conductor:

1. Electrical grade, annealed copper, and fabricated in accordance with ASTM standards. Number 12 minimum size.

C. Stranding and Number of Conductors:

1. Number 12 and number 10 solid.
2. Cables larger than number 10, stranded in accordance with ASTM Class B stranding designations.
3. Control wires stranded in accordance with ASTM Class B stranding designations.
4. Cables, multi-conductor.

D. Insulation:

1. Type THW or THHN thermoplastic insulation suitable for use in wet locations up to 75 degrees Celsius. Use for lighting, receptacle and motor circuits. Type XHHW for panel and equipment feeders.
2. Type THHN Flame Retardant: Heat resistant thermoplastic insulation, nylon jacket rated for 90 degrees Celsius operation. Use for lighting branch circuit wiring installed and passing through the ballast channels of fluorescent fixtures, wiring in fixture supports metal roof-decks in or near rooftop insulation, in joint spaces or in raceways exposed to the sun.
3. Type XHHW Flame retardant cross linked synthetic polymer suitable for 90 degrees Celsius operation.

4. Type SFF-2: Silicon insulated, braided glass jacket heat-resistant wire suitable for 150 degrees Celsius operation. Use for fixture wiring or any wiring within 3 feet horizontally or 10 feet above any furnace, boiler or similar heating appliance.

E. Type TC: Consisting of color coded copper conductors type XHHW flame and moisture resistant fillers and ozone resisting jacket of either neoprene, PVC or hyphalon.

F. Manufacturers:
1. Pirelli, Cyprus, Phelps-Dodge, Triangle, Anaconda, Kaiser, General Cable, Okonite, Simplex, National Electric Products, Collyer, Kerite, Hatfield, Rome and Canada.

G. Connectors:
1. Make connections, splices, taps and joints with solderless devices, mechanically and electrically secure. Protect exposed wires and connecting devices with electrical tape of insulation or provide insulation values not less than on conductor.

2. Branch Circuit Wires (Numbers 10 and smaller): Use any of the following types of terminals and connecting devices:

a. Hand Applied: Coiled, tapered, spring-wound devices with a Conducting corrosion-resistant coating over the spring steel and a plastic cover and skirt providing full insulation for splice and wired ends. Screw connector on by hand. Manufacturer: "Wing Nut" (Ideal Industries), "Piggy" (Thomas and Betts) or "Switchlok" (3M Company).
b. Tool Applied: Steel cap, with conduction and corrosion resistant metallic plating, open at both ends, fitted around the twisted ends of the wire and compressed or crimped by means of a special dye designed for the purpose. Specifically fitted plastic or rubber insulating cover wrap over each connector.
c. Manufacturer: "Stakon" (Thomas & Betts), "Number 410 Crimp Connector" (Ideal Industries), or "Wrap-Cap" (Buchanan).

3. Larger Cables (Copper Conductors, No. 8 and Larger):
a. Use compression type connectors, taps, and splices specifically designed for the particular connection. Insulate splice either by tapping or by use of "Bakelite" covers designed to fit around splice.
b. Manufacturers: Thomas & Betts, Burndy Engineering Co. Inc, Per fit.

H. Electrical Tape:
1. Specifically designed for use as insulating tape.
2. Manufacturer: Johns-Manville or Minnesota Mining and Manufacturing.

I. Lubricant: Use lubricant only where the possibility of damage to conductor exists. Use only a lubricant designed by the cable manufacturer and one which is inert to cable raceways.

J. Color Code of wire and Cable shall be as follows: Factory color-code wire number 2 and smaller. Wire number 1 and larger may be color-coded by color taping of the entire length of the exposed ends.

3 phase, 4 wire, 277/480v	3 phase, 4 wire, 120/208v	Control wire
Phase A - Brown Phase B - Orange Phase C - Yellow Neutral - White Ground - Green	Phase A - Black Phase B - Red Phase C - Blue Neutral - White Ground - Green	AC Control - Yellow DC Control - Blue Secondary CT - Black Secondary PT - Red

2.4 EQUIPMENT SUPPORTS

A. Support raceways on accepted types of wall brackets, specialty steel clips or hangers, of ceiling trapeze hangers or malleable iron straps.

B. Plumber's perforated straps are not permitted.

C. Do not suspend raceways or equipment from other raceways, steam, water or other piping of ductwork, except as otherwise permitted. Provide independent and secure support methods as shown on the Drawings.

D. Acceptable manufacturers' brackets of hangers are Kindorf, Elcan, Binkley, Multi-Frame, Power-Strut, Globe-Strut or Unistrut.

2.5 SWITCH AND WIRING DEVICES, SEE 16140

A. Local Wall Switch:
1. Provide specification grade, flush mounting, quiet operating AC type, with toggle operator and heat resistant plastic housing. Silver alloy contact. Rated 20A at 277V and capable of full capacity on tungsten of fluorescent lamp load. Design for side or back wiring with up to Number 10 wire. Verified by UL to meet or exceed Federal Specification WS-896E.
2. Use single pole, double pole, 3-way, 4-way, pilot keyed type as indicated on drawings or required.

3. Manufacturers: "1990 Series" (Arrow Hart), "1220 Series" (Hubbell), or "1220 Series" (Leviton). Color as selected by the Architect.

B. Duplex Convenience Receptacle:
1. Provide 3-pole NEMA and American National Standards Institute standard type, with bronze contacts that accept plug with two (2) parallel blades and one (1) grounding blade. Rated 20 amperes at 125-volt electrical alternating currents. Comply with Underwriters' Laboratories Standard 498.
2. Manufacturers: Hubbell (Catalog Number 5262), Arrow-Hart or Leviton.

C. Duplex Receptacle - Ground Fault Interrupter Type:
1. Identical to general purpose duplex receptacle except with solid-state ground-fault sensing and circuit interrupter, Class A, Group 1, per UL 943, and five milliamperes ground-fault trip level.
2. Provide "feed-through" type capable of protecting connected downstream receptacles on a single circuit.
3. Provide shallow depth design to permit installation in a 2 3/4 inch deep outlet box.
4. Manufacturers:
   a. Arrow-Hart Division, Cooper Industries.
   b. Hubbell Inc.: GF-5X62 Series.

D. Cover Plates:
1. Provide cover plates for wall receptacles, outlets, and switches of .040 alloy 302 stainless steel with satin finish. When two of more switches or devices are shown in one location, mount under a common plate.
2. Manufacturers: Arrow-Hart or Leviton.

E. Floor Mounted Service Fittings:
1. Provide flush-type power fitting consisting of brass flush cover suitable for floor box, with duplex threaded opening. Provide brass finish protective rings for use with threaded openings. Provide brass carpet rings.
2. Provide flush-type data/communications fitting consisting of brass flush cover suitable for floor box, with duplex flap opening. Provide brass finish protective rings for use with threaded openings. Provide brass carpet rings.
3. Manufacturers:
   a. Hubbell Inc.
   b. Walker Div., Butler Mfg. Co.

F. Switch and Pilot Light: "Number 1261" (Hubbell) switch with "Number 1375" flush neon pilot light with red jewel.

G. Thermal Switch: Bryant Catalog Number 10003 or equal of Cutler Hammer with heater sized to motor load.

PART 3 - EXECUTION

3.1 RACEWAY SYSTEMS

A. Securely fasten all raceways at intervals and locations required by the National Electrical Code. Install capped bushings on conduits as soon as installed and remove only when wires are pulled.

B. Clean conduits thoroughly and dry inner surfaces before wires and cables are installed. Clean, or replace conduits found to be plugged or dirty.

C. Above Grade: Defined as the area above finished grade for a building exterior and above top surface of any slabs (for other concrete work) on grade for a building interior. Above grade raceways to comply with the following:
1. Install raceways exposed except in finished spaces. Install a minimum of 6 inches from flues, steam pipes, of other heated lines. Provide flashing and counter-flashing for waterproofing or raceways, outlets, fittings etc., which penetrate the roof. Route exposed raceways parallel or perpendicular to building lines with right-angle turns and symmetrical bends. Run concealed raceways in a direct line and, where possible, with long sweep bends and offsets.
2. Provide sleeves in forms for new concrete walls, floor slabs and partitions for passage of raceways. Waterproof sleeved raceways where required.
3. Provide raceway expansion joints with necessary bonding conductor at building expansion joints and where required to compensate for raceway or building thermal expansion and contraction. Terminate raceways 1-1/4 inches and larger with insulated bushings or rain-tight connections with insulated throats.
4. Provide flexible metal conduit in sufficient lengths not exceeding 6 feet for:
   a. Makeup of motor, transformer or equipment, and/or raceway connections where isolation of sound and vibration transmission is required. For connections in locations exposed to weather and in interior locations subject to moisture, and motor connections use watertight flexible conduit.
   b. Connections to recessed lighting fixture.
   c. Provide separate grounding conductor.
5. Provide raceway installation (with appropriate seal-offs, explosion-proof fittings etc.) in all special occupancy areas, as defined and classified in Article 500 of the National Electrical Code, in accordance with that article. Provide conduit seal-offs where portions of an interior raceway system pass through walls, ceilings or floors which separate adjacent rooms having substantially different maintained temperatures.
6. Utilize type of conduit as follows:
   a. Outdoor - RG
   b. Indoor Hazardous Area - IMC
   c. Indoor Non-Hazardous Area - EMT

D. Below Grade: Defined as the area below finished grade for a building exterior and below or within the bottom floor slab for a building interior. Below grade raceways to conform to the following:
1. Project below-grade raceways four (4) inches minimum above the floor or equipment foundation.

2. Install exterior underground conduits 24 inches minimum below finished grade. Do not penetrate waterproof membranes unless proper seals are provided and penetration is approved by the Architect.
3. Utilize type of conduit as follows:
   a. Use rigid galvanized steel 90 degree elbows for conduit turning up above grade or finished floor.
   b. Communication conduit - PVC Schedule 40 with concrete duct bank under the roadway.
   c. Branch wiring for lighting and power - PVC Schedule 40.
   d. Fire alarm wiring to PIV - RG (to protect from lightning).

E. Supporting and Hanging Conduit:
1. Do not support conduit from pipes, hangers, or extension of installation work of other building trades.
2. Support single conduit runs with galvanized ring bolt type hangers with specialty spring clips. Do not use plumbers perforated straps or malleable galvanized iron straps.
3. Support multiple conduit runs with trapeze-type, hot-dipped galvanized steel hangers, galvanized steel conduit straps and minimum 1/2 inch galvanized threaded support rods. Provide 20 percent spare capacity.
4. Install conduit to prevent sagging and formation of water traps.
5. Support conduits on both sides of bends.

F. Connections, Fittings and Couplings:
1. Fasten conduit terminations in sheet metal enclosures by two locknuts, and terminate with bushings. Install locknuts inside and outside enclosure.
2. Where conduit joints occur in concrete slabs, damp or wet locations or exposed to weather, ensure that joints are mechanically tight and sealed against the entrance of water by using a coating of thread lubricant.

G. Spare Conduits:
1. Provide nylon pulling rope, minimum 1/8 inch diameter, in conduits indicated or specified as spare or empty. Provide three feet of slack, in addition to rope the length of each conduit.
2. Seal spare and empty conduits with a conduit cap or plug to which the pulling rope is attached.

3.2 OUTLET, JUNCTION AND PULLBOXES

A. Provide outlet, junction, and pullboxes as indicated on the Drawings and as required for the complete installation of the various electrical systems, and to facilitate proper pulling of wires and cables. J-boxes and pullboxes shall be sized per National Electrical Code minimum.

B. The exact location of outlets and equipment is governed by structural conditions and obstructions, or other equipment items. When necessary, relocate outlets so that when fixtures or equipment are installed, they will be symmetrically located according to the room layout and will not interfere with other work or equipment. Verify final location of outlets, panels. equipment, etc., with the Architect.

3.3 MOUNTING HEIGHT

A. Unless otherwise noted, locate outlets as follows:
1. Heights listed are from finished floor to center of device. Verify exact locations with Contractor before installation.

a. Lighting Switch:
Office Area 4'-0" AFF
Plant Area 4'-6" AFF
or as noted on drawings

b. General Use Receptacle:
Office Area 1'-0" AFF
Plant Area 1'-6" AFF
or as noted on drawings

c. Telephone Outlet:
Office Area 1'-0" AFF
Plant Area 4'-6" AFF
Wall Phone 4'-6" AFF
or as noted on drawings

d. Wall Mounted Fixtures: As shown on drawings.

3.4 WIRE AND CABLES - 600 VOLTS

A. Provide a complete system of conductors in raceway system. Mount wiring through a specified raceway, regardless of voltage application unless specifically noted elsewhere.

B. Branch circuits whose length from panel to furthest outlet exceeds 75 feet for 120 volt circuits or 300 feet for 277 volt circuits, use number 10 or larger.

C. Do not install wire in incomplete conduit runs or until after the concrete work and plastering is completed and moisture is swabbed from conduits. Eliminate splices wherever possible. Where necessary, splice in readily accessible pull, junction or outlet box.

D. Flashover or insulation value of joints to be equal to that of the conductor. Provide Underwriters' Laboratories listed connectors rated at 600 volts for general use and 1,000 volts for use between ballast and lamps or gaseous discharge fixtures.

E. Use terminating fittings, connectors, etc., of a type suitable for the specified cable furnished. Make bend in cable at termination prior to installing compression device. Make fittings tight. Recheck splices and termination and make mechanically and electrically tight during a fifteen (15) day period immediately prior to final acceptance of the work.

F. Install wire in raceways and make up terminations in accordance with manufacturer's recommendations using special washers, nuts, etc., as required. Use an accepted

wire-pulling lubricant equivalent to "Yello" (Ideal) for all wire number 4 and larger. Strip insulation so as to avoid nicking of wire.

G. Extend wire sizing for the entire length of a circuit unless otherwise noted.

3.5 SWITCH AND WIRING DEVICE

A. General:
1. Install devices, used with concealed conduit systems, in single or multiple gang pressed steel boxes with gang plates.
2. Install devices, used with exposed conduit systems, in single or double gang type "FS" or "FD" cast metal boxes.
3. Install devices and wall plate flush and level.

B. Local Wall Switches:
1. Mount switches vertically with the "on" position on top unless noted or specified otherwise.
2. Where switches are indicated to be installed near doors, corner walls, etc., mount same not less than 2 inches and not more than 12 inches from trim. Verify exact location with the Architect.
3. Carefully coordinate the location of switches to insure locations at the strike side of doors.
4. Furnish and install and engraved legend for each switch that controls motors, equipment, systems, etc., not located within sight of the controlling switch.

C. Convenience Receptacles:
1. Unless otherwise noted, mount receptacle vertically with U-shaped ground position at bottom.

D. Toilet and Outdoor Locations:
1. Receptacles located outdoors, toilets and where indicated to be GFI receptacles or protected by GFI circuit breaker.
2. Protect exterior receptacles by a cast brass metal plate with a stainless steel spring-loaded, gasket lift cover to remain locked in either open or closed position.

E. Floor Mounted Service Fittings:
1. Set floor box level and flush with finish flooring material.
2. Use cast iron floor boxes for installation in slab on grade.

3.6 EQUIPMENT SUPPORTS

A. Provide structural supports for the proper attachment of electrical equipment, and fixtures.

B. Mount wall-mounted equipment directly to wall by means of steel bolts. Maintain at least 1/4 inch air space between equipment and supporting wall. Mount groups or arrays of equipment on adequately sized steel channels, such as those manufactured by Kindorf, Unistrut, and Globestrut.

C. Support equipment suspended from ceiling by adjustable threaded steel rods of adequate diameter and strength anchored to the structural steel, as shown on the drawings and as required. Support auxiliary steel, if required, from the building steel. Do not secure hangers to furred ceilings, ductwork, or other piping.

D. Secure equipment and steel to solid masonry by means of screw and bolt anchors and expansion bolts. On structural steel use clamps that do not depend primarily on set-screw pressure for security.

E. Mount lighting fixtures rigidly, with no "rocking" action. Support fixtures as shown on the drawings and in accordance with local building and electrical codes.

F. Do not drill or pierce structural steel members without prior approval.

G. Where outlets are installed in steel stud type systems, provide additional cross bracing, bridging, and/or straps to make the outlet completely rigid prior to the application of the wall facing material.

3.7 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.8 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 "Penetration Firestopping."

END OF SECTION 16050

SECTION 16120 -LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL – County Standard Network Specification – Revised 10/13/2023

1) Network devices
    a. Ethernet switches and routers **(Owner Provided, Contractor Installed)**
        i. All construction, remodel, or expansion projects shall include a VoIP-capable gigabit router and/or switch as needed. Please contact IT for details on specific ordering information.
        ii. Ethernet copper speeds of 10/100/1000 are mandatory for any user-facing switch ports. Additional network speeds may be specified as needed.
        iii. Switch
            1. The basic model type for all new facilities is a single Cisco Catalyst 9300 with UPOE (see section 2 for more information) for smaller and medium installations.
            2. Multiple Cisco 9300 switches arranged in a stack configuration may be used for closets requiring more than 48 ports.
            3. Larger locations may call for a Cisco modular switch. The basic model type for larger locations shall be the Catalyst 9400 with UPOE line cards.
            4. Any site requiring a different device will be evaluated on a case-by-case basis.
            5. If the specified switch or switch stack is purchased for use as a Layer 3 switch, the appropriate Layer 3 routing license add-on(s) shall be purchased.
                a. The Layer 3 routing license add-on(s) specified shall enable full OSPF and/or EIGRP routing capabilities.
            6. DNA Advantage and/or Network Advantage licensing shall be purchased with the switch.
            7. Any switch with the ability to house a redundant power supply and/or fan module shall be ordered with all possible redundant power supplies and/or fan modules.
            8. Any stackable switch intended for use in a stack shall be ordered with all required StackWise and/or StackPower cables.
        iv. Router
            1. The basic model type (if a router is required) for all new facilities is the Cisco 4xxx/K9 router, sized and licensed appropriately for throughput and features.
        v. All networking devices purchased shall be purchased with at least 3 years of Cisco SNT SmartNet (8x5xNBD) support, or 3 years of SNTP SmartNet (24x4x365) for critical components.
    b. Power over Ethernet (PoE)

i. Power over Ethernet (PoE+ or UPOE) is mandatory for any user-facing switch ports. Additional PoE standards may be specified as needed.
ii. PoE shall conform to applicable standards, including but not limited to IEEE 802.af, IEEE 802.3at Type 1, IEEE 802.3at Type 2, IEEE 802.3bt Type 3, and IEEE 802.3bt Type 4.
iii. Any additional network device requiring PoE, including but not limited to IP cameras or DVRs, shall be figured into the PoE capacity sizing for the network switches.

c. VoIP **(Owner Provided and Owner Installed)**
i. If this is a new facility requiring new Cisco VoIP phones, Cisco VoIP phones and licenses must be purchased, and additional consultant's fees may be needed to bring up the facility with the county's central Cisco VoIP phone system. Contact IT for details.
ii. The total number of VoIP phones needed for a project shall be figured into the PoE capacity sizing for the network switches.

d. Wireless infrastructure (WiFi) **(Owner Provided, Contractor Installed)**
i. Since wireless standards change so quickly, this document will be adjusted on at least a yearly basis.
ii. For calendar year 2023, the standard for new-installation internal access points is:
1. Cisco Aironet 9120 series for medium-density indoor deployments
a. These radios require 802.3bt UPoE for full functionality. Please size switch accordingly.
2. Cisco Aironet 9130 series for high-density indoor deployments
a. These radios require 802.3bt UPoE for full functionality. Please size switch accordingly.
3. For outdoor deployments, the access points will be specified on a case-by-case basis
iii. Any access point purchased will be a model that supports Cisco CleanAir air quality sensing capability.
iv. All access points will be purchased with an additive license for the applicable Cisco Wireless controller, either singly or in a package as needed.
v. The total number of access points needed for a project shall be figured into the PoE capacity sizing for the network switches.

2) Infrastructure
a. Access control
i. All designated wiring closets, IDFs, or MDFs shall have an access control method on its door(s), including but not limited to: push-button lock, swipe-card reader, contactless RF device reader, or biometric device.
ii. All rooms mentioned above shall have a method to detect, and generate an alarm, if the access-controlled door is propped open or fails to close completely.

b. Shared space
    i. All designated wiring closets, IDFs, or MDFs shall be designated as non-shared space, with the idea being that these devices will not share space with janitorial supplies, cooking utensils, general storage, or similar things.
c. Fire suppression
    i. All designated wiring closets, IDFs, or MDFs shall have a method of fire suppression of a HALON-type or "Clean Agent" type and not a water sprinkler if at all possible.
d. Climate control
    i. Any location requiring the installation of active electronic devices (switches, routers, firewall, UPSs, DVRs, servers, etc) shall be evaluated for the projected total thermal load created by such devices, and appropriate climate control measures shall be installed, including but not limited to: passive venting, active venting, dedicated thermostat, or dedicated air conditioning system.
    ii. The room shall not be configured so that it receives active heating during the winter months, unless the temperature in said room is reasonably projected to fall to or below freezing.
e. Copper wiring
    i. The basic copper wiring type for all new work shall be Cat6A UTP. This requirement may be waived or modified on a per-situation basis, for reasons including but not limited to:
        1. Interoperability with existing cabling infrastructure
        2. Need for greater throughput
        3. Space considerations in existing conduit
    ii. All wiring termination shall be consistent in manufacturer from end-to-end so as to be eligible for the 25 year warranty.
    iii. All terminations shall be 25-year certified and installed by a technician certified in the manufacturer's installation and terminate requirements so as to qualify for the 25-year warranty.
    iv. No networking hardware shall be residential-grade, unless there is no difference between the enterprise/commercial grade hardware and residential-grade hardware.
    v. Data terminations shall be made on standard single Category 6A RJ-45 8 position jack with a minimum of 50 micro inches of gold surface plating on the contact wires and plugs. The County currently prefers Panduit Minicom Modules.
    vi. Wiring standard for Category 5e/6/6A wiring termination is T568B.
    vii. The following tests shall be run on all installed copper networking (Cat 5E, 6, 6A, etc) data runs.
        1. Testing shall be end to end, patch panel to jack including patch cables. (Total run length not to exceed 100 meters).
            a. Wire Map
            b. Length

c. Insertion Loss
d. NEXT Loss
e. PS NEXT Loss
f. ACR-F Loss
g. PS ACR-F Loss
h. Return Loss
i. Propagation Delay
j. Delay Skew

2. Test results shall be presented in an Excel spreadsheet, version 5.0 or greater, detailing cable port location (building, closet etc.) and all requested test data for the run.

f. Cable routing
   i. All cables shall be brought to the wiring rack or enclosure and terminated to a patch panel appropriate for the type of cable.
   ii. No cables shall be run directly from the wall, cable chase, or conduit to the network equipment.
   iii. Wiring to all outlets to run above the ceiling shall be fastened to the building structure at 4 - 5 foot intervals through the combined use of, but not limited to, J hooks, beam clamps, D-rings, and hangers.
   iv. At no time are voice or data drops/homeruns to be directly secured to the building structure above ceiling without the use of cable supports.
   v. Cabling above ceiling shall be sectioned off, bundled and tied, and routed back to intermediate or master wiring closets using a star configuration.
   vi. All wiring shall run continuously from the outlet to the wiring closet without breaks or splices. Cable supports shall be employed every 4 - 5 feet. Cable supports (J Hooks etc.) shall be sized 50% larger than needed to allow for future growth.
   vii. Cable pulling tension shall not exceed 110N (25lbf) for UTP horizontal four pair cables.
   viii. Copper cabling (Cat 5E, 6, 6A, etc) shall have a minimum two (2) foot service loop for each cable above ceiling. Service loop is to be neatly dressed and secured.
   ix. Copper cabling patch panel terminations shall maintain cable jacket and twist a minimum of one half inch from point of termination.
      1. End station terminations shall maintain cable jacket and twist up to the edge of the jack housing.
      2. Dust caps must always be used to provide pair protection and strain relief.

g. Wiring type
   i. Category 6A UTP is considered the bare minimum, unless specified otherwise

ii. Consideration: Cat6A is thicker than Cat 5, 5e, or 6. Ensure that conduits are sized accordingly.
iii. Wiring jacket color is to correspond to the jack attached to it, so that a white jack will have white cable run to it.

h. Patch panels
i. Leviton Quickport eXtreme 6+ snap-in jacks
ii. For any number of drops exceeding 11 installed in a single patch panel, the standard is to use a 48-position patch panel.
iii. Use either Leviton 4S255-Q48 or 4S255-Q24 high-density patch panels, or their successor model numbers having equivalent traits.

i. Wall plates
i. Leviton Quickport compatible wall plates
ii. 3 jacks per wall plate: blue, white, and gray.
iii. Jacks shall be labeled by affixing a unique number to the wall plate; this number will apply to all jacks, so that for faceplate "1" there will be a "Blue-1", a "White-1", and a "Gray-1", with corresponding numbers being applied to the patch panel ports.

j. Wireless access point jacks
i. All runs servicing a wireless access point shall consist of two Cat6A runs (white and blue, labeled as described above), each terminating in a jack in a common faceplate mounted to the ceiling and/or ceiling tile close to the access point's desired location. The faceplate shall be labeled with the jack number.

k. Fiber
i. The basic fiber type for all runs shall be at least 6-pair single-mode fiber. Different fiber types or pair counts may be specified as needed.
ii. All fiber drops shall be terminated in LC-female style connectors at both ends, unless specified otherwise.
iii. The fiber patch panel shall be clearly labeled with the location of the termination of the far end and the fiber type (OM4, single mode, multimode, etc).
iv. Optical fiber connecting hardware shall be installed to provide well-organized installation and cable management and always in accordance with manufacturer's guidelines.
v. Fiber optic cable service loops shall be provided at all fiber termination points. Wiring closet loops shall be a minimum of 15ft. End termination or main termination point loop is to be a minimum of 30ft.
vi. Splice trays must be enclosed and protect all fiber splices.
vii. All inside distribution and outside plant fiber cabling must be strain relieved to hinder the possibility of breakage and connection failure.
viii. The use of inner duct is mandatory in ALL situations where fiber is being installed. Buried or aerial fiber optic cable must be approved and designed to specific standards intended for aerial or buried

application. In general, all fiber must run in inner duct to its termination point (fiber patch panel).

ix. Testing is to be end to end with all terminations and splices involved for each strand tested.
    1. OTDR, Both directions.
    2. Test results shall be presented in an Excel spreadsheet, version 5.0 or greater, detailing cable detailing cable port, location (building, closet etc.) length and attenuation in dB.
    3. Additionally, each test is to include a graphical representation of the test, measurement results, and cable information and set up parameters. The following standards will be used:
        a. ANSI/TIA/EIA-455-59A, Measurement of Fiber Point Discontinuities Using an OTDR.
        b. ANSI/TIA/EIA-455-60A, Measurement of Fiber or Cable Length Using an OTDR.
        c. ANSI/TIA/EIA-455-61A, Measurement of Fiber or Cable Attenuation Using an OTDR.
        d. ANSI/TIA/EIA-526-7, Optical Power Loss Measurements of Installed Singlemode Fiber Cable Plant.
        e. ANSI/TIA/EIA-526-14-A, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant.

3) Power protection
    a. Single-phase loads
        i. 1 x APC rack-mount UPS (dual-conversion or double-conversion model only), sized appropriately for the intended load.
            1. As of calendar year 2020, APC offers the Easy UPS On-Line, Smart-UPS On-Line, and Symmetra as dual-conversion units.
                a. Smart-UPS On-Line and Symmetra UPS units shall be purchased with AP9631 monitoring card or the equivalent built-in management card.
                b. Easy UPS On-Line UPS units shall be purchased with the APV9602 monitoring card.
            2. UPS up to 3kVA servicing a 120VAC load shall be operated from a 120VAC outlet sized appropriately for the current draw of the purchased unit.
            3. UPS larger than 3kVA shall be operated from a 208VAC outlet unless specifically needed otherwise, with a step-down PDU if needed.
        ii. 1 x APC AP9625 two-post adapter for two-post telco style rack applications.
        iii. 1 x Hubbell MCCPSS19 horizontal 20A PDU
    b. Three-phase loads
        i. Locations requiring 3-phase power protection shall
4) Racks and power delivery
    a. Wiring rack
        i. For wall-mount applications

1. Hoffman EWMW2424340 telco rack with dual hinges or Middle Atlantic Products DWR-12-22PD rack.

ii. For floor-mount applications
1. If a 2-post open rack is needed
a. CPI 55053-703 telco rack
b. CPI 10250-712 12" ladder rack to run cables to the rack
c. CPI 11421-712 12" wall angle kit
d. CPI 10595-712 rack mounting plate
e. If multiple telco racks are used and one or more do not have a ladder rack tying them to the wall, use the CPI 12407-719 rack bracing kit.
2. If a 4-post enclosed rack is needed
a. Tripp Lite SR42UBDPWD or equivalent

iii. Rack(s) will be tied to earth ground in a manner consistent with local electrical code.

b. Cable management
i. 4 x Panduit WMPVF45-E vertical cable management trays (for floor-mount racks only)
ii. 2 x Panduit NMF-2 or NMF-3 horizontal cable management trays, depending on size of cable bundle to manage

c. Backboard
i. IT/wiring closet shall be provided with at least one wall-mounted sheet of 4'x8' fire-retardant plywood backboard
ii. Backboard will have mounted on it a grounding strip tied to earth ground in a manner consistent with local electrical code.

d. Power outlets
i. At least 4 x 20A 120VAC and/or 1 x 30A 208VAC outlets to power UPS and other backboard-mounted devices.
ii. Alternate and/or supplemental power feeds of differing voltages and/or current capacities may be specified as needed.
iii. Outlets shall be fed with generator power if applicable.

END OF SECTION 16120

SECTION 16130 - RACEWAY AND BOXES 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 raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible nonmetallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1. Custom enclosures and cabinets.
2. For handholes and boxes for underground wiring, including the following:

    a. Duct entry provisions, including locations and duct sizes.
    b. Frame and cover design.
    c. Grounding details.

d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
e. Joint details.

C. Coordination Drawings: Conduit routing 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. Structural members in the paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

D. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Qualification Data: For professional engineer and testing agency.

F. Source quality-control test reports.

1.5 QUALITY ASSURANCE

A. 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.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. 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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.

C. Rigid Steel Conduit: ANSI C80.1.

D. Aluminum Rigid Conduit: ANSI C80.5.

E. IMC: ANSI C80.6.

F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

G. EMT: ANSI C80.3.

H. LFMC: Flexible steel conduit with PVC jacket.

I. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Steel or die-cast, set-screw or compression type.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

J. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

A. 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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corporation.

4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

C. ENT: NEMA TC 13.

D. RNC: NEMA TC 2**,** Type EPC-40-PVC**,**]unless otherwise indicated.

E. LFNC: UL 1660.

F. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

G. Fittings for LFNC: UL 514B.

2.3 METAL WIREWAYS

A. 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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

C. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type [**1**] [**12**] [**3R**], unless otherwise indicated.

D. Fittings and Accessories: Include 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.

E. Wireway Covers: Screw-cover type or as indicated.

F. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS

A. 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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.

C. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.

D. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

E. Fittings and Accessories: Include 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.

2.5 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.

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. Thomas & Betts Corporation.
b. Walker Systems, Inc.; Wiremold Company (The).
c. Wiremold Company (The); Electrical Sales Division.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.

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. Butler Manufacturing Company; Walker Division.
b. Enduro Systems, Inc.; Composite Products Division.
c. Hubbell Incorporated; Wiring Device-Kellems Division.
d. Lamson & Sessions; Carlon Electrical Products.
e. Panduit Corp.
f. Walker Systems, Inc.; Wiremold Company (The).
g. Wiremold Company (The); Electrical Sales Division.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. 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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

C. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

D. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

F. Metal Floor Boxes: Cast or sheet metal, fully adjustable, rectangular.

G. Nonmetallic Floor Boxes: Nonadjustable, round.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

J. Hinged-Cover Enclosures: 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. Nonmetallic Enclosures: Plastic

K. 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 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.

1. Color of Frame and Cover: Gray
2. Configuration: Units shall be designed for flush burial and have integral closed bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC."
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

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:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. Armorcast Products Company.
    b. Carson Industries LLC.
    c. CDR Systems Corporation.
    d. NewBasis.

C. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.

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:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. Armorcast Products Company.
    b. Carson Industries LLC.
    c. Christy Concrete Products.

d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.

2.8 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.9 SLEEVE SEALS

A. 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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Carbon steel Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.10 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 a 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 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit.
2. Concealed Conduit, Aboveground: Rigid steel conduit.
3. Underground Conduit: RNC, Type EPC-40 PVC, direct buried.
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.
6. Application of Handholes and Boxes for Underground Wiring:

    a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
    b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.
    c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT or RNC.
2. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
    a. Electrical rooms.
    b. Mechanical rooms.

3. Concealed in Ceilings and Interior Walls and Partitions: EMT or RNC.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.

5. Damp or Wet Locations: Rigid steel conduit.

C. Minimum Raceway Size: 1/2-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.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits in contact with concrete.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

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. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

E. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

F. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

G. 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.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.

H. 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.

I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

J. 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.

K. Raceways for Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet
2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway 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.

L. Install raceway sealing fittings at suitable, approved, and accessible locations 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 at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

M. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures**,** 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.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

N. 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.

O. Set metal floor boxes level and flush with finished floor surface.

P. 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 Division 31 Section "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Division 31 Section "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 Division 31 Section "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, placing them 24 inches o.c. Align planks along the width and along the centerline of conduit.

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 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 the enclosure.

E. 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 INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.8 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 16130

SECTION 16140 - 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. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Receptacles with integral surge suppression units.
4. Wall-box motion sensors.
5. Isolated-ground receptacles.
6. Hospital-grade receptacles.
7. Snap switches and wall-box dimmers.
8. Solid-state fan speed controls.
9. Wall-switch and exterior occupancy sensors.
10. Communications outlets.
11. Pendant cord-connector devices.
12. Cord and plug sets.
13. 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. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

1.7 EXTRA MATERIALS

A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Floor Service Outlet Assemblies: One for every 10 but no fewer than one.

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. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5351 (single), 5352 (duplex).
b. Hubbell; HBL5351 (single), CR5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5381 (single), 5352 (duplex).

B. Hospital-Grade, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement SD.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 8300 (duplex).
b. Hubbell; HBL8310 (single), HBL8300H (duplex).
c. Leviton; 8310 (single), 8300 (duplex).
d. Pass & Seymour; 9301-HG (single), 9300-HG (duplex).

C. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; CR 5253IG.
b. Leviton; 5362-IG.
c. Pass & Seymour; IG6300.

3. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

D. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; TR8300.
b. Hubbell; HBL8300SG.
c. Leviton; 8300-SGG.

d. Pass & Seymour; 63H.

3. Description: Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; GF20.
b. Pass & Seymour; 2084.

C. Hospital-Grade, Duplex GFCI Convenience Receptacles, 125 V, 20 A: Comply with UL 498 Supplement SD.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; HGF20.
b. Hubbell; HGF8300.
c. Leviton; 6898-HG.
d. Pass & Seymour; 2091-SHG.

2.4 TVSS RECEPTACLES

A. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 1449, with integral TVSS in line to ground, line to neutral, and neutral to ground.

1. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 volts 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. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5362BLS.
b. Hubbell; HBL5362SA.

c. Leviton; 5380.

3. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.

C. Isolated-Ground, Duplex Convenience Receptacles:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; IG5362BLS.
b. Hubbell; IG5362SA.
c. Leviton; 5380-IG.

3. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

D. Hospital-Grade, Duplex Convenience Receptacles: Comply with UL 498 Supplement SD.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 8300BLS.
b. Hubbell; HBL8362SA.
c. Leviton; 8380.

3. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.

E. Isolated-Ground, Hospital-Grade, Duplex Convenience Receptacles:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; IG8300HGBLS.
b. Hubbell; IG8362SA.
c. Leviton; 8380-IG.

3. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Comply with UL 498 Supplement SD. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.5 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; L520R.
b. Hubbell; HBL2310.
c. Leviton; 2310.
d. Pass & Seymour; L520-R.

B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; IG2310.
b. Leviton; 2310-IG.

3. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.6 PENDANT CORD-CONNECTOR DEVICES

A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.

1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.7 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.8 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Pilot Light Switches, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221PL for 120 V and 277 V.
b. Hubbell; HPL1221PL for 120 V and 277 V.
c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
d. Pass & Seymour; PS20AC1-PLR for 120 V.

3. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221L.
b. Hubbell; HBL1221L.
c. Leviton; 1221-2L.
d. Pass & Seymour; PS20AC1-L.

3. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 1995.
b. Hubbell; HBL1557.
c. Leviton; 1257.
d. Pass & Seymour; 1251.

F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 1995L.
b. Hubbell; HBL1557L.
c. Leviton; 1257L.
d. Pass & Seymour; 1251L.

2.9 OCCUPANCY SENSORS

A. Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 6111 for 120 V, 6117 for 277 V.
b. Hubbell; WS1277.
c. Leviton; ODS 10-ID.
d. Pass & Seymour; WS3000.
e. Watt Stopper (The); WS-200.

3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft.

B. Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; AT120 for 120 V, AT277 for 277 V.
b. Leviton; ODS 15-ID.

3. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft..

C. Long-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; ATP1600WRP.
b. Leviton; ODWWV-IRW.
c. Pass & Seymour; WA1001.
d. Watt Stopper (The); CX-100.
e. <**Insert manufacturer's name; catalog number.**>

3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft.

D. Long-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; ATD1600WRP.
b. Leviton; ODW12-MRW.
c. Watt Stopper (The); DT-200.

3. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft.

E. Wide-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; ATP120HBRP.
b. Leviton; ODWHB-IRW.
c. Pass & Seymour; HS1001.
d. Watt Stopper (The); CX-100-3.

3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft.

F. Exterior Occupancy Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Leviton; PS200-10.
b. Watt Stopper (The); EW-100-120.
c. <**Insert manufacturer's name; catalog number.**>

3. Description: Passive-infrared type, 120/277 V, weatherproof, adjustable time delay up to 15 minutes, 180-degree field of view, and 110-foot detection range. Minimum switch rating: 1000-W incandescent, 500-VA fluorescent.

2.10 COMMUNICATIONS OUTLETS

A. Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 3560-6.
b. Leviton; 40649.

3. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.

B. Combination TV and Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 3562.
b. Leviton; 40595.

3. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e; and one Type F coaxial cable connector.

2.11 WALL PLATES

A. Single and combination types to 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 stainless steel
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in "wet 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, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, die-cast aluminum with satin finish.

D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Blank cover with bushed cable opening.

2.13 MULTIOUTLET ASSEMBLIES

A. 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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Incorporated; Wiring Device-Kellems.
2. Wiremold Company (The).

C. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

D. Raceway Material: Metal, with manufacturer's standard finish.

E. Wire: No. 12 AWG.

2.14 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate 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.
2. TVSS Devices: Blue.
3. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. 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 the 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 just 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 pigtails.
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 all devices that have been in temporary use during construction or that show signs that they 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 pigtails 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, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails 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 left.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

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.

3.2 IDENTIFICATION

A. Comply with Division 16 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.
3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED 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 not acceptable.
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. The 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.

END OF SECTION 16140

SECTION 16195 - 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.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 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. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on a white background.
2. Legend: Indicate voltage.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. 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.

F. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4-inch-wide black stripes on 10-inch centers diagonally over orange background that extends full length of raceway or duct and is 12 inches wide. Stop stripes at legends.

G. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

2.2 ARMORED 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 a white background.
2. Legend: Indicate voltage.

C. 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.

D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

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. 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.

C. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands: 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.

2.4 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.

B. 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.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inche long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.5 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical 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

2.6 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

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. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - First subparagraph below applies to OSHA requirements for building operations and does not reflect the clear working space required by NFPA 70.
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.7 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

D. 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.

2.8 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.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 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. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

H. 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.

I. 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 exceeds 16 inches overall.

J. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. 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.

B. 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 Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit 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. 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.

C. 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.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

D. 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.

E. 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.

F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels**.**

1. Comply with 29 CFR 1910.145.
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.

G. 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.

H. 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: Engraved, laminated acrylic or melamine label 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 self-adhesive, engraved, laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets.
   c. Access doors and panels for concealed electrical items.
   d. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
   e. Substations.
   f. Enclosed switches.
   g. Enclosed circuit breakers.
   h. Enclosed controllers.
   i. Contactors.
   j. Remote-controlled switches, dimmer modules, and control devices.
   k. Monitoring and control equipment.

END OF SECTION 16195

SECTION 16230 - ENGINE GENERATORS

PART 1 - GENERAL

1.1 SUMMARY

Provide packaged electric generating plant for standby service.

1.2 REFERENCE STANDARDS

A. ANSI/NEMA MG 1 - Motors and Generators.

B. NFPA 70 - National Electrical Code.

C. NFPA 99 - Health Care Facilities.

1.3 SUBMITTALS PRIOR TO MANUFACTURE

A. Product Data. Submit brochures on engine, remote radiator, sound enclosure, muffler, battery, battery charger, control panel, remote alarm annunciator panel, load bank and any accessory equipment showing ratings, construction features, and performance characteristics. Indicate fuel consumption at full load.

B. Dimensional Drawings. Submit dimensional drawings of packaged unit and any separately mounted accessory equipment such as batteries and charger, load bank and remote alarm annunciator panel. Include weight of the packaged unit.

C. Electrical Diagrams. Submit schematic and wiring diagrams of the electrical system showing all factory wiring and clearly indicating all wiring and connections to be made in the field. Include internal wiring diagrams of any packaged controllers. Indicate wattage and voltage of any electrical strip heaters. Also submit fully detailed interconnection drawings indicating each individual connection to any remote equipment, including a separate connection drawing to show point-to-point electrical wiring connections.

D. Mechanical and Piping Diagrams. Submit detailed drawings showing all ductwork and piping connections to be made in the field. Indicate sizes and point-to-point piping connections between unit and remote equipment.

1.4 SUBMITTALS AFTER MANUFACTURE

A. Factory and Field Tests. Submit three copies of each factory and field test report on the actual packaged electric generating plant provided, indicating results for all tests described herein.

B. Operation and Maintenance Manuals. Two weeks prior to final inspection, deliver manufacturer's operation and maintenance manuals pertaining directly to the unit provided. Bind each set in a substantial binder, with each item properly indexed. Include the following information:

1. Project record drawings clearly indicating operating features and including as-built shop drawings, outline drawings, and schematic and wiring diagrams.
2. Instructions for erection, alignment including tolerances, and preparation for use.

3. Complete description of safety equipment, safety procedures and safety precautions.
4. Starting, normal running, emergency, and shutdown procedures.
5. Normal maintenance, inspection and lubrication procedures.
6. Recommended spare parts list.

1.5 WARRANTY

Provide manufacturer's written 1-year warranty for complete genset assembly.

1.6 TRAINING

Formal training for the operation and maintenance of all packaged electric generating plant equipment and each system specified herein shall be given by factory trained and certified personnel. The training shall consist of a minimum of four 4-hour training sessions. The timing of the training should coincide with the schedule for the manufacturer's representatives to be on site for testing and start-up of the systems. The specified training shall be given at a location designated and provided by the Owner for a minimum of 10 personnel selected by the Owner, in addition to any necessary on-site orientation and training. A training program shall be submitted with material, instructors' qualifications, and proposed schedule, a minimum of 60 days prior to the proposed training. The Owner reserves the right of approval of any training course, material, instructor and schedule. A minimum of 12 bound copies of training material shall be provided at the time of training, with four additional copies submitted at the time of Substantial Completion included in the Owner's Manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURER

Acceptable manufacturers include Generac Industrial Power.

2.2 DESCRIPTION

Provide a complete, packaged, diesel engine-electric generator with a remote radiator which is aligned on a single skid-type base. Make the packaged system of new, unused equipment of the manufacturer's latest design. Include all necessary instruments, devices, switches, and other appurtenances for proper operation of the unit. Supply steel safety guards around all external rotating parts. Provide a unit on which adjustments, repairs and normal maintenance are possible without the use of special tools. Provide an overall, sound attenuating housing as further described in this section. The supplier will be responsible for the proper performance of the complete unit and support systems. Transition time from the instant of failure of the normal power source to the generator source shall not exceed 10 seconds as required by NEC paragraph 700-6(b)(1).

2.3 ENGINE

A. Type. Provide a stationary, liquid-cooled, full diesel, compression ignition engine, either naturally aspirated or turbocharged. Supply a unit suitable for operation on No. 2 diesel fuel oil.

B. Rating. Provide an engine with brake horsepower not less than 10 percent greater than required by the full load rating of the generator, including losses, and with all accessories attached.

C. Speed. Make engine speed suitable for direct connection to the generator without exceeding engine manufacturer's published curves. Speed must not exceed 10 rpm. Provide

governor of the full hydraulic type, Woodward EGP3 with a 2301A speed controller or an approved substitution, to maintain frequency stability of any constant load, including no load, within plus or minus 1/4 percent, and to maintain frequency regulation between no load steady-state and full load steady-state within 3 percent.

D. Accessories. Provide all accessories, devices and appurtenances necessary for proper operation, including but not limited to the following:

1. Lubrication System.
   a. Positive displacement mechanical lube oil pump.
   b. Full flow replaceable element oil filter.
2. Air System. Replaceable dry element air intake filter.
3. Starting System.
   a. Heavy-duty, battery-driven electric starter motor.
   b. Fully charged, lead-calcium, impact-resistant, plastic-cased, storage battery or batteries mounted on the unit or in a separate corrosion-proof rack near the unit. Make battery capacity sufficient for four cranking cycles at firing speed of 30 seconds duration each with 15-second rest periods. Provide all battery cables, connections, electrolyte, water and a hydrometer.
   c. Static, solid-state type battery charger unit which automatically controls the charge rate. Include a charging rate ammeter, a voltmeter, and a manual reset, thermal overload circuit breaker to protect the rectifier assembly and transformer. Select a charger suitable for operation at 120 volts, single phase, 60 hertz. Make charging time be 24 hours maximum. Mount charger on unit, using adequate vibration devices.
   d. Engine-driven alternator with full-wave rectifier and transistorized voltage regulator for charging battery when engine is running.
4. Coolant System. Closed, liquid coolant system complete with radiator, fan, coolant manifold, coolant expansion chamber (overflow tank), temperature control valve, and engine-driven coolant circulating pump. Provide a thermostatically controlled, corrosion-resistant, 120-volt a-c, engine jacket coolant heater with leads brought out to a screw terminal block and suitably identified. Fill the system with engine coolant which is a solution of at least 50 percent ethylene glycol in water.

4. Coolant System. A remote-mounted radiator, suitable for outdoor mounting, sized in accordance with the engine supplier's recommendation for 105°F ambient. It shall include an electric motor-driven fan, fan shroud, fan core guard, surge tank, and filler with pressure cap. If the horizontal or vertical distance between the engine and the radiator, as shown on the plans, exceeds the engine manufacturer's maximum limit, a properly coordinated heat exchanger or hot well tank and auxiliary circulating pump shall be supplied. Power for the radiator fan shall be provided by the generator along with the motor starter and necessary controls. All interconnecting wiring and conduit is to be included. All piping connections should be flexible. Isolation valves on all radiator lines shall be full port. All coolant required for a completed fully-piped system shall be included. Thermostatic controls for the jacket and intercooler system shall be included. The following are the maximum permissible sound pressure levels allowed 3 feet below the fan ring of each remote radiator in free field conditions.

Octave Band Center Frequency, Hz	63	125	250	500	1000	2000	4000	8000
Max. Sound Pressure Level, dB re 10^{-12} watts	97	97	98	96	93	90	85	69

5. Exhaust System. High degree, critical-rated muffler with maximum silencing capacity mounted horizontally on top of unit. Include an 18-inch length of flexible stainless steel exhaust tubing for mounting on outlet side of muffler. Provide exhaust condensation trap and a rain cap on exhaust end of tubing. The generator engine exhaust, with the muffler in place, shall have the following maximum permissible sound pressure levels:

Octave Band Center Frequency, Hz	63	125	250	500	1000	2000	4000
Max. Sound Pressure Level, dB re 10^{-12} watts	71	62	88	74	74	72	70

6. Fuel System.
   a. Engine-driven, self-priming fuel injection pump suitable for injecting fuel from the day tank to the engine.
   b. Day tank with float switch mounted in skid base of unit and having a minimum capacity for operating unit at full load for 1-1/2 hours.
   c. Full flow replaceable element fuel filter.
   d. Flexible fuel connection lines between day tank and engine.
   e. Check valve in fuel line at day tank to prevent fuel line from emptying back into tank.
   f. Tank shall be tank-in-tank construction. Interstitial space shall have a fuel sensor to detect a leak in the inner tank. The alarm shall be on the remote alarm panel.

7. Field Connections. Flanges for all field connection shall be flush with the surface of the acoustical enclosure. No field connections are to be made inside the enclosure. All mechanical flex connectors between the enclosure and field piping are to be provided by the manufacturer.

2.4 GENERATOR

A. Type. Furnish a direct-coupled, synchronous, brushless-type generator with amortisseur windings, revolving field P.M.G., exciter, 2/3 pitch built-in static rectifier and automatic voltage regulator.

B. Rating.

1. Voltage. 208/120Y, three phase, four wire, grounded neutral.
2. Frequency. 60 hertz.
3. Kilowatts. 200.
4. Power Factor. 0.8.
5. Duty. Standby duty, used with large non-linear loads.
6. Overload. Generator shall be sized to accommodate a 110 percent load for 8 hours.

C. Insulation System. Class H.

D. Temperature Rise. Class B (80°C rise over a 40°C ambient).

E. Instantaneous Voltage Dip. Less than 15 percent when a full load is applied. Less than 15 percent when a full load is removed.

F. Voltage Regulator. ± 1/4 percent regulation - no load to full load with under-frequency protection, 3-phase sensing and loss of sensing shutdown. Input power shall be received from P.M.G.

G. Enclosure. Exterior weatherproof rated and drip-proof.

H. Stator. Shall be 2/3 pitch, with random-wound coils using V.P.I. Windings with true form-wound coils may be substituted at no additional cost to Owner. Windings using true form-wound coils shall incorporate rectangle wire, V.P.I. and additional epoxy over-coat for increased moisture protection.

H. Stator. Shall be 2/3 pitch. Windings must be true form-wound coils incorporating rectangle wire, V.P.I. and additional epoxy over-coat for increased moisture protection.

I. Coupling. From engine, drive rotor through a semi-flexible coupling to ensure permanent alignment.

J. Space Heaters. Provide thermostatically controlled, low surface temperature, 240-volt heaters operating on 120 volts to prevent condensation. Size heaters so that kW rating is not less than twice the value given in the Appendix to IEEE Standard 43, paragraph A1.3.

K. Provide under-frequency protection for the generator.

L. Provide an oversized generator termination cabinet.

2.5 CONTROL PANEL

Mount control panel on unit and include, but do not limit to, the following instruments and protective devices.

A. A-c ammeter having a 5-ampere movement with scale not smaller than 120 percent nor larger than 175 percent of full load current.

B. Four-position ammeter switch with positions A, B, C and OFF.

C. Three current transformers; 5-ampere secondary, primary to match ammeter full scale.

D. A-c voltmeter with scale 0-600 volts.

E. Seven-position voltmeter switch with positions A-B, B-C, C-A, A-N, B-N, C-N and OFF.

F. Automatic solid-state voltage regulator.

G. Exciter field rheostat for adjusting voltage plus or minus 5 percent of rated voltage.

H. Frequency meter with a scale indicating from 90 to 110 percent of rated hertz.

I. Governor control.

J. Fine speed adjustment knob.

K. Nonresettable elapsed time meter with a 9,999.9-hour maximum indication.

L. Coolant temperature gauge.

M. Battery charge-rate ammeter or voltmeter.

N. Oil pressure gauge.

O. Main circuit breaker, 100 percent rated, with trip set as recommended by generator manufacturer, with ground fault indication.

P. Combination alarm-shutdown system with manual reset and indicating lights for high engine temperature, low engine temperature, low oil pressure, engine overspeed and engine failed to start. Include an additional set of contacts for remote alarms.

Q. Provide a relay that energizes when the engine is operating. The output contacts from each machine will be connected in parallel such that when any of the generators start, the diesel pumps will be given a start signal. This relay shall also start the remote radiator fan.

R. HAND-OFF-AUTOMATIC selector switch for control of engine.

S. Battery-operated panel lights.

T. Vibration isolators for control panel.

2.6 ENGINE START-STOP CONTROLS

Provide controls in the control panel for starting and stopping the engine, including the following:

A. Three-Position Selector Switch. Mount on front of the control panel with the following positions labeled.

1. HAND: To permit starting the engine from the panel for test purposes, without load transfer.
2. OFF: To stop engine and disconnect control for prevention of start during maintenance and to reset automatic controls. Provide extra contact for remote alarm.
3. AUTOMATIC: To set up circuits for automatic start and stop on demand of remote mounted transfer switch or exerciser.

B. Automatic Cranking.

1. Crank control and time delay relays to provide a minimum of four intermittent crank periods. Use a crank limiter to limit total crank time plus rest time to 45 seconds maximum. Use adequate rest periods for battery provided.
2. Make cranking cycle terminate immediately on engine start-up by a fuel pressure switch or some other acceptable means.

C. Cool-down Period. An adjustable from 5 to 30 minute time delay for unloaded running of the engine generator after retransfer of the load to the normal source.

D. Exerciser. An adjustable exerciser to automatically run the unit unloaded from 10 to 60 minutes every 7 days. Design exerciser so that no interruption of normal power to the load will occur.

2.7 REMOTE ALARM ANNUNCIATOR PANEL

A. Provide remote audiovisual alarm panel, in accordance with NFPA 99, wired in parallel. Mount a lamp TEST pushbutton and an audible SILENCE pushbutton on the front of the panel. Provide General Electric No. 755 lamps with a transformer or LED lights. Provide indicating lights to signal:

Not-in-Auto (flashing red)
Overcrank (red)
Emergency Stop (red)
High Engine Temperature (red)
Overspeed (red)
Low Oil Pressure (red)
Air Damper (red)
Battery Charger Malfunction (red)
Low Battery Voltage (red)
Low Fuel (red)
Auxiliary Prealarm (yellow)
Auxiliary Fault (red)
System Ready (green)
Prealarm High Engine Temperature (yellow)
Prealarm Low Oil Pressure (yellow)
Low Coolant Temperature (red)
Day Tank Fuel Leak (red)
High Crankcase Pressure (red)

B. Terminals shall be provided for each signal above plus additional terminals for common fault and common alarm.

2.8 BASE

Mount the assembled packaged unit on a skid base of welded structural steel, box-type construction. Use vibration isolators of either steel spring or neoprene construction. Prime all exposed metal parts with a rust inhibitor and finish in durable machinery enamel. Vibration isolation shall be provided and shall be sized for 3 inches of static deflection.

2.9 WEATHERPROOF HOUSING

A. Construction. Provide an overall weather-protective housing with removable side panels and a hinged, padlockable meter panel door to make the engine generating plant suitable for outdoor installation under all weather conditions.

B. Painting. Prime all exposed metal parts with a suitable rust inhibitor applied to the clean, bare metal followed by two coats of an epoxy paint for exterior weather exposure.

C. Acoustical Treatment. Cover the interior of all housing sheet metal with a 1/32-inch layer of “Sheald” acoustical material as manufactured by Cominco, Ltd., Oakville, Ontario, Canada, or approved substitution.

D. Opening Screens. Cover all openings in the housing with 1/4-inch galvanized hardware cloth to keep out birds and small animals.

2.10 SOUND ATTENUATION HOUSING

A. Construction. Provide an overall housing with removable side panels and a hinged, padlockable meter panel door. Unitized construction between the stud and the acoustical enclosure. The maximum sound level measured one meter from the enclosure in free field conditions under full load shall not exceed 85 dBA.

B. Painting. Prime all exposed metal parts with a suitable rust inhibitor applied to the clean, bare metal followed by two coats of an epoxy paint.

C. Acoustical Treatment. Intake and exhaust silencers shall be provided at the ends of the skid.

D. Ventilation Fans. A ventilation fan or fans shall be provided in the enclosure. The fans shall provide the CFM requirements for the combustion air and for removing radiant heat from the generator and the engine and maintain a 30°F temperature rise in the enclosure. In addition to the static pressure requirements for the enclosure, the fans shall also be able to overcome an additional 3/8 inch of water in static pressure. All motor starters and associated control and wiring shall be included. Power for the fans shall be derived from the generator. The ventilation flow shall be from the generator end to the engine end. An acoustic treated duct shall be provided between the exhaust silencer and the louver in the wall.

2.11 FACTORY TESTS

A. Before delivery to the job site, have each engine generating plant with enclosure and radiator satisfactorily tested as a unit as described in the following paragraphs and in accordance with the manufacturer's design parameters. The test procedure shall simulate the head requirements for the cooling water that are required to be met in the field conditions.

B. Shutdown Tests. Bring the engine generator to stable operation and then create the following conditions in turn to cause alarm and shutdown.

1. High engine temperature.
2. Low engine temperature.
3. Low oil pressure.
4. Engine overspeed.

C. Voltage and Frequency Stability Tests. Have the engine generator carry rated kW load at 0.8 power factor for 1 hour. During this test, frequency and voltage must not vary more than parameters stated in this section.

D. Full Load Tests. Start the generator under no load and then have full rated kW at 0.8 power factor applied in a single increment within 10 seconds of start-up. Remove the load from the unit 5 minutes after start-up and then reapply full rated kW at 0.8 power factor 30 seconds later. Run the unit an additional 5 minutes under load before shutdown. During this test, the instantaneous voltage dip must not exceed that stated in paragraph 2.4E of this section, and frequency and voltage regulation must not vary more than parameters stated in this section with strip chart recorders. Unit shall be tested for 4 hours at 100 percent rated load.

2.12 TOOLS

Provide one set of any special tools other than standard wrenches required for preventative maintenance of the genset assembly. Package tools in an adequately sized metal tool box.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Follow manufacturer's installation procedures. Have installation supervised and approved by a qualified representative of the unit manufacturer.

B. Install packaged electric generating plant on a concrete pad in accordance with Section 16050, Electrical General Provisions.

3.2 ENGINE EXHAUST

Install an 18-inch length of exhaust tubing between engine exhaust outlet and muffler inlet. Turn muffler tailpipe up and terminate with rain cap.

3.3 FAN DISCHARGE

Provide an acoustically lined elbow to direct radiator fan discharge up. Make drain holes in bottom so rain water will not accumulate. Brace elbow structurally with steel that has been hot-dip galvanized after all cuts and holes have been made. Support system must be approved for strength, finish and appearance.

3.4 FIELD TESTS

A. Perform field tests at the site after installation is complete and in the presence of the Architect/Engineer.

B. Manufacturer's Representative. Engine generator manufacturer shall furnish a representative to operate each unit during the field tests, to check all details of the installation, and to instruct the operators.

C. Preparation for Testing. Have the engine generator system completed and ready for operation at the time field tests are to be run. Fill fuel tanks, provide all necessary lube oil and coolant, and install new, unused oil and air filter elements.

D. Instruments. Provide all instruments necessary to conduct the tests.

E. 4-Hour Test. Notify Architect/Engineer 14 days before each test. Then complete a 4-hour, full-load test and 1-hour 110 percent load test using load bank as a condition for final acceptance. Read and record all gauges and meters before starting the test, then every 10 minutes during the first hour, and then every half hour during remainder of the 4-hour period. Remove load and run engine generator at no load for 15 minutes; then shut unit down and immediately make one last recording of all gauge and meter indications. Have recordings field witnessed during test by the Architect/Engineer. Deliver three copies of such witnessed recordings to the Owner within one week of the test. Generator set supplier shall include testing relative load bank and all necessary cabling. All fuel and other fluids required for testing to be provided by the genset supplier.

F. Actual Plant Load Tests.

1. After the successful 4-hour, full-load field test described above, make additional on-site tests using actual available plant loads in the presence of the Architect/Engineer to demonstrate satisfactory performance of the complete engine generator system. Include different sequenced start-ups of the various specified loads, as directed by the Architect/Engineer.

2. As a final test, after all other tests have been successfully completed, operate the engine generator system under actual available plant loads for 2 hours of successful operation.
3. After final testing, refill all fuel tanks.

END OF SECTION

SECTION 16410 - 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. Receptacle switches.
4. Shunt trip switches.
5. Molded-case circuit breakers (MCCBs).
6. Molded-case switches.
7. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified.

1.5 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.

C. Qualification Data: For qualified testing agency.

D. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. 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.

F. Manufacturer's field service report.

G. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "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.

1.6 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.

1.7 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.

1.8 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.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than 3 of each size and type.
2. Fuse Pullers: 2 for each size and type.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

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. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of 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. 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. Lugs: Mechanical type, suitable for number, size, and conductor material.
5. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

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. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. 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.

C. 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. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Hookstick Handle: Allows use of a hookstick to operate the handle.
5. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS

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. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of 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.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

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.
4. Ground-fault pickup level, time delay, and I^2t response.

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: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.

2.4 MOLDED-CASE SWITCHES

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. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of 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. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.

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
3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

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. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Division 16 Section "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.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. 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.

D. 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.

E. 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. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.

c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

G. 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.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 16410

SECTION 16450 - GROUNDING AND BONDING 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: Grounding systems and equipment.

B. Section includes grounding systems and equipment, plus the following special applications:

1. Overhead-line grounding.
2. Underground distribution grounding.
3. Ground bonding common with lightning protection system.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
1. Ground rods.
2. Ground rings.
3. Grounding arrangements and connections for separately derived systems.

C. Qualification Data: For qualified testing agency and testing agency's field supervisor.

D. Field quality-control reports.

E. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems for the service based on NFPA 70B.

a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
b. Include recommended testing intervals.

1.4 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 UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 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:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Bare Grounding Conductor and Conductor Protector for Wood Poles:

1. No. 4 AWG minimum, soft-drawn copper.
2. Conductor Protector: Half-round PVC or wood molding; if wood, use pressure-treated fir, cypress, or cedar.

D. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.2 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, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad, Zinc-coated 3/4 inch by 10 feet in diameter.

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 tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.

E. 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.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING OVERHEAD LINES

A. Comply with IEEE C2 grounding requirements.

B. Install 2 parallel ground rods if resistance to ground by a single, ground-rod electrode exceeds 25 ohms.

C. Drive ground rods until tops are 12 inches below finished grade in undisturbed earth.

D. Ground-Rod Connections: Install bolted connectors for underground connections and connections to rods.

E. Lightning Arrester Grounding Conductors: Separate from other grounding conductors.

F. Secondary Neutral and Transformer Enclosure: Interconnect and connect to grounding conductor.

G. Protect grounding conductors running on surface of wood poles with molding extended from grade level up to and through communication service and transformer spaces.

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. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.

C. 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.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

G. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.

1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

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 Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. 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 3 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.

D. 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.

E. 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.

F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

G. 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 LABELING

A. Comply with requirements in Division 16 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. 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.

D. 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.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. 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. Substations and Pad-Mounted Equipment: 5 ohms.

H. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 16450

SECTION 16470 - PANELBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Agreement, Part 0, Special Conditions and Forms, and Division 01 Specification Sections, apply to this Section.

B. Related Sections include the following:

1. Section 16050, Common Work Results for Electrical.
2. Section 16195, Identification for Electrical Systems.

1.02 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.03 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 graft paper; include selectable ranges for each type of overcurrent protective device.
8. A/E to prepare, in conjunction with Short Circuit, Coordination, and Arc Flash report, a circuit breaker spreadsheet for all breaker settings with circuit breaker models and characteristics.

C. 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.

D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories 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 PB 1.

D. Comply with NFPA 70.

1.05 DELIVERY, STORAGE, AND HANDLING

A. It is the Contractor's responsibility to ensure on-time delivery of all materials and equipment required for the Project. All materials furnished or incorporated in the Work shall be new, unused, of best quality, and especially adapted for the service required; whenever the characteristics of any material are not particularly specified, such material shall be utilized as is customary in first class work of a nature for which the material is employed.

B. Contractor shall provide necessary means to properly stage and store all materials and equipment until time of use or installation on the Project. Contractor shall be solely responsible for materials and equipment stored on the Site; type and extent of security provided to be at Contractor's discretion. Coordinate all requirements with Owner.

C. Contractor shall be responsible for proper handling, rigging, and installing of all materials and equipment for the Project.

D. Owner reserves the right to reject any materials or equipment that are not properly stored in accordance with these specifications or the manufacturers' requirements.

E. Remove loose packing and flammable materials from inside panelboards; install temporary heating to prevent condensation.

F. Handle and prepare panelboards for installation according to NEMA PB 1.

1.06 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 30 degrees C to 40 degrees C.
b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of electric service.
2. Comply with NFPA 70E.

1.07 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 in Division 03.

1.08 WARRANTY

A. All panelboards furnished and installed under this contract shall be guaranteed against defects in design, materials and workmanship for the full warranty period which is standard with the manufacturer, but in no case less than one (1) year from the date of Substantial Completion.

1.09 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. All circuit breakers (including GFCI and GFEP types (if any): Provide one spare of each type, ampacity, and pole configuration for each panelboard.
   a. In-place spare breakers (as scheduled on the Contract Drawings) shall meet this requirement.
   b. If there are no in-place spare breakers of a particular size or type, then loose spare breakers, as indicated, shall be provided in accordance with this section.
   c. All spare breakers (whether in-place or loose) shall match exactly the characteristics of installed breakers.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PANELBOARDS

A. All panel boards shall be UL listed as a complete assembly.

B. 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. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. 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. Back Boxes: Galvanized steel.

5. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

C. Incoming Mains Location: Top and bottom.

D. Phase, Neutral, and Ground Buses:

1. Bussing shall be 98% conductivity copper, silverplated at joints. Minimum panelboard bus current rating shall be equal to or greater than the current rating of the overcurrent protective device feeding the panelboard.
2. Bus assembly shall be designed for a maximum temperature rise of 55 degrees C above 40 degrees C ambient temperature when carrying rated current.
3. Minimum thickness of bus bars shall be 3/32".
4. Bussing shall be braced to withstand a fault current equal to the highest device interrupting capacity in the panel.
5. Neutral bus copper shall be sized for 100% on same basis as phase bussing as described above, and insulated from the cabinet. Provide removable NEC approved grounding means in panelboards to be used for service entrance. Make provisions for ground fault CT’s where required for breakers specified with ground fault trips.
6. Arrange bus bar connections so that adjacent vertical circuit protective devices are consecutively connected to phases A, B, and C throughout panel.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mfg. Standard mechanical lugs
3. Ground Lugs and Bus-Configured Terminators: Mfg. Standard mechanical lugs
4. Feed-Through Lugs: Mfg. Standard mechanical lugs, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

5. Subfeed (Double) Lugs: Mfg. Standard mechanical lugs suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
6. All lugs shall be UL listed for use with panel.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

H. Panelboard Main Breaker Rating: Shall be as scheduled.

2.02 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial – Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: As indicated on Drawings.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger than 125 A: Bolt-on circuit breakers.

2.03 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: As indicated in Drawings.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.04 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Provide molded case, circuit breakers equipped with thermal-magnetic, quick-make, quick-break, trip free on faults, thermal-inverse time delay element and magnetic instantaneous trip coil in each ungrounded phase conductor.
2. Engrave breaker ampere rating on handle or trip unit.
3. Furnish multi-pole breakers with internal common trip.
4. Ground fault breakers class "A" type to trip on fault currents of 4-6mA. GFCI circuit breakers shall have frequency suppression circuitry to prevent false tripping and a separate neutral-to-load neutral conductor.
5. All breakers 200 amperes and larger shall have interchangeable trip units.
6. Furnish locking devices for branch circuit (0-70 ampere) breakers as noted on drawing. All breakers in feeder panels (CCB) shall be provided with built in lock hasp for locking breaker in "off" position.
7. All circuit breakers shall have bolted bus connections. Plug-in circuit breakers shall not be acceptable, except for circuit breakers 225-ampere frame size and greater may be plug-in type where individual positive locking device requires mechanical release.
8. All AC circuit breakers must be provided with features to enable maintenance personnel to lock out and tag out all circuits in compliance with OSHA 1910.147 and ACPO 10-160-212.
9. Adjustable Long Time, Instantaneous Trip and Ground Fault: Factory adjusted to low-trip setting current values. Provide adjustable trip devices for each circuit breaker supplying individual motor loads where indicated.
10. Tripping Device: Quick-make, quick-break toggle mechanism with inverse-time delay and instantaneous overcurrent trip protection for each pole. Trip unit to be interchangeable within frame sizes for breakers 200 amperes or larger. Breakers 100 amperes and above shall have adjustable trip selection for trip units.
11. Circuit Breakers with Solid State Trip Devices:

    a. General: Provide adjustable circuit breakers with solid state trip devices having the following features:

        1) Ambient Compensation: Trip device insensitive to temperature changes between minus 20 degrees C and plus 55 degrees C.
        2) Adjustability: Breaker ratings and trip settings shall be changeable by operation of controls on front panel of breaker, by change of plug-in element without removing breaker from mounting, or by a combination of the two methods.
        3) Ground Fault Tripping: Adjustable for pick-up and time-delay values. Provide for indicated units.

12. Provide testing for all circuit breakers 100A and greater.

    a. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

        1) Standard frame sizes, trip ratings, and number of poles.
        2) Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
        3) Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

2.05 PANELBOARD CABINETS (SAME MANUFACTURER AS PANELBOARD INTERIORS)

A. Cabinet shall be Code gage thickness; hot dip galvanized steel or painted with trim and door. Hardware shall be combination latch and cylinder lock, all keyed the same. Provide celluloid or plastic covered directory card and holder on the inside of door. Trim, door and exposed interior shall be factory primed and finished with smooth standard gray powder coat paint. Reinforce cabinets as necessary for service and short circuit rating intended and seismic conditions specified.

B. Cabinets shall be flush or surface mounted as indicated on drawings, and shall be of sufficient size to allow NEC required 3-inch gutter space each side of panel and at top and bottom of panel; minimum 20 inches wide. Provide adjustable trim clamp, semi-flush hinges and inside rabbet.

C. Enclosures shall be NEMA 1 for indoor installations except where the NEC requires other type of enclosure.

D. Provide panels with door-in-door hinged trim construction.

2.06 TVSS / SPD

A. General
    1. Only TVSS / SPD unit manufacturers acceptable to owner shall be utilized. Refer to Section 264300, Transient Voltage Surge Suppression.
    2. TVSS / SPD units manufactured and provided by the switchgear/panelboard manufacturer are not an acceptable equal.

B. TVSS / SPD units shall be installed in strict accordance with the manufacturer's requirements, in accordance with the NEC, UL, NEMA, and all other applicable codes and standards. This shall include overcurrent protection (direct connection to the bus is not permitted) and lead lengths that are as short as possible.

C. Whenever possible, TVSS / SPD unit overcurrent protective devices shall be connected to the branch breaker that is closest to the main breaker or main lugs connection point (typically top or bottom) in the switchboard / panelboard so as to place the TVSS / SPD device as close as possible to the main bus or feeder connection point.

D. Minimize Lead length
    1. It is absolutely imperative that TVSS / SPD units be installed with lead lengths as short as possible to enhance the TVSS / SPD performance by minimizing the let though voltage at the portion of the distribution equipment or switchgear that is being protected.
    2. A lead length of 18" or less is desirable. This length includes the total cable length including both line (from bus to breaker) and load (from breaker to TVSS / SPD) conductor on installations that are protected by an individually mounted breaker or fuse

block. Installations with overall TVSS / SPD lead lengths longer than 36" must be reviewed by the Engineer (A/E consultant) and owner. With respect to TVSS / SPD lead length, neatness is absolutely secondary to short lead length.

3. It has been demonstrated that the potential let through voltage can increase by as much as 25 volts per inch of lead length at the impulse levels found in high frequency currents common to lightning discharges.

E. TVSS / SPD Installation (Panelboards)

1. TVSS / SPD units that are installed to protect panelboards shall be mounted separately adjacent to the panelboard and at the same elevation as the associated breaker to minimize lead length.

2.07 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

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.

3.02 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

C. Comply with mounting and anchoring requirements specified in Section 260548, Vibration and Seismic Controls for Electrical Systems.

D. Mount top of trim 90 inches above finished floor unless otherwise indicated.

E. 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.

F. Install overcurrent protective devices and controllers not already factory installed.

G. Set field-adjustable, circuit-breaker trip ranges.

H. Install filler plates in unused spaces.

I. At all flush mounted panelboards, 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.

J. Comply with NECA 1.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 16195, 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. Permanently attach nameplates and circuit numbers to panel.

D. Use sequential alternate permanent circuit numbers arranged left to right and top to bottom.

E. Provide typewritten circuit directories describing service of each circuit after loads have been balanced.

F. Provide laminated plastic nameplate circuit identification for each circuit in

G. Provide each panelboard with nameplate showing panel designation, voltage rating and phase. Indicate source of power (feeder origin). Feeder origin shall include switchgear/switchboard designation, floor number, and floor location ID or nearest column number.

H. Label shall be engraved laminated-plastic nameplate mounted with two (2) cadmium-plated screws. Nameplates shall be black with 1/4” High white letters (commercial only), red letters (essential), or blue background (DC).

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections.

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.

3.05 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as directed by electrical engineer.

C. Load Balancing: Prior to Substantial Completion and with all loads connected and operating measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
3. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

END OF SECTION 262416

SECTION 16510 - LED INTERIOR LIGHTING

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. Interior solid-state luminaires that use LED technology.
2. Lighting fixture supports.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
6. Photometric data and adjustment factors based on laboratory tests.

a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

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. Samples: For each luminaire and for each color and texture with standard factory-applied finish.

D. Samples for Initial Selection: For each type of luminaire with custom factory-applied finishes.

1. Include Samples of luminaires and accessories involving color and finish selection.

E. Samples for Verification: For each type of luminaire.

1. Include Samples of luminaires and accessories to verify finish selection.

F. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lighting luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
4. Structural members to which luminaires will be attached.
5. Initial access modules for acoustical tile, including size and locations.
6. Items penetrating finished ceiling, including the following:

a. Other luminaires.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
f. Ceiling-mounted projectors.

7. Moldings.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

D. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Product Certificates: For each type of luminaire.

F. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

G. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

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. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

C. Provide luminaires from a single manufacturer for each luminaire type.

D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

E. Mockups: For interior lighting luminaires in room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of luminaires in mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. 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.

2.2 LUMINAIRE REQUIREMENTS

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. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. Recessed Fixtures: Comply with NEMA LE 4.

E. Bulb shape complying with ANSI C79.1.

F. Lamp base complying with ANSI C81.61.

G. CRI of minimum 85. CCT of 3500 K or as shown on the plans.

H. Rated lamp life of 50,000 hours.

I. Lamps dimmable from 100 percent to 0 percent of maximum light output.

J. Integral driver.

K. Nominal Operating Voltage: 120 Vac or 277 Vac as specified on the plans.

1. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

L. Housings:

1. Extruded-aluminum housing and heat sink.
2. Powder-coat finish.

2.3 CYLINDER

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. Amerlux.
2. Architectural Lighting Works.
3. Axis Lighting, Inc.
4. Cooper Lighting.
5. Edge Lighting.
6. Edison Price Lighting.
7. Elite Lighting Corporation.
8. Eureka.
9. Focal Point.
10. GE Lighting Solutions.
11. Juno Lighting Group by Schneider Electric.
12. Lighting Science Group.
13. Lightolier; a Philips group brand.
14. Lithonia Lighting; Acuity Brands Lighting, Inc.
15. MP Lighting.
16. OSRAM SYLVANIA.
17. Pure Lighting.
18. Sea Gull Lighting.
19. Selux Corporation.
20. Specialty Lighting Industries, Inc.

21. Tech Lighting.

B. Minimum 500 to 8000 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. With integral mounting provisions.

2.4 DOWNLIGHT

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. Amerlux.
2. Architectural Lighting Works.
3. Cooper Lighting.
4. Edge Lighting.
5. Edison Price Lighting.
6. Elite Lighting Corporation.
7. Eureka.
8. Focal Point LLC.
9. Gallium Lighting, LLC.
10. GE Lighting Solutions.
11. Juno Lighting Group by Schneider Electric.
12. Lighting Science Group.
13. Lighting Services Inc.
14. Lightolier; a Philips group brand.
15. Lithonia Lighting; Acuity Brands Lighting, Inc.
16. MP Lighting.
17. OSRAM SYLVANIA.
18. Peerless: Acuity Brands Lighting, Inc.
19. Pure Lighting.
20. RAB Lighting.
21. Sea Gull Lighting.
22. Specialty Lighting Industries, Inc.

B. Minimum 1000 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Universal mounting bracket.

D. Integral junction box with conduit fittings.

2.5 HIGHBAY, LINEAR

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Axlen LED Lighting.
2. Cooper Lighting.
3. Digital Lumens.
4. Elite Lighting Corporation.

5. GE Lighting Solutions.
6. Juno Lighting Group by Schneider Electric.
7. Lighting Science Group.
8. ON-Q Lighting Systems.
9. OSRAM SYLVANIA.
10. RAB Lighting.

B. Minimum 10,000 lumens. Minimum allowable efficacy of 80 lumens per watt.

2.6 HIGHBAY, NONLINEAR

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Albeo Technologies, Inc; A GE Company.
2. Cooper Lighting.
3. Digital Lumens.
4. Elite Lighting Corporation.
5. GE Lighting Solutions.
6. Juno Lighting Group by Schneider Electric.
7. OSRAM SYLVANIA.
8. RAB Lighting.

B. Minimum 10,000 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Universal mounting bracket.

D. Integral junction box with conduit fittings.

2.7 LINEAR INDUSTRIAL

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Albeo Technologies, Inc; A GE Company.
2. Axlen LED Lighting.
3. Cooper Lighting.
4. Elite Lighting Corporation.
5. GE Lighting Solutions.
6. Lighting Science Group.
7. Lithonia Lighting; Acuity Brands Lighting, Inc.
8. OSRAM SYLVANIA.
9. RAB Lighting.

B. Minimum 5000 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Housing and heat sink rated to the following:

1. Class 1, Division 2 Group(s) [A] [B] [C] [and] [D].
2. NEMA 4X.
3. IP 54.

4. IP 66.
5. Marine and wet locations.
6. CSA C22.2 No 137.

2.8 LOWBAY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Albeo Technologies, Inc; A GE Company.
2. Cooper Lighting.
3. Elite Lighting Corporation.
4. GE Lighting Solutions.
5. Lighting Science Group.
6. Lithonia Lighting; Acuity Brands Lighting, Inc.
7. OSRAM SYLVANIA.

B. Minimum 5000 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Universal mounting bracket.

2.9 PARKING GARAGE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Lighting.
2. Gallium Lighting, LLC.
3. Elite Lighting Corporation.
4. GE Lighting Solutions.
5. ON-Q Lighting Systems.
6. OSRAM SYLVANIA.
7. RAB Lighting.

B. Minimum 2000 lumens. Minimum allowable efficacy of 75 lumens per watt.

C. Low-profile housing and heat sink.

D. Fully gasketed and sealed.

E. Stainless-steel latches.

F. Integral pressure equalizer.

2.10 RECESSED LINEAR

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Albeo Technologies, Inc; A GE Company.

2. Architectural Lighting Works.
3. Axis Lighting, Inc.
4. Cooper Lighting.
5. Elite Lighting Corporation.
6. Finelite.
7. Focal Point LLC.
8. GE Lighting Solutions.
9. Lithonia Lighting; Acuity Brands Lighting, Inc.
10. Lumen Pulse.
11. ON-Q Lighting Systems.
12. OSRAM SYLVANIA.
13. RAB Lighting.
14. Selux Corporation.

B. Minimum 1500 lumens. Minimum allowable efficacy of 85 lumens per watt.

C. Integral junction box with conduit fittings.

2.11 STRIP LIGHT

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Lighting.
2. Elite Lighting Corporation.
3. GE Lighting Solutions.
4. Lighting Science Group.
5. Lithonia Lighting; Acuity Brands Lighting, Inc.
6. OSRAM SYLVANIA.
7. Philips Lighting Company.
8. Stile Lighting.

B. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Integral junction box with conduit fittings.

2.12 SURFACE MOUNT, LINEAR

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Albeo Technologies, Inc; A GE Company.
2. Architectural Lighting Works.
3. Axis Lighting, Inc.
4. Cooper Lighting.
5. Elite Lighting Corporation.
6. Finelite.
7. Focal Point LLC.
8. GE Lighting Solutions.
9. Lighting Science Group.

10. Lightolier; a Philips group brand.
11. Lithonia Lighting; Acuity Brands Lighting, Inc.
12. Lumen Pulse.
13. MP Lighting.
14. OSRAM SYLVANIA.
15. Pure Lighting.
16. Specialty Lighting Industries, Inc.
17. Stile Lighting.
18. Tech Lighting.
19. The Lighting Quotient.

B. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Integral junction box with conduit fittings.

2.13 SURFACE MOUNT, NONLINEAR

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. Architectural Lighting Works.
2. Cooper Lighting.
3. Edge Lighting.
4. Elite Lighting Corporation.
5. Eureka.
6. Focal Point LLC.
7. GE Lighting Solutions.
8. Lithonia Lighting; Acuity Brands Lighting, Inc.
9. Lumen Pulse.
10. MP Lighting.
11. OSRAM SYLVANIA.
12. Peerless: Acuity Brands Lighting, Inc.
13. Philips Lighting Controls.
14. Pure Lighting.
15. Tech Lighting.

B. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Integral junction box with conduit fittings.

2.14 SUSPENDED, LINEAR

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Architectural Lighting Works.
2. Axis Lighting, Inc.
3. Axlen LED Lighting.
4. Cooper Lighting.

5. Edge Lighting.
6. Elite Lighting Corporation.
7. Finelite.
8. Focal Point LLC.
9. Gallium Lighting, LLC.
10. GE Lighting Solutions.
11. Lightolier; a Philips group brand.
12. Lithonia Lighting; Acuity Brands Lighting, Inc.
13. Lumen Pulse.
14. MP Lighting.
15. ON-Q Lighting Systems.
16. OSRAM SYLVANIA.
17. Pure Lighting.
18. Selux Corporation.
19. Specialty Lighting Industries, Inc.
20. Stile Lighting.
21. Tech Lighting.

B. Minimum 1500 lumens. Minimum allowable efficacy of 85 lumens per watt.

2.15 SUSPENDED, NONLINEAR

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Architectural Lighting Works.
2. Cooper Lighting.
3. Edge Lighting.
4. Elite Lighting Corporation.
5. Eureka.
6. Focal Point LLC.
7. Lithonia Lighting; Acuity Brands Lighting, Inc.

B. Minimum 1500 lumens. Minimum allowable efficacy of 85 lumens per watt.

C. Integral junction box with conduit fittings.

2.16 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:

1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Housings:

1. Extruded-aluminum housing and heat sink.
2. Clear powder-coat finish.

E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI for all luminaires.

2.17 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.

2.18 LUMINAIRE FIXTURE SUPPORT COMPONENTS

A. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

B. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gauge.

C. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

D. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 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:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

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 120 inches in length.
2. Ceiling mount with pendant mount 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.

2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
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 to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

J. Comply with requirements in Section 16120 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 16195 "Identification for Electrical Systems."

3.5 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.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 16510

SECTION 16520 - 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. Standalone daylight-harvesting switching controls.
4. Indoor occupancy sensors.
5. Outdoor motion sensors.
6. Lighting contactors.
7. Emergency shunt relays.

B. Related Requirements:

1. Division 16 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

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. Cooper Industries, Inc.
2. Intermatic, Inc.
3. Invensys Controls.
4. Leviton Mfg. Company Inc.
5. NSi Industries LLC; TORK Products.
6. Tyco Electronics; ALR Brand.

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: DPST.
3. Contact Rating: 20-A ballast load, 120-/240-V ac.
4. Programs: Two on-off set points on a 24-hour schedule, allowing different set points for each day of the week.
5. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
6. Astronomic Time: All channels.
7. Automatic daylight savings time changeover.
8. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

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. Cooper Industries, Inc.
2. Intermatic, Inc.
3. NSi Industries LLC; TORK Products.
4. Tyco Electronics; ALR Brand.

B. Description: Solid state, with DPST 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
3. Time Delay: Fifteen second minimum, to prevent false operation.

4. Surge Protection: Metal-oxide varistor.
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.

C. Description: Solid state, with DPST dry contacts rated for 1800 VA, to operate connected load, complying with UL 773.

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.
3. Time Delay: Thirty-second minimum, to prevent false operation.
4. Lightning Arrester: Air-gap type.
5. Mounting: Twist lock complying with NEMA C136.10, with base.

2.3 INDOOR OCCUPANCY SENSORS

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. Bryant Electric; a Hubbell company.
2. Cooper Industries, Inc.
3. Hubbell Building Automation, Inc.
4. Leviton Mfg. Company Inc.
5. Lightolier Controls.
6. Lithonia Lighting; Acuity Lighting Group, Inc.
7. Lutron Electronics Co., Inc.
8. NSi Industries LLC; TORK Products.
9. RAB Lighting.
10. Sensor Switch, Inc.
11. Square D; a brand of Schneider Electric.
12. Watt Stopper.

B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.

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 15 minutes.
3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
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 (21.5 to 2152 lux); 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- (3-m-) 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 90 feet (27.4 m) 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.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.

2.4 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

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. Bryant Electric; a Hubbell company.
2. Cooper Industries, Inc.
3. Hubbell Building Automation, Inc.
4. Leviton Mfg. Company Inc.
5. Lightolier Controls.
6. Lithonia Lighting; Acuity Lighting Group, Inc.
7. Lutron Electronics Co., Inc.
8. NSi Industries LLC; TORK Products.
9. RAB Lighting.
10. Sensor Switch, Inc.
11. Square D; a brand of Schneider Electric.
12. Watt Stopper.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.

C. Wall-Switch Sensor Large Rooms:

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 2100 sq. ft.
2. Sensing Technology: Dual technology - PIR and ultrasonic.
3. Switch Type: SP, field selectable automatic "on," or manual "on" automatic "off."
4. Voltage: Match the circuit voltage 120 V; dual-technology type.
5. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
6. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
7. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

D. Wall-Switch Sensor Small Rooms:

1. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft.
2. Sensing Technology: Dual technology - PIR and ultrasonic.
3. Switch Type: SP, field selectable automatic "on," or manual "on" automatic "off."
4. Voltage: Match the circuit voltage 120 V; dual-technology type.
5. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
6. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
7. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

2.5 OUTDOOR MOTION SENSORS

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. Bryant Electric; a Hubbell company.
2. Cooper Industries, Inc.
3. Hubbell Building Automation, Inc.
4. Leviton Mfg. Company Inc.
5. Lithonia Lighting; Acuity Lighting Group, Inc.
6. NSi Industries LLC; TORK Products.
7. RAB Lighting.
8. Sensor Switch, Inc.
9. Watt Stopper.

B. General Requirements for Sensors: Solid-state outdoor motion sensors.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. **PIR**, weatherproof. 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.. Comply with UL 773A.
3. Switch Rating:

    a. Lighting-Fixture-Mounted Sensor: 500-VA fluorescent.
    b. Separately Mounted Sensor: 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.

4. Switch Type: SP
5. Voltage: Match the circuit voltage 120-V type.
6. Detector Coverage:

    a. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft.
    b. Long Range: 180-degree field of view and 110-foot detection range.

7. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
8. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
9. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
10. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and help eliminate false "off" switching.
11. Operating Ambient Conditions: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F, rated as "raintight" according to UL 773A.

2.6 LIGHTING CONTACTORS

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. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
3. Eaton Corporation.

4. General Electric Company; GE Consumer & Industrial - Electrical Distribution; Total Lighting Control.
5. Square D; a brand of Schneider Electric.

B. Description: Electrically operated and electrically held, combination-type lighting contactors with fusible switch 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 or scheduled, matching the NEMA type specified for the enclosure.

2.7 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 16 Section "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 Division 16 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than **No. 16** AWG. Comply with requirements in Division 16 Section "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.

3.2 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Division 16 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.

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.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Division 16 Section "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.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to evaluate lighting control devices and perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections:

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.

D. Lighting control devices will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 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 2 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.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 16520

Cherokee County Property Management

Access Control 28 10 00

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SECTION 28 10 00 ACCESS CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Professional Series Access Modules. (PRO4200)
B. Integrated security management system. (Win-Pak)
C. Web based modular access control system. (Win-Pak)
D. Web based access control system. (Win-Pak)
E. Access control readers.
F. Access control credentials.
G. Access control cables.

1.2 RELATED SECTIONS

A. Section 26 05 00 - Common Work Results for Electrical.
B. Section 27 11 23 - Communications Cable Management and Ladder Rack.

1.3 REFERENCES

A. Electronic Industries Alliance (EIA):
    1. RS232C - Interface between Data Terminal Equipment and Data Communications Equipment Employing Serial Binary Data Interchange.
    2. RS485 - Electrical Characteristics of Generators and Receivers for use in Balanced Digital Multi-Point Systems.

B. Federal Communications Commission (FCC):
    1. FCC Part 15 - Radio Frequency Device.
    2. FCC Part 68 - Connection of Terminal Equipment to the Telephone Network.

C. Federal Information Processing Standards (FIPS):
    1. Advanced Encryption Standard (AES) (FIPS 197).
    2. FIPS 201: Personal Identity Verification (PIV) of Federal Employees and Contractors.

D. National Fire Protection Association (NFPA):
    1. NFPA70 - National Electrical Code.

E. Homeland Security Presidential Directive 12 (HSPD-12).
F. Underwriters Laboratories (UL):
    2. UL294 - Access Control System Units.
    3. UL1076 - Proprietary Burglar Alarm Units and Systems.

1.4 SECURITY MANAGEMENT SYSTEM DESCRIPTION

A. PRO4200: The Security Management System shall function as an electronic access control system.

1) User programmable relay outputs allow for specific control needs
2) User programmable alarm inputs offer flexible system configuration and control
3) RS485 communication to all modules
4) Analog to digital converter technology provides digital filtering and input conditioning
5) Dedicated cabinet tamper and power monitor inputs
6) Supports the choice of normally open, normally closed, supervised, and non-supervised circuits
7) Supports a wide range of reader technologies including OSDP and Wiegand
8) System off-line modes customizable per reader include secured access, locked (no access), and unlocked (full-access)
9) Supports multiple reader and card formats for maximum flexibility and security options
10) Operating modes includes locked, unlocked, secure access, card only, card and PIN, card or PIN and PIN only
11) Any combination of 16 downstream I/0 or readers modules may be connected to the PRO42IC RS485 ports. 4,000 ft (1,250 m) total bus length per port
12) Supports over 50,000 transaction buffer

B. WIN-PAK: The Integrated Security Management System (ISMS) shall function as an electronic access control. The following definitions are applicable for the WIN-PAK system:

1.5 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
   1. Product Data: Manufacturer's data sheets on each product to be used, including:
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods.

B. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square representing actual product, color, and patterns.
C. Manufacturer's Product Data: Submit manufacturer's data sheets indicating systems and components proposed for use.

D. Shop Drawings: Submit complete shop drawings indicating system components, wiring diagrams and load calculations.
E. Record Drawings: During construction maintain record drawings indicating location of equipment and wiring. Submit an electronic version of record drawings for the Security Management System not later than Substantial Completion of the project.
F. Operation and Maintenance Data: Submit manufacturer's operation and maintenance data, customized to the Security Management System installed. Include system and operator manuals.
G. Maintenance Service Agreement: Submit a sample copy of the manufacturer's maintenance service agreement, including cost and services for a two year period for Owner's review.

1.6 QUALITY ASSURANCE

A. Manufacturer: Minimum ten years experience in manufacturing and maintaining Security Management Systems. Manufacturer shall be Microsoft Silver Certified.
B. Installer must be certified by Honeywell Integrated Security Dealer Service Certification Program (DSCP).

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's labeled packages. Store and handle in accordance with the manufacturer's requirements.
B. PROJECT CONDITIONS
C. 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.

1.8 WARRANTY

A. Manufacturer's Warranty: Submit manufacturer's standard warranty for the security management system.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Honeywell Commercial Security
B. Substitutions: Not permitted.
C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

2.2 ACCESS AND SECURITY MANAGEMENT SYSTEM (PRO4200)

A. Security Management System Manufacturer: PRO4200 Security Management Suite as manufactured by the Honeywell Commercial Security.
B. The Security Management System shall function as an electronic access control system.
C. Access Control Software Suite: The Security Management System shall offer a security management software suite available in four scalable versions: The Security Management System platform shall offer a complete access control solution: Provide the following software system:

2.3 INTEGRATED SECURITY MANAGEMENT SYSTEM (ISMS)

A. Product: WIN-PAK Access Management System as manufactured by the Honeywell Commercial Security.
B. The ISMS will function as an electronic access control system.

    1. Components are to run on a single computer or on multiple computers, allowing flexibility in configuring a networked system.

2.4 ACCESS CONTROL READERS (Data security with Omni Class cards.)

A. Product: OM40 US Single-Gang 13.56 MHz Contactless Smart Card Readers as manufactured by the Honeywell Commercial Security:
   1. Typical contactless smart card read range shall be:
      a. 2.5 to 4.5 inches (6.3 to 11.4 cm) using OmniClass card.
      b. 1 inches (2.5 cm) using OmniClass Key Fob.
      c. 1 inches (2.5 cm) using OmniClass Sticker (Tag).
      d. 1.5 to 2 inches (3.8 to 5.0 cm) using OmniClass + 125 KHz HID Prox card.
      e. 1 to 2 inches (2.5 to 5.0 cm) using MIFARE Card (card serial number only).
   2. Contactless smart card readers shall meet the following physical specifications:
      a. Dimensions: 3.30 x 4.80 x .85 inches (8.38 x 12.19 x 2.16 cm).
      b. Weight: 8.8.oz (249.5 g).
      c. Material: UL94 Polycarbonate.
      d. Two-part design with separate mounting plate and reader body.
      e. Color: Black.
   3. Contactless smart card readers shall meet the following electrical specifications:
      a. Operating voltage: 5 to 16 VDC, reverse voltage protected. Linear power supply recommended.
      b. Current requirements: (average/peak) 65/90 mA at 12 VDC.

B. Product: OP10 Mini-Mullion 125 kHz Contactless Proximity Card Readers as manufactured by the Honeywell Commercial Security:
   1. Typical contactless proximity card read range shall be:
      a. 1.5 to 4 inches (3.8 to 10.2 cm) using OmniProx card
   2. Contactless proximity card readers shall meet the following electrical specifications:
      a. Operating voltage: 5.0 to 16 VDC, reverse voltage protected. Linear power supply recommended.
      b. Current requirements: 60/120 mA at 12 VDC.
   3. Contactless proximity card readers shall meet the following physical specifications:
      a. Dimensions: 3.15 x 1.57 x 0.50 inches (80 x 40 x 12.8 cm).
      b. Material: UL94 Polycarbonate.
      c. Two-part design with separate reader body and cover.
      d. Color: Black, charcoal gray and ivory interchangeable bezels.
   4. Contactless card reader shall be Honeywell OP10 compatible with selected card media.

2.5 ACCESS CONTROL CREDENTIALS

A. Access cards shall be used with access readers to gain entry to access controlled portals (e.g.; doors, gates, turnstiles) and to hold information specific to the user and shall be ISO 26 BIT Contactless Proximity Card technology credentials.

2.6 ACCESS CONTROL CABLES

A. Access Control System components shall be connected using the following Honeywell Genesis Series Cables:
   a. Part Number: CLP3, Plenum Rated, CMP, CL3P, FT6 Listed.
      1) Component 1: 22 AWG, 6 stranded conductors, shielded.
      2) Component 2: 18 AWG, 4 stranded conductors.
      3) Component 3: 22 AWG, 2 stranded conductors.
      4) Component 4: 22 AWG, 4 stranded conductors.
      5) Color - YELLOW

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine site conditions to determine site conditions are acceptable without qualifications. Notify Owner in writing if deficiencies are found. Starting work is evidence that site conditions are acceptable.

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. System, including but not limited to access control, alarm monitoring and reporting, time management, and user identification cards shall be installed in accordance with the manufacturer's installation instructions.

B. Supervise installation to appraise ongoing progress of other trades and contracts, make allowances for all ongoing work, and coordinate the requirements of the installation of the System.

3.4 FIELD TESTING AND CERTIFICATION

A. Testing: The control, alarm monitoring and reporting, time management, and user identification cards shall be tested in accordance with the following:
   1. Conduct a complete inspection and test of all installed access control and security monitoring equipment. This includes testing and verifying connection to equipment of other divisions such as life safety and elevators.
   2. Provide staff to test all devices and all operational features of the System for

witness by the Owner's representative and authorities having jurisdiction as applicable.

3. Correct deficiencies until satisfactory results are obtained.
4. Submit written copies of test results.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

PRO4200

Professional Series Access Modules

The PRO4200 professional series family of access control modules is designed for high density installations.

The PRO4200 professional series can be managed through WIN-PAK® integrated security software for more advanced features such as video integration, advance reporting, rules and photo badging, elevator control, touch-less access and mobile credential management.

Supporting up to 18 doors per enclosure and 34 doors per intelligent controller along with up to 100,000 card capacity, PRO4200 Series provide a combination of small installation footprint and superior cost per door ratio.

The new PRO42IC Intelligent Controller provides I/O support for 2 Doors *. The PRO42R1 provides I/O support for one card access reader, while the PRO42R2 support two card access readers. Both interface with the intelligent control module (PRO42IC). In the event that communication to the intelligent control module is lost, the card access readers be individually configured to allow entrance based on security needs. This customization allow or a be configured as secured, locked and unlocked. PRO4200 modules provide latest bi-directional and strong encrypted OSDP communication with the Access Control readers. For legacy and retrofit installations, Wiegand format is still supported.

The PRO42OUT interfaces provide up to 16, Form C, 30 VDC, 2A relay output controls depending if the board is rack or tile-mounted, power fail and panel tamper when tile mounted.

Relays may be used for elevator control, status annunciation and for general facility control, such as door monitoring.

The PRO42IN interfaces provide 16 supervised alarm inputs and a dedicated power fail and panel tamper when tile mounted. An analog to digital converter samples the input values and the digitized result is filtered and processed. Filter parameters are configurable for each input point, resulting in the ability to specify a custom End-Of-Line (EOL) resistance value, sensitivity range and timing parameter.

The PRO4200 Series of access modules are designed to accommodate various mounting options. Units can be mounted in a rack configuration (PRO22ENC1, PRO22ENC2 and PRO22E C5) when space is limited, or in a tile-mount configuration (PRO22ENC3).

** The new PRO42IC Intelligent Controller provides I/O support for up to 2 doors with a maximum of 2 OSDP readers per door or 1 Wiegand reader per door. The PRO42R1 provides I/O support for up to 1 door and the PRO42R2 supports up to 2 doors. The PRO42R1 and PRO42R2 will support a maximum of 2 OSDP readers per door or 1 Wiegand reader per door.*

FEATURES AND BENEFITS

- Modular design fits a wide variety of applications
- Up to 9 modules, power-supply and battery can be accommodated by the PRO22ENC1, PRO22ENC2 and PRO22ENC5 (no battery) enclosures
- User programmable relay outputs allow for specific control needs
- User programmable alarm inputs offer flexible system configuration and control

- RS485 communication to all modules
- Analog to digital converter technology provides digital filtering and input conditioning
- Dedicated cabinet tamper and power monitor inputs
- Supports the choice of normally open, normally closed, supervised, and non-supervised circuits
- Supports a wide range of reader technologies including OSDP and Wiegand

- System off-line modes customizable per reader include secured access, locked (no access), and unlocked (full-access)
- Supports multiple reader and card formats for maximum flexibility and security options
- Operating modes includes locked, unlocked, secure access, card only, card and PIN, card or PIN and PIN only

- Any combination of 16 downstream I/O or readers modules may be connected to the PRO42IC RS485 ports. 4,000 ft (1,250 m) total bus length per port
- Supports over 50,000 transaction buffer

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SPECIFICATIONS

MODULE SPECIFICATIONS	PRO4200 SERIES SINGLE READER MODULE (PRO42R1)	PRO4200 SERIES DUAL READER MODULE (PRO42R2)
PORT	Reader port 12/24VDC @ 500mA, OSDP; Wiegand; Dt/Clk*	2 Reader port 12/24VDC @ 300mA, OSDP; Wiegand; Dt/Clk*
KEYPAD	Keypad multiplexed with card data	
WIRE SUPPORT	Two-wire or one-wire bi-color LED support	
BUZZER SUPPORT	Buzzer support only with one-wire LED control	
ALARM INPUTS	2 supervised, general purpose alarm inputs with programmable circuit type	8 supervised, general purpose alarm inputs with programmable circuit type (only 6 supervised inputs available when using PRO22ENC1, PRO22ENC2 and PRO22ENC5 enclosures)
OUTPUT RELAYS (DOOR STRIKE(S)	1 output relay, form C, 5A 40 VDC	2 output relay, form C, 2A 30 VDC
OUTPUT RELAYS	1 general purpose output relay, form C, 5A 30 VDC	2 general purpose output relay, form C, 5A 30 VDC
MOUNTING	Designed to be tile-mounted using the PRO22ENC4 enclosure	N/A
ALARM INPUT PROPERTIES		
INPUTS	Inputs may be assigned to door related functions or general purpose I/O	
CIRCUIT TYPE	Circuit type - normally open, normally closed, non-supervised, supervised (with standard 1K or custom end-of-line resistance 200-10K)	
LINE CONDITIONING	Line conditioning - programmable sensitive hold time	
OUTPUT CONTROL PROPERTIES		
OUTPUTS	Outputs may be assigned to door related functions or general purpose I/O	
RELAY RATING	The relay(s) are rated to handle the inductive loads of door locking devices S-4 SUPPRESSOR CABLE TO THE DOOR OPENER	
CONFIGURABLE	Configurable as standard (energize to activate) or fail-safe (de-energize to activate)	
PULSE TIME	1-42,400 seconds, 1-255 for door relays	
RS485 PORT	RS485 port, 4,000 ft (1,250m) total bus length	
STANDARD SPEED	38.4 Kbps	

MODULE SPECIFICATIONS	PRO4200 SERIES SIXTEEN RELAY OUTPUT MODULE (PRO42OUT)	PRO4200 SERIES SIXTEEN ALARM INPUT MODULE (PRO42IN)
ALARM INPUTS	2 dedicated (unsupervised) alarm inputs for tamper detection and power loss (tile-mounted only)	
ALARM INPUTS	N/A	16 general purpose inputs with programmable circuit type
OUTPUT RELAYS	12 general purpose output relays, form C, 5A 30 VDC (16 are available when using PRO22ENC3 tile-mounted enclosure)	2 general purpose, form C, 5A 30 VDC relays (only one available when using PRO22ENC1, PRO22ENC2 and PRO22ENC5)
OUTPUT CONTROL PROPERTIES		
OUTPUT	All 16-relay outputs in the tile-mount configuration (1 rack mount) are available for general purpose I/O	Both relay outputs are available for general purpose I/O
DRY CIRCUIT LOGIC	The 5A relays are rated to handle dry circuit logic (Resistive)	Both relay outputs are rated to handle dry circuit logic (Resistive)
PULSE TIME	1-32,400 seconds	
CONFIGURABLE	Configurable as standard (energize to activate) or fail-safe (de-energize to activate)	N/A
ALARM INPUT PROPERTIES		
INPUTS	2 dedicated for tamper detection and power loss	All 16 inputs may be assigned to door related functions or general purpose I/O 2 dedicated for tamper and power loss
CIRCUIT TYPE	N/A	Circuit type - normally open, normally closed, non-supervised, supervised (with correct EOL)
LINE CONDITIONING	N/A	Line conditioning - programmable sensitivity and hold time
COMMUNICATION FEATURES		
MEASUREMENTS	RS485 port, 4,000 ft (1,250m) total bus length per port	
SPEED	38.4 Kbps	

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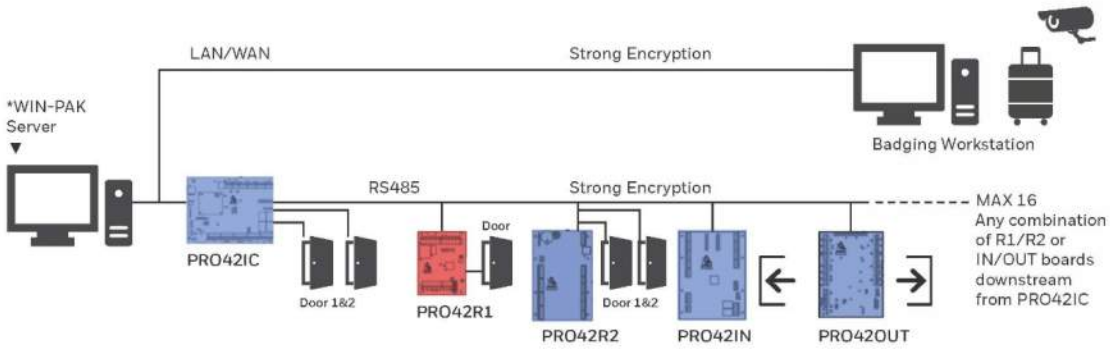
BENEFITS

- Anti-passback support - free pass and exempt flags, last area accessed, last reader accessed and time/date of last access
- Modular hardware architecture provides flexibility and expansion capabilities
- Large, local controller database allows access control decisions to be made by controller in real time without the need to communicate to the server
- ADA compliant allowing expanded door times selectable per reader
- Scalable architecture ensures optimal performance with a seamless upgrade path to accommodate future growth beyond its initial installation
- Four-state alarm input circuits - normally opened, normally closed, non-supervised, supervised (w/EOL)
- Rack or tile mounting options available
- Alarm conditioning with programmable sensitivity and hold time
- Selectable reader states include card and PIN, card or PIN, card only, or PIN only
- Power Supply supports 120 or 230 VAC
- System off-line modes customizable per reader include secured access, locked (no access), and unlocked (full-access)
- Supports multiple reader and card formats for maximum flexibility and security options
- Supports Wiegand and/or OSDP communication
- Enhanced Cyber Security
- Port based network access control using 802.1X
- Host communications protected by TLS 1.2/1.1 or AES-256/128

PRO4200 CONFIGURATION



RED *boards = Mercury Series 3*

BLUE *boards = Honeywell PRO4200 modules*

**WIN-PAK 4.8.2 or higher supports Legacy Mode which includes all feature sets of the PRO3200 Series.*
**Native support in WIN-PAK coming soon (PRO42IC On-Board Door support, OSDPV2, TLS1.2).*

		PRO22ENC1		PRO22ENC3	
MODULE	READERS	INPUTS	OUTPUTS	INPUTS	OUTPUTS
PRO42R1	2 OSDP | 1 Wiegand	N/A	N/A	2	2
PRO42R2	4 OSDP | 2 Wiegand	6	4	10**	6
PRO42OUT	0	0	12	2**	16
PRO42IN	0	16	1	18**	2
****Two are used to monitor Power and Tamper (Dedicated)**					
PRO22ENC1 = 9 Board Capacity/PRO22ENC3 = 2 Board Capacity					

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SPECIFICATIONS

DIMENSIONS / BOARDS

- **PRO42R1**
  2.75" H x 4.25" W x 1.0" D
  (70mm x 108mm 25mm)
- **PRO42IC, PRO42R2; PRO42IN; PRO42OUT**
  9.0" H x 5.5" W x 1.0" D
  (230mm x 140mm x 25mm)

ENCLOSURES

- **PRO22ENC1**
  13.9" H x 17" W x 9" D
  (353 mm x 432mm x 229 mm)
- **PRO22ENC2**
  13.9" H x 18.9" W x 9" D
  (353 mm x 480 mm x 229 mm)
- **PRO22ENC3**
  14" H x 16" W x 4" D
  (356 mm x 406 mm x 102 mm)
- **PRO22ENC4**
  8.37" H x 7.63" W x 7.63 D
  (213 mm x 194 mm x 194 mm)
- **PRO22ENC5**
  9.35" H x 16.85" W x 5.6" D
  (237 mm x 428 mm x 142 mm)

ENVIRONMENT

- Temperature: 0°C to 49°C* operational; -55°C to 85°C storage
- Humidity: 5 to 85% RHNC

WIRE REQUIREMENTS

- **Power**
  twisted pair, 18 AWG
- **Ethernet**
  F(S)TP/CAT7, 300 ft (100m) max
- **RS485**
  22- 24 AWG, 4,000 ft (1,200m) max, two twisted pairs with shield (F(S)TP/CAT7)
- **Alarm Input**
  twisted pair, 30 ohms max

ENCLOSURES

- **PRO22ENC1**
  (Wall-mount) Capacity: 9 modules. Power supply and battery not included
- **PRO22ENC2**
  (19" Rack-mount) Capacity: 9 modules. Power supply and battery not included
- **PRO22ENC3**
  (Tile-mount) Capacity: 2 modules. Power supply and battery included
- **PRO22ENC4**
  (Tile-mount) Capacity: 1 module (PRO42R1 only). Power supply and battery included
- **PRO22ENC5**
  (Cage only for custom enclosures) Capacity: 9 modules. Power supply and battery not included


PRO42IC


PRO42R2


PRO42OUT


PRO42IN

ORDERING

PRO4200 CONTROLLERS	
PRO42IC	PRO4200 Intelligent Controller
PRO42R1	PRO4200 Single Reader Module
PRO42R2	PRO4200 Dual Reader Module
PRO42OUT	PRO4200 16 Relay Output Module
PRO42IN	PRO4200 16 Alarm Input Module

OPTIONAL ACCESSORIES	
PRO22DCC	Daisy Chain cable required for PRO22ENC1, PRO22ENC2 and PRO22ENC5
PRO42PSU230	Rack-mounted power supply for PRO22ENC1, PRO22ENC2 and PRO22ENC5. Requires PRO22BAT1
PRO22BAT1	Battery, 7AH 12V

PRO-SERIES ENCLOSURES	
PRO22ENC1	(Wall-mount) Capacity: 9 modules. Power supply and battery not included
PRO22ENC2	(19" Rack-mount) Capacity: 9 modules. Power supply and battery not included
PRO22ENC3	(Tile Mount) Capacity: 2 modules. Power supply and battery included
PRO22ENC4	(Tile-mount) Capacity: 2 modules.(PRO42R2 only). Power supply and battery not included
PRO22ENC5	(Cage only for custom enclosures) Capacity: 9 modules. Power supply and battery not included

For More Information
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HSI- PRO42-02-ME(1220)DS-C

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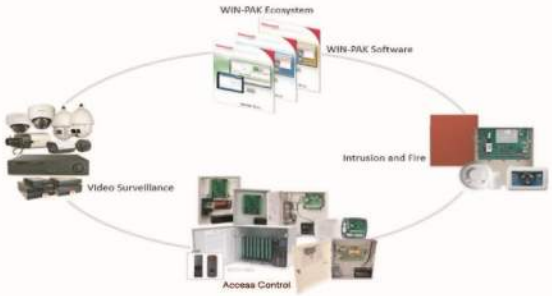
WIN-PAK® 4.8.5 INTEGRATED SECURITY SOLUTION

Honeywell's WIN-PAK 4.8.5 software solution provides a cost-effective way to integrate and manage access control, video surveillance, and intrusion detection through a single interface.

WIN-PAK 4.8.5 provides an intuitive browser-based interface allowing users to perform common access control actions from virtually anywhere. WIN-PAK 4.8.5 can be easily scaled from a single site up to a multi-region, enterprise-level solution with multiple Accounts and Subaccounts, all without placing restrictions on the number of users or sites being managed. WIN-PAK 4.8.5 supports third party integrations such as HID's Mobile Access® & Suprema Biometric Readers. Using the included WIN-PAK API, your software developers can create custom integrations to meet your integration needs.



FEATURES AND BENEFITS

ELIMINATES DISPARATE SYSTEMS AND INTERFACES

- Integrated access, video, intrusion, and fire* systems through one interface
- Direct management of Selected Suprema biometrics reader using controller/reader

INCREASES SITUATIONAL AWARENESS, ELIMINATES COSTLY FALSE ALARMS

- Disarm intrusion system through any valid card swipe at an access control reader
- Arm intrusion system through a valid triple-swipe at an access control reader
- Coordinate intrusion, access, or fire* events with video actions to maximize awareness

SCALES AS YOUR BUSINESS GROWS

- Unrestricted number of cardholders and system users
- Unrestricted number of sites and access points
- Accommodates up to 40 recorders and 2,560 cameras.

MINIMIZES MAINTENANCE AND SYSTEM SUPERVISORY COSTS

- Customizable and automated system reporting functions with email delivery
- Perform common daily access control tasks from anywhere through the web interface
- Included API for custom integrations to third-party systems

MINIMIZES ONBOARDING AND TRAINING COSTS

- Intuitive web interface for access management, with embedded Help tool

MINIMIZES SERVER DEPLOYMENT COSTS

- Supports VMWare 6.5 to help leverage existing IT infrastructure and server assets

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WIN-PAK® 4.8.5 TECHNICAL SPECIFICATIONS

	WPX485	WPS485	WPP485
WEB BROWSER	Included-Access Only		
SYSTEM WORKSTATION/USERS	1	5	Unrestricted
INTRUSION INTEGRATION	NA	VISTA-128/250 FBPT and BPT	
INTEGRATED VIDEO	NA	40 NVRs x 64 Cameras - 2,560 Cameras	
ACCOUNTS/SUBACCOUNTS	NA	1/1	5 /Unrestricted
SUPREMA BIOMETRIC SUPPORT	NA	32	600
TIME AND ATTENDANCE REPORTS WEB MODULE	NA	NA	Included
NOTIFICATIONS AND REPORTING	Email, SMS		
INTERACTIVE FLOOR PLANS	Included		
ELEVATOR CONTROL	Included		
PHOTO ID PRODUCTION	Included		
LOCKDOWN	Included		
CUSTOM CARDHOLDER FIELD TEMPLATES	Included		
TRACKING AND MUSTER REPORTS	Included		
GUARD TOUR REPORTS	Included		

ORDERING INFORMATION

WIN-PAK 4.8.5	
WPX485	WIN-PAK XE 4.8.5
WPX485	WIN-PAK XE 4.8.5
WPX485	WIN-PAK XE 4.8.5
WIN-PAK XE 4.8.5 UPGRADES	
UX48S485	Upgrade from WPX485 to WPS485
UX48P485	Upgrade from WPX485 to WPP485
WIN-PAK SE 4.8.5 UPGRADES	
US48P485	Upgrade from WPS485 to WPP485

SUPPORTED ACCESS

MPA2, NETAXS®-123, PRO3200, NETAXS®-4, PW6000 (panel to approved Installers - WPP48 only), HON-FIN4000 /Superma (not supported by XE)

SUPPORTED VIDEO (NOT SUPPORTED BY XE)

ADPRO®, MAXPRO® NVR, MAXPRO® HYBRID, Performance Series (ENVR-includes 4K)

SUPPORTED INTRUSION (NOT SUPPORTED BY XE)

VISTA-128BPT, VISTA-250BPT, VISTA-128FBPT, VISTA-250FBPT

WIN-PAK 4.8 supports the following 64-bit OS: Windows Server 2019, Windows Server 2016, Windows 10 Professional.

SQL supported: SQL 2019 Standard, Express.

Browsers supported: Edge™, Chrome™, Safari®, FireFox®.

VMWare Supported: ESXi 6.5.

Language Supported: Arabic, Chinese, Czech, Dutch, English, French, Italian, Polish, Portuguese, Russian and Spanish.

For more information,
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SECTION 28 23 00
VIDEO SURVEILLANCE SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Video management system including the following as applicable:
   1. Digital video recording management and network software.
   2. Web/mobile server.
   3. Network PTZ and fixed cameras.

1.2 RELATED SECTIONS

A. Section 26 00 00 - Electrical.

1.3 REFERENCES

A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. Certifications: CE, FCC Class A, IK7, IK10, IP66, ISO, NEMA4, ONVIF, PSIA, RoHS 2, UL, and cUL, NEMA 4.

C. Institute of Electrical and Electronics Engineers (IEEE): IEEE 1100 Recommended Practice for Powering and Grounding Electronic Equipment.

D. National Fire Protection Association (NFPA):
   1. NFPA 70 2005 National Electrical Code.
   2. NFPA 72 National Fire Alarm Code.
   3. NFPA 80 Fire Doors and Windows, 2007 Edition.
   4. NFPA 101 Life Safety Code, 2009 Edition.

E. International Organization for Standardization (ISO): ISO 7816 Smart Card Standard.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - 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: Schematic of system components with physical space requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 5 year experience manufacturing similar products.

B. Installer Qualifications: Minimum 2 year experience installing similar products.

1.6 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to starting work of this section.

1.7 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.

1.8 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 recommended limits.

1.9 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.10 WARRANTY

A. Manufacturer's limited warranty with 3 year parts and labor warranty period except where noted 5 year (Valerus Elite line of servers and IP cameras).

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Vicon Industries, which is located at: 135 Fell Court; Hauppauge, NY 11788; Toll Free Tel: 800-645-9116; Tel: 631-952-2288; Fax: 631-951-2288; Email:request info (AEC_Support@vicon-security.com); Web:http://www.vicon-security.com

2.2 VIDEO MANAGEMENT SYSTEMS

A. General:
   1. All equipment and materials used shall be standard components, regularly manufactured, regularly utilized in the manufacturer's system.
   2. All systems and components shall have been thoroughly tested and proven in actual use.
   3. All systems and components shall be provided with the availability of a toll free 24-hour immediate technical assistance for the dealer/installer at no charge.

4. All systems and components shall be provided with an explicit manufacturer warranty.

B. Basis of Design: Valerus Video Management System as manufactured by Vicon Industries.
   1. Digital Video Recording Management and Network Software - General:
      a. Video Management Software (VMS): Browser-based application meeting requirements of business and government surveillance applications.
         1) Web client with single point of management for entire system.
         2) Configuration Sections of Application: Add, configure, and operate recording servers, application servers, web servers, as well as IP cameras and encoders (edge devices).
         3) Operation and Maintenance Application: Complete and comprehensive for video surveillance system.
         4) Full live digital video and audio surveillance over a standard 1 Gbps network.
      b. The VMS shall support recording, playback and archiving of video in standard industry compression formats, including H.265, H.264 and M-JPEG.
      c. True Open Standards (ONVIF) as Basis: Thin client architecture. Centrally licensed. COTS compatible software or available preloaded on a manufacturer certified application/web server or recording server (NVR).
      d. Three License Tiers: Associated with number of edge devices and a specific feature set. Licensing shall be based on a per edge device basis.
      e. COTS PCs with a minimum of Intel Core i7 processor, 16 GB of RAM and 5 GB of disk space for installation and a minimum of 75 GB of disk space for a recording device.
         1) Operating System: Microsoft Windows 10 64-bit.
         2) Operating System: Microsoft Windows 2012, 2016 and 2019 64-bit Server.
         3) The Client (web) supports Windows 7 Operating systems.
      f. Software Features: Easy to Use Tabs: Access configuration screen and dashboard monitoring systems health. Monitoring Screen: Video display area with available resources list. Multiple Display Views: Configurable with variety layouts. Multiple Monitors: Supported.
      g. Live Video: Stream through Recording Server (NVR) with auto fail over to cameras. PTZ available from live video. Presets and tours are configurable. Digital zoom provided on video displays.
      h. Web Based Interface:
         1) Access the VMS from any standard web browser enabled device.
         2) Browser compatibility: Internet Explorer 11 and Microsoft Edge. Chrome shall be able to be used with the Valerus Chrome extension from the Chrome store.
         3) Provide live viewing, playback and PTZ controls.
         4) Mobile App: Apple and Android smart phones and tablets. View live or recorded video. View concurrent multiple video streams; 4 on phones, 9 on tablets. Full control of PTZ, including presets. Quick and simple playback. Pinch to zoom on live and recorded video.
      i. Export Icon: Easy access on display to save a video clip. Archived in MP4 format and authenticated in the player per the ONVF spec.
      j. Playback: Supported from main screen without leaving live video viewing area. Clicking Playback from time icon will allow selecting the playback to start from a specific date and time using standard calendar tools.
      k. Software Delivery: Provided on manufacturer's website.
      l. Events: Setup in configuration area. Pre-Event Recording: Supported and with event notification.
      m. Access Control System Support: Accessed using a simple tab click. Interface opens in popup window that can be used in conjunction with the VMS.
      n. Enhanced Edge-based Analytics: Show bounding boxes around detected

objects in live and playback video.

o. Authorization roles shall be configurable; these roles shall then be listed in the Resources list on the monitoring display screen. This Resources list can be viewed in a hierarchy view with these groups or as a flat list.
p. Video Masking: Available centrally through the VMS. Allow users with the correct authority to unmask video as needed using icon on the display screen. Unmask feature available on live and playback video.
q. Quick Configuration Wizard: Streamlined process for typical and basic system setup with minimal input required.
r. Search Functions: Six search functions available including museum search, thumbnail search, events framework search, event/alarm search, audit log and Analytics Search.
s. Capability for 360 degree lens dewarp available for use with cameras with fisheye lenses.
t. Integration with Active Directory (AD): Allow user management via the AD.
u. Override mode: Allows operating in case AD communication is lost.
v. Import user list: A user list can be prepared in advance in standard Excel sheet saved in .csv format and imported into Valerus VMS.
w. Auto Archive: Archiving can be set up to occur on a schedule, for either all data or only events-based recording.
x. Multi-language Support: All text in the user interface translated to selected language.
y. Backup and Restore for system settings available.
z. Keypads and PLC controls supported. Numeric IDs for devices configurable for use with controls. These devices shall be able to control remote monitors.
aa. Central Software Upgrade Interface: Provides the ability to upgrade the entire system by pushing the upgrade from the Application Server to all devices on the system.
bb. System supports IPv4/IPv6 and HTTPS.
cc. A Gateway module shall be available to bridge migration from a legacy ViconNet Video Management System to this VMS and use the old system resources.
dd. The system shall have built in Log Collection from all system PCs, making it easier to troubleshoot problems. An advanced tool shall be provided.
ee. The system shall accept external text strings from third party systems.
ff. Alarm notification shall be both visual and audible.
gg. A Report button shall generate an Excel or HTML report of the devices sorted by their hosting NVRs or a flat list.
hh. Devices shall be able to be replaced or moved, for load balancing purposes.
ii. An NVR Failover unit shall be able to be configured to take over in the event of an NVR failure.
jj. A Mapping function shall be provided that allows the placement of resource devices on any imported map. The map shall be either a static or live map.
kk. An Events Database shall exist to store any event that occurs in the system. From the Event Search screen, a query shall be able to be created to search for any event that occurs on the system from any resource in the system.
ll. A video clip, either in live or playback, shall be able to be bookmarked for easy referral.
mm. The ability to use mobile devices as mobile cameras shall be available. The mobile device shall be able to receive event alerts.
nn. The VMS shall be able to accept partner systems through an integration framework.
oo. A Snapshot function shall be provided to capture video from live or playback; this snapshot shall be able to be saved. It shall be possible to capture snapshots from all resources and update them all at the same time.
pp. An Audit Log shall be available to track every user's actions.

qq. Keypads/PLC shall have the ability to call up other remote monitors.
rr. A thick-client solution shall be available for users who don't want to use a browser.
ss. Shall be operational in a virtual environment.
tt. An integration framework shall be provided to allow partnerships with third party systems such as LPR and Access Control.
uu. An Alarms Management module shall be provided that shall allow events to be defined as alarms and provide tools to review open alarms and close them. Alarms shall have a defined life cycle and procedures shall be able to be created to handle these alarms, if needed.
vv. A Client Performance Indicator shall be provided to indicate system performance as more cameras are added and displayed.
ww. Monitors shall be able to be managed from the Application Server in a central way and a monitor can be defined as an alarm monitor for use by the alarms/rules in the system. Monitor IDs shall be synced.
xx. The system shall have an enhanced dashboard that shall present the system's health status and provide health monitoring information and statistics on all connected devices, including Application Server, NVRs, and cameras. It shall provide notifications that notifications that provide cyber security and an easy-to-use activity mapping chart.

2. Setup, Configuration and Security of VMS:
   a. Multi-User Authorization Login Application.
      1) Offer levels of authorization based on functions.
      2) Setup Utility: Allows Administrator to configure additional users as well as user groups.
      3) User authorization: Configurable for specific system operations. Authorization Permission Setup: Performed using the User screen.
      4) Authorization Roles: Available to configure from the Authorization Roles screen. Permissions: Provide authority to perform all system functions.
      5) Users and groups on AD servers may be imported and become a group in the VMS.
      6) The software shall offer a full multi-user authorization process as follows: Authorization Roles: Created once globally. Authorized and given specific permissions. Users: Created once globally and may be given rights to groups. No virtual limit on number of groups and users authorized in the software. Authorization Roles to be authorized or denied access to: Monitoring screen for video display. Configuration. Dashboard. Video and audio (media) export. Override masking.
   b. A user, given appropriate access, may remotely configure components connected to the network. An access list shall be able to be created to add those PCs that are allowed to connect to Valerus, adding another layer of security.
   c. Software permits viewing of live video from any edge device connected to any recording server on the network.
   d. Export Icon: Simplifies process of exporting video, creating archives, and saving video to media, such as: USBs, CD, DVDs, or solid-state drives. An embedded player shall be optional with each exported/archived video clip for playback on any machine if configured to do so.
   e. Event Rules: Create rules triggered by an event occurrence. Define actions executed for a given event. Events are selectable. Rules are configurable after an event is selected.
   f. Event Association: Multiple devices may be associated with an event. Actions Triggered by Event: Configurable as On and Off. Display live video. Display a view. Go to a preset. Operate a relay. Run a PTZ tour. Run a view tour. Start a URL. Delay function.
   g. Scheduled Recordings: Applies to cameras, encoders, and microphones.

Scheduling is based on rules configurable for actions the system takes upon an event. Schedules accessible on recording tab in device configuration. Create and Schedule Recordings: By authorized users. How often schedules repeat; weekly, monthly, yearly, or never. Determines how the systems prioritizes schedules if schedule times overlap. Schedules available when configuring recording and rules, saving the need to create multiple and duplicate schedules. Sequencing cameras, including multi-screen displays. Record cameras at different qualities and frame rates from any recorder on the network. Schedule shall allow running preconfigured combinations of camera, sensor and PTZ programmed routines.

h. System Components: Application/Web Server: Act as main system server; Windows based. Global configuration of the system is stored on this server. Recording Servers (NVRs): Windows based providing communication, live streaming, recording, video playback and audio from cameras and encoders.

i. Device Configuration: Valid devices to be configurable for system recognition and operation. Cameras fixed or with integrated PTZ. Microphones. Encoders. Sensors. Relays.

j. Authentication: Video from cameras are enabled to verify the authentication of the video and present an authentication symbol on the displayed video for recorded playback through the player when enabled only on export.

3. User Interface for VMS:
   a. User Friendly Tabs: Allow monitoring of live and playback video, and configuration of the system.
   b. Login Window: Consists of Username and Password fields. Default Username and Password: Available for initial login. Configurable for increased security; there shall be an option to enforce a complex password.
   c. Serve operators, supervisors, and system administrators.
   d. Monitoring Display Screen:
      1) Selection of number of tiles to display.
      2) Resource list of devices in system. Viewable as flat list or hierarchical list based on user configured groups. Resources include names of devices and icons depicting devices. Video Channels (cameras) connected, differentiating between PTZ and fixed cameras. Audio Channels (microphones). Views. Tours. Web Pages. Relay Outputs.
      3) Display Area: Offers display configurations up to 36 tiles. Full screen View: Available. More views added by clicking the plus sign to create new view tabs while not losing the default view. Controls: Change the layout. Stop all displays. Export. Synchronize playback. Control current selected tab.
      4) Camera Controls: Display at top of a tile when mouse hovers and may be locked in place. Playback. PTZ control. Digital zoom. Unmask. Export. Configuration settings
      5) Playback controls: Visible when cameras go to playback. Looping a video section. Slow mode. Play from time. Rewind, fast rewind, pause, forward, and fast forward. Back to live video and current time.
      6) Access to all available programming menus.
      7) Viewing live devices is performed by dragging a device to any tile. Audio devices display in a smaller area below the video tiles.
   e. Dashboard, Search, Alarms and Configuration Menu Access: Clicking a tab at the top of the screen.
4. Video Quality for VMS: Support any resolution video, jpeg, and H.264 compression.
5. Add-Ins for VMS
   a. Access Control Systems: Available for integration.
      1) Meet requirements of business and government access control systems.
      2) Monitor and control facility access as well as video detection, temperature, and communications loss monitoring.

3) Provide control and access to users on Local Area Networks (LAN), Wide Area Networks (WAN), wireless networks and the Internet.
4) Video viewing playback and PTZ control from the VMS.

b. A method to add partner systems shall be provided through an integration framework. It shall support VAX Access Control, Vicon LPR, Neural Lab LPR and Thermal Radar sensor.

2.3 CAMERAS FOR VIDEO MANAGEMENT SYSTEMS

A. General:
1. All equipment and materials used shall be standard components, regularly manufactured, regularly utilized in the manufacturer's system.
2. All systems and components shall have been thoroughly tested and proven in actual use.
3. All systems and components shall be provided with the availability of a toll free 24-hour immediate technical assistance for the dealer/installer at no charge.

B. Manufacturer requires the use of uninterruptible power supply systems (UPS) to prevent voltage fluctuations that can affect operation and cause damage to the equipment. Failure to comply voids the warranty.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared. 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. 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 approved submittals.

3.4 PROTECTION

A. Protect installed products until completion of project. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION