OLD VAIL MIDDLE SCHOOL
VAIL UNIFIED SCHOOL DISTRICT

NEW LIBRARY

13299 E. Colossal Cave Rd.
VAIL, AZ 85641

SWAIM PROJECT #1116.54
DATE: October 11, 2019
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The Contractor shall provide and pay for all materials, labor services, tools, and other items necessary to complete the Project as specified and shown on the drawings. All materials shall be new, and both workmanship and materials shall be of good quality. All workmen and subcontractors shall be skilled in their trades. The Contractor shall be responsible for safe, proper, and lawful construction and shall construct in the best and most workmanlike manner a complete project reasonably implied. The Contractor shall protect the work and be responsible for any damage or injury due to his act or neglect. The Contractor shall keep the premises free from accumulation of waste materials at all times. Measurements must be taken on the job before erection or fabrication. Extra compensation will not be allowed because of differences between job and drawings that have not been brought to the attention of the Architect in writing before starting the work. Mention in the specifications or indication on the drawings of articles, materials, operations, or methods requires that the Contractor provide each item mentioned, perform each operation and provide all necessary labor, equipment, and incidentals.

1. PROJECT SCHEDULE:

   The project shall be completed as follows:

   A. Anticipated Notice to Proceed: December 1, 2019
   B. Substantial Completion: June 1, 2020

2. GENERAL NOTES:

   A. Smoking and all other tobacco products are not allowed on campus.

   B. Before the project will be classified as "final completion," the Contractor will develop and complete a punch list. The Owner and Architect will determine when the project meets "final completion." A punch list must be established and completed within the project calendar day time frame.

END OF SECTION

010300 ADDITIVE ALTERNATES

This section identifies each Alternate and describes basic changes to the Work only when that Alternate is made a part of the Work by specific provision in the Agreement.
1. The scope of Work for all Alternates shall be in accordance with applicable Drawings and Specifications.

2. Each Alternate is intended to cover all of the work required for a complete finished job.

3. Coordinate related Work and modify surrounding Work as required to properly and completely integrate the Alternates into the Work.

4. The Base Bid and the Alternates are exclusive in their scope of work. There is no overlap between or among the Base Bid and Alternates. The cost of any item of work shall be included only once, in the Base Bid or in the Alternates.

The Contractor shall include in his proposal the costs to accomplish each of the following described items of work:

1. W.I. Fence
2. Portable Risers
3. Gabion Seat Walls

END OF SECTION

010400 SUPERINTENDENCE

The Contractor shall keep on his work a competent superintendent satisfactory to Architect. The superintendent shall not be changed except with the consent of the Architect, unless the superintendent proves to be unsatisfactory to the Contractor and ceases to be in his employ. The superintendent shall represent the Contractor in his absence and all directions given to him shall be as binding as if given to the Contractor. Important directions shall be confirmed in writing to the Contractor. Other directions shall be so confirmed on written request in each case.

END OF SECTION

010410 WORK BY OTHERS

The following work shall be furnished and installed by others under separate contract with the Owner. Contractor shall allow access to the site and adequate space for storage of materials and equipment, cooperate and coordinate with Owner to accommodate the work within the specified time period. Responsibility for related work under this contract is noted. Where facilities are to be provided for rough-in only, under this contract, he shall verify requirements before proceeding with the work. Such items are as follows:

1. Furnishings
2. Library Shelving
3. Irrigation

END OF SECTION

010430 CLAIMS FOR EXTRA COST

If the Contractor claims that any instructions by drawings or otherwise involve extra cost under this contract, he shall give the Architect written notice thereof after the receipt of such instructions and in any event before executing the work. Submit a detailed cost breakdown with quantities and unit prices. No such claim will be valid unless so made. Cost of extra work shall be established and approved by the Architect before executing the work.

END OF SECTION

010950 REFERENCES

References to standard specifications and codes shall mean latest published edition at date of contract.

END OF SECTION

010960 CONTRACT DOCUMENT CLARIFICATIONS

Prior to commencing work, Contractor shall carefully examine the drawings, visit the site of work, and fully inform himself of all existing conditions and limitations excepting in underground and inaccessible locations. Should the Contractor, at any time during the course of this project, become aware of any inconsistencies, errors, omissions, or conflicts in drawings, specifications, codes, ordinances, or existing conditions, he shall notify the Architect in writing to request clarification direction. In the event of failure to so notify the Architect, the Contractor shall correct any deficiencies resulting therefrom as directed by the Architect at no extra cost.

END OF SECTION

010970 WORKMANNSHIP

If, in Contractor's opinion, any work is shown on drawings or specifications in such a manner to make it impossible to produce a high caliber of workmanship, such conditions shall be referred to Architect for clarification. Failure to notify Architect of such conditions and proceeding with work shall be cause for rejection of work and must be reworked or reinstalled in acceptable manner at no extra cost to Owner. Should conflict occur between drawings and specifications, Contractor shall be deemed to have estimated the more expensive way, unless certified in writing by Architect. Cutting or repairing work in place necessary because of progress of work
or negligence of Contractor shall be paid for by the Contractor responsible for the work in progress or the negligence.

END OF SECTION

010980  PERMITS

1. Building permits are not required. Utility connection fees shall be paid for by the Owner. All other permits shall be paid for by the Contractor.

2. Building Code Inspections shall be by the Architect and Engineers of record.

3. Special Inspections shall be paid for by the Owner.

END OF SECTION

011000  REGULATIONS AND STANDARDS

1. Conform to all codes and regulations having jurisdiction over this project, including International Building Code, local codes, and applicable mechanical and electrical codes.

A. Regulations: Comply with requirements of local laws and regulations covering construction and local industry standards, in the installation and maintenance of temporary services and facilities including but not limited to, the following:
   (1) Building codes, including local requirements for permits, testing, and inspection.
   (2) Health and safety regulations.
   (3) Utility company regulations and recommendations governing temporary utility services.
   (4) Police and Fire Department rules and recommendations.
   (5) Police and Rescue Squad recommendations.
   (6) Environmental protection regulations governing use of water and energy, and the control of dust, noise, and other nuisances.

B. Standards:
"Temporary Job Utilities and Services."

(2) Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services", as prepared jointly by AGC and ASC for industry recommendations.

END OF SECTION

011100  DEFINITIONS

"Or (approved) equal" shall mean approved as an equal in opinion of Architect prior to bid. "Approved" shall mean approved in writing by Architect. "As required" shall mean as required by competent construction practices. "As acceptable" shall mean acceptable by Architect. "As recommended" shall mean as recommended by Manufacturer.

END OF SECTION

011200  CONTRACTOR’S LICENSE LAW

Contractor shall comply with, and require all subcontractors to comply with, State and City Contractor's License Law and to be duly registered and licensed thereunder.

END OF SECTION

011300  SPECIFICATION HEADINGS

For convenience of reference, these specifications are separated into titled divisions. Such separations shall not operate to make the Architect or Owner an arbitrator to establish limits to the contracts between Contractor and subcontractors.

END OF SECTION

013300  SHOP DRAWINGS AND SAMPLES

Contractor shall supply the Architect with a schedule of all shop drawings to be submitted. Submit samples where required. Approved sample shall constitute example of work expected of entire project. All submissions are through General Contractor and shall be stamped, reviewed, and approved by the Contractor prior to submitting to the Architect. The Contractor shall not proceed with work until submittals are approved.

Review is for general conformance with the design concept and contract documents. Markings or comments shall not be construed as relieving the Contractor from
compliance with the contract plans and specifications or departure therefrom. The Contractor remains responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction and assembly, for coordination of his work and that of all other trades, and for performing his work in a safe and satisfactory manner.

1. Shop Drawings:
   
   A. Submit one (1) electronic copy for annotation and correction by Architect.
   
   B. All submittals shall have an 8.5" x 11" cover sheet indicating the type of submittal and project name. The remainder of the sheet shall be reserved for approval stamps from Contractor, Architect, and Consultants.

2. Materials List and Literature:
   
   A. Manufacturer’s literature and materials’ lists shall be submitted electronically. All color selection information shall be submitted in hard copy form or with actual samples for review.
   
   B. Manufacturer's literature shall be labeled to indicate the name of the project, manufacturer, brand or other identification where required. In addition, catalogues shall be marked to indicate the specific items submitted for approval.
   
   C. The right is reserved to require submission of samples of any material, and any materials' lists, whether or not specifically mentioned herein.

END OF SECTION

013310   COST BREAKDOWN AND PROGRESS SCHEDULE

After construction contract is awarded, Contractor shall provide a breakdown of his costs into categories, and an estimated schedule of progress in graph form. The schedule shall be updated monthly.

END OF SECTION

013345   PRIOR APPROVAL REQUESTS

All prior approval requests must include documentation which clearly indicates the differences in specification between the requested prior approval and the base specification. A sample manufacturer's warranty and a product sample is required where applicable. All prior approval requests must be received by the Architect with
the time limits prescribed in the instructions to bidders. Requests received after that
time will not be considered.

END OF SECTION

015000  TEMPORARY FACILITIES

The Contractor shall provide temporary field office, telephone, and restroom
facilities. Connections for temporary power and water shall be by the contractor. Power and water shall be paid for by the Owner.

END OF SECTION

015100  SITE PROTECTION

No existing trees or other vegetation shall be removed, trimmed, or damaged
without approval of the Architect. Vegetation located in the vicinity of construction
shall be tagged, fenced off, and/or tied back for protection. Portions of the site not
affected by new construction shall remain undisturbed.

END OF SECTION

015150  TEMPORARY ENCLOSURES, BARRIERS AND FENCES

1. Provide and maintain all fences, barricades, lights, shoring and other
protective structures or devices necessary for the safety of workmen, equipment, the public, and property as required by state or municipal
laws and regulations, local ordinances, laws, and other requirements of
the county, state, and other authorities having jurisdiction with regard to
safety precautions, operation, and fires hazards.

2. Provide 6 foot high woven wire temporary fencing around the construction
area. Fencing shall be erected and secured in a manner to withstand the
forces to which it may be subjected. Locate gates for access to the areas as
required. Close and lock all gates after normal working hours. Barbed wire
is not permitted on fencing.

3. Protect all elements of construction from any danger of damage from wind,
rain, dust, frost, freezing temperatures, or other infiltration of weather.

END OF SECTION

015200  SECURITY
The Architect and the Owner do not assume any responsibility, at any time, for the protection of construction areas and premises, or for loss of materials, from the time that the contract operations have commenced until the final acceptance of the work by the Architect and Owner. If watchman service is deemed necessary by the Contractor, such protection shall be provided and paid for by the Contractor.

END OF SECTION

015250  NOISE AND DUST CONTROL

Exercise all possible care to control excessive noise and dust during the construction to keep these problems to a minimum. Traffic or construction areas shall be sprinkled with water or chemicals as required and in accordance with applicable County requirements. The contractor shall pay for and provide all water necessary to minimize dust during the project.

END OF SECTION

016000  MATERIALS

Each Contractor is responsible for proper care of his materials and equipment until date of acceptance of work. Materials damaged or destroyed shall be removed and replaced with new materials. All materials shall be new unless noted otherwise. Installation of materials over sub-surface will be considered as acceptance of sub-surface by materials applicator.

END OF SECTION

017700  PROJECT CLOSEOUT

1.  General:

A.  Related Documents:

   (1)  Drawings and general provisions of Contract, including General Conditions and other Division-1 Specification Sections, apply to this Section.

2.  Summary:

A.  This section specifies administrative and procedural requirements for project closeout including, but not limited to, the following:
    Review procedures
    Project record document submittal
    Operating and maintenance manual submittal
    Submittal of warranties
Final cleaning

3. Substantial Completion:

   A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in request.

      (1) In the Application for Payment that coincides with, or follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and as statement showing an accounting of changes to the Contract Sum.

      (2) If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.

      (3) Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.

      (4) Submit record drawings, maintenance manuals, final project photographs, damage or settlement survey, property survey, and similar final record information.

      (5) Deliver extra stock and similar items.

      (6) Complete final clean-up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

      (7) The Owner's Representative will repeat review when requested and assure that the Work has been substantially completed.

      (8) Results of the completed review will form the basis of requirements for final acceptance.

4. Final Acceptance

   A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

      (1) Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include
certificates of insurance for products and completed operations where required.

(2) Submit an updated final statement, accounting for final additional changes to the Contract Sum.

(3) Submit consent of surety to final payment.

B. Re-inspection Procedure: The Owner’s Representative will again review the Work upon receipt of notice that the Work, including review list items from earlier reviews, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Owner's Representative.

5. Record Document Submittals

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Owner's Representative's reference during normal working hours.

B. Record Drawings: Maintain a clean, undamaged set of prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.

Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.

Note related Change Order numbers where applicable.

Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates, and other identification on the cover of each set.

If digital copies of record drawings in PDF format are used, provide one (1) hard copy set to Owner as well as three (3) digital copies.

C. Record Specifications: Maintain one complete copy of the Project
Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options, and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data.

Upon completion of the Work, submit record Specifications to the Owner's Representative for the Owner's records.

D. Record Product Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work that cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.

E. Maintenance Manuals: Provide three (3) hard copies and two (2) electronic copies of all O&M Manuals for equipment and products installed during the construction or remodeling project. Organize operating and maintenance data into suitable sets of manageable size. All of the close out documents are to be placed in a white three ring binder which has a see-through front panel and binding edge that allows a sheet to be installed as a title sheet.

All information shall be installed in a proper indexed individual heavy-duty 2-inch, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Table of Contents is to be typed and installed.

All notebooks are to have divisions for each of the categories as listed below. Include the following types of information.

1. Provide a copy of all maintenance parts and supplies required to maintain building operations for a year or through normal maintenance cycle. Examples would be filters, lamp schedule, etc.

2. Provide copies of all shop drawings and product Cut Sheets for all brand names of major items used on the project, such as
light fixtures, electrical switch gear, HVAC units, fans, coils, etc.

(3) Provide all **Letters of Warranty** for installation and project.

(4) Provide a **listing of all Sub-Contractors** performing work on the project and their responsibility during the project.

(5) Provide any and all Regulatory Documents, i.e., permits, air inspections, waste manifest, etc. that applies to the project, or were part of the project during the construction or remodeling phases, that are required by Federal, State, Local Code, and/or Regulatory Agencies.

(6) Provide a copy of **Record Drawings** for project.

6. **Closeout Procedures**

   A. **Final Cleaning:**

      (1) General: General cleaning during construction is required.

      (2) Cleaning: Clean the site, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits.

      (3) Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

      Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION

**017710 CLEAN-UP**

The job site work area shall be clean and orderly at all times. Upon completion, leave work in clean condition. Each subcontractor responsible for removal of debris caused by his work. Contractor shall do the following cleaning:

1. Clean all tire marks off of sidewalks and concrete paving in project area.

2. Glass: Remove putty, stains, etc. and wash and polish all glass, both sides.
3. Painted, Decorated, and Stained Work: Remove all marks, stains, fingerprints, and other soil and dirt. Touch-up as required.
4. Hardware and Metal Surfaces: Clean all hardware and metal surfaces.
5. Tile and plumbing fixtures: Clean and polish; seal tile grout.
6. Clean all fingerprints off finished surfaces – walls, ceilings, millwork, etc.
7. Carpet: Vacuum and remove any spots.
8. Concrete floors: Clean and polish.

END OF SECTION

017720 ADDITIONAL MATERIALS FOR OWNER MAINTENANCE

Upon completion of the project, the Contractor shall furnish the Owner with containers of each of the following items of material of each color or type used in the job:

1. Paints and stains: 1 unopened gallon, each color.
2. Rubber base: 50 linear feet, each color.
3. Ceramic tile: 1 box, each type and color.
4. Acoustic Ceiling Tiles: 1 box.
5. Carpet Tile: 1 box.

The above materials shall not be utilized by the Contractor for repairs or replacement prior to final acceptance of the project by the Owner.

END OF SECTION

017740 GUARANTEE

Contractor shall guarantee his work for a period of two years, or a longer period when so specified, from date of final acceptance. Should defects develop within guarantee period due to faults in materials and/or workmanship, Contractor shall make all repairs and do all necessary work to Architect’s satisfaction without cost to Owner within ten days after notice to Contractor. If Contractor fails to do work so ordered, Owner may have work done and charge cost thereof against monies retained and, if said monies shall be insufficient to pay such cost or money available, Contractor and his sureties agree to pay Owner for such work. Nothing herein intends or implies that guarantee shall apply to work which has been abused or neglected by the Owner.

END OF SECTION
END OF DIVISION
DIVISION 3 - CONCRETE

031000 CONCRETE FORMWORK

1. GENERAL:

A. Description of Work

   (1) Work as evident on drawings and specified herein or required for furnishing all labor, materials, equipment and services necessary for installation of formwork, complete in conjunction with Section 033000 Cast-In-Place Concrete.

B. Related Work

   (1) Section 032000: Concrete Reinforcing Steel
   (2) Section 033000: Cast-In-Place Concrete.

C. Standards

   (1) Formwork shall conform to the latest edition of the following standards and to the drawings and specifications:

      a. ACI 347 American Concrete Institute - Recommended Practice for Concrete Formwork.
      b. ACI SP-40 American Concrete Institute - Formwork for Concrete
      c. ASTM American Society for Testing and Materials Standards.

D. Formwork Design

   (1) The Contractor shall assume all responsibility for the safety of the formwork and shall provide all necessary design, construction, materials, and maintenance to produce the required concrete work safely. Design all formwork to have sufficient camber to maintain the tolerances specified. Strength shall be sufficient to compensate for the weight of the fresh concrete and a construction live load of 50 psf minimum.

2. PRODUCTS:

   A. Form Facing Materials

      (1) Concrete surfaces to be left exposed at completion of work: PLYFORM Class I or II B-B EXT-DFPA conforming to the U.S.
Product Standard PS I for Softwood Plywood.

(2) Concrete surfaces to be left unexposed at completion of work: Plywood or boards capable of producing finished surfaces that are reasonably true to line and plan.

B. Form Ties

(1) Continuous single member and internal disconnecting.

C. Form Release Agent

(1) Nonstaining, free from lubricating, conventional form and diesel oils, or kerosene; a chemically active form release agent that will not impair bonding of plaster, paint or cement coatings to concrete surfaces.

3. EXECUTION:

A. Forms

(1) For plywood formed surfaces to be left exposed at the completion of the work, use 5/8" or thicker plywood with joints true, level and taped or caulked to prevent leakage of cement paste, and locate form ties level and plumb in horizontal rows and vertical tiers.

(2) Concrete surfaces that will remain exposed at completion of the work shall be formed as specified, as shown on Drawings, and in such a manner that the exposed surfaces require a minimum of reworking to be acceptable to the Architect. Forms shall be sufficiently tight to prevent leakage of cement paste. Flashes of concrete that occur between abutting edges of plywood forms shall be removed.

(3) Allowable Tolerances: In accordance with requirements of ACI 347, paragraph 3.3.1; mass concrete in accordance with ACI 347, Paragraph 3.3.
B. Accessories

(1) Install accurately and firmly in forms all inserts and embedded items as shown on Drawings, as required to support or fasten the work of other trades, as provided and located by other trades, and as necessary to complete the work. Secure them against displacement during concreting.

C. Removal of Forms

(1) Forms shall be removed only with the approval of Architect and in a manner to insure complete safety of the structure. In no case shall the supporting forms or shoring be removed until the members have acquired sufficient strength to support safely their weight and the load thereon. The results of suitable control tests may be used as evidence that the concrete has attained such sufficient strength.

END OF SECTION
032000 – CONCRETE REINFORCING STEEL

1. GENERAL:

A. Description of Work

(1) Work as evident on the drawings and specified herein or required for furnishing all labor, materials, equipment, and services necessary for the installation of reinforcement complete, in conjunction with Section 033000 Cast-In-Place Concrete.

B. Related Work

(1) Section 033000: Cast-In-Place Concrete.

(2) Drawings: General Structural Notes.

C. Submittals

(1) Certificate: Mill certificate of compliance shall be provided for all reinforcing steel.

(2) Shop Drawings: Furnish shop drawings in accordance with Section 013300 Shop Drawings and Samples showing all reinforcing steel bending and assembly diagrams, splicing, laps or rods, shapes, dimensions and details. Shop drawings shall be approved before fabrications.

   a. In reviewing shop drawings, the Architect / Engineer will attempt to detect omissions and major errors, but neither failure of the Architect / Engineer to do this nor the review of the shop drawings shall relieve the Contractor of their responsibility to comply with the Drawings and Specifications.

E. Standards

(1) Detailing, fabrication and placing of all reinforcing steel shall conform to the latest edition of the following standards and to the Drawings and Specifications.

   a. IBC International Building Code, Chapter 21, Masonry; and Chapter 19 Concrete.

   b. ACI 315 American Concrete Institute-Manual of Standard Practice for Detailing Reinforced Concrete Structures.

   c. ACI 318 American Concrete Institute-Building Code Requirements for Reinforced Concrete.
d. ICBO Research Recommendation Report

e. ASTM American Society for Testing and Materials Standards, latest editions.

2. PRODUCTS:

   A. Reinforcement

      (1) Reinforcing Steel: ASTM A615 with supplement (SI), marked "S" and as follows: Grade 40 for Numbers 3 thru 4; Grade 60 for Numbers 5 thru 18.

      (2) Welded Wire Fabric (mesh): ASTM A185; Wire per ASTM A82.

      (3) Tie Wire: ASTM A82, 18 gage black annealed wire.

      (4) Dowel Bar Splicers and Dowel-Ins: As manufactured by the Richmond Screw Anchor Co., or approved equal, with a minimum rated tensile capacity of 150% of the yield strength for grade 60 steel. Dowel-ins shall have enlarged ends so that the cross-sectional area of bar is not reduced for threading.

   B. Accessories

      (1) Spacers, ties, chairs and other devices as required for placing spacing, supporting and fastening reinforcement.

3. EXECUTION:

   A. Accessories

      (1) Contractor shall supply all necessary wiring, chairs, bolsters, supports, and support bars, to put the reinforcement in place, fasten it securely, and keep it in place while concrete is being poured. Spacers, chairs, ties, and other accessories conforming to the American Concrete Institute Standards shall be furnished and installed to hold the bars in position. Chairs in sufficient number to prevent sagging and to support any pedestrian traffic during construction shall be used, but in no case less than that shown in the "Standard Number and Location of Accessories" in ACI 315.

   B. Placement

      (1) Metal reinforcement shall be free from scale, rust and other coatings which destroy bond. Metal reinforcement shall not be straightened or re-bent in a manner which will injure the material. Bars with kinks or bends not shown on the plans shall not be used.
(2) On any vertical construction joint in the work where horizontal bars extend beyond the construction joint, the forms or head against which the work ends shall be perforated at the proper places to allow the bars to project through.

(3) Unless otherwise indicated on the plans, reinforcement shall be so placed as to provide a protective concrete covering in accordance with ACI 318. The bars shall be cut and bent as required and wired together. All bending shall be accurately done, as shown on the plans and by methods and appliances approved by the Architect. Adjoining bars and splices shall be per drawings but not less than at least 36 diameters in concrete, 48 diameters in masonry, and not less than 2’-0”.

(4) Splices and laps shall be in accordance with plans. Necessary splices not shown on the Drawings shall be lapped sufficiently to develop the strength of the bar by bond and securely wired location shall be approved by the Architect.

(5) The clear distance between reinforcing bars shall not be less than 1-1/3 times the maximum size of coarse aggregate or 1-inch absolute minimum.

(6) All horizontal reinforcing in concrete shall be continuous around corners or corner bars shall be provided. Where bars of different sizes intersect at corners, corner bars of the larger size shall be provided.

END OF SECTION
033000 – CAST-IN-PLACE CONCRETE

1. GENERAL:
   
   A. Description of Work
      
      (1) Work as evident on the Drawings and specified herein or required for furnishing all labor, materials, equipment, and services necessary to complete all cast-in-place concrete work.
   
   B. Related Work
      
      (1) Drawings: General Structural Notes
      (2) Section 031000: Concrete Formwork
      (3) Section 032000: Concrete Reinforcing Steel
      (4) Section 072610: Under Slab Vapor Barrier
   
   C. Submittals
      
      (1) Certificates: Cement will be accepted on the basis of the manufacturer's certification of compliance, accompanied by mill test reports, that cement meets the physical and chemical requirements of the specification under which furnished.
      
      (2) Mix Design: Concrete mix design.
   
   D. Standards
      
      (1) Concrete work shall conform to the latest edition of the following Standards and to the Drawings and Specifications for the construction of Concrete Work:
         
         a. IBC International Building Code, Chapter 19, Concrete.
         b. ICBO Research Recommendation Report.
         c. ACI 318 American Concrete Institute – Building Code Requirements for Reinforced Concrete.
         d. ASTM American Society for Testing and Materials Standards.
   
   E. Quality Control - Field Tests of Concrete
      
      (1) All quality control testing during construction, if required by the Architect or Engineer, shall be paid for by the Owner and accomplished by the Geotechnical Laboratory of record that
prepared the original report. In the event any retesting is required due to the failure of materials to meet specifications limits, the Contractor shall pay for all such retesting.

(2) Compressive Strength Tests: ASTM C39; one set of samples of each class of concrete placed each day shall be taken not less than once a day, nor less than once for each 150 cubic yards of concrete, not less than once for each 5,000 square feet of surface area for slabs or walls; one sample tested at 7 days, two samples tested at 28 days. Additional samples for early strength or 56 day testing shall be paid for by the Contractor. Testing of mixes shall be paid for by the Owner and accomplished by an accredited testing laboratory approved by the Architect.

(3) When tests of laboratory cured cylinders fail to meet specified requirements, the Contractor shall change proportions of water-cement ratio to increase the strength to the specified value, as directed by the testing laboratory.

(4) If any strength test of laboratory-cured cylinders falls below required $f'_c$ by more than 300 psi, if there is evidence that quality of concrete is below specification requirements, or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken by the Contractor to assure that load-carrying capacity of the structure is not jeopardized.

a. When load tests indicate that concrete does not meet specifications, measures as prescribed by the Architect shall be taken by the Contractor to correct the deficiency at no additional expense to the Owner.

F. Embedded Items

(1) Full cooperation shall be given other trades to install embedded items. Suitable templates or instructions, or both, will be provided for setting items placed in the forms. Embedded items shall have been completed and approved before concrete is placed.

2. PRODUCTS:

A. Cement

(1) Portland Cement Type II, conforming to ASTM C150 and shall be properly protected from weather.

B. Aggregate
(1) Sand (fine aggregate) shall be hard, clean, screened, and washed sand. Gravel (coarse aggregate) shall be sound, clean, and durable particles and graded between the limits for size No. 57. Aggregates shall be free from clay, loam, organic or foreign substances, and shall conform to the requirements of ASTM C33.

C. Water

(1) Clean, fresh and free from harmful acids, alkalis, oils, and organic substances.

D. Expansion Joint Filler

(1) Resin impregnated fiberboard conforming to physical requirements of ASTM D1752, 1/2-inch unless otherwise indicated.

OR

(2) Sponge rubber, preformed, nonextruding, cement gray color; ASTM D1752, Type 1; 1/2-inch thick unless otherwise indicated.

E. Membrane-Forming Curing Compound

(1) Products complying with ASTM C309, Type I include the following:
   a. Burke "Res-X Clear Resin Base: Or equal at floor surfaces to receive paint, resilient floor covering, or other bonded finish to slab.
   b. Burke "Cure Clear Wax Base" or equal at floor surfaces to receive natural concrete finish.

(2) Apply curing compounds in accordance with manufacturer's instructions.

F. Admixtures

(1) Subject to prior approval by the Architect. The admixtures shall be shown capable of maintaining the same composition and performance throughout the work as the product used in establishing concrete proportions in accordance with ACI 318, Section 5. Calcium chloride or any admixture containing chloride ions shall not be used. Fly Ash shall not be allowed in mortar or grout. Fly Ash for concrete shall be Class F conforming to ASTM C618 and shall not replace more than 20% cement by weight.

G. Concrete Water Admixture

Interior concrete floor slabs shall have one of the following waterproofing
admixtures or an approved equal

(1) AConcure@ by Concure Corporation (1-800-925-7746)
(2) ADarapel@ by W.R. Graw & Co. (1-602-233-12976)
(3) ARheomix 235” by Master Builders Technologies (1-800-628-9990)

H. Chemical Hardener

(1) Colorless aqueous solution containing a blend of magnesium fluosilicate combined with a wetting agent, containing not less than two pounds of fluosilicates per gallon.

I. Moisture-Retaining Cover

(1) One of the following, complying with ASTM C171:
   a. Waterproof paper.
   b. Polyethylene film CS 238 at least 6 mils thick.
   c. Polyethylene-coated burlap.

J. Grout-Non-Shrink, Non-Metallic

(1) Grout for column and beam bearings, "Five Star Grout" as manufactured by U.S. Grout Corp., Old Greenwich, Conn.

K. Drill-In Expansion Anchors

(1) The anchors shall be a non-drilling type per the general structural notes. Anchors require Special Inspection by Testing Laboratory.

M. Non-Structural Fill Concrete

(1) Fill Concrete used behind retaining walls shall be 1,000 psi at 28 days, with 8" slump and ½" maximum aggregate.

3. EXECUTION:

A. Concrete Design

(1) Design mixes shall develop the compressive strength within 28 days as indicated on the drawings for the various uses indicated.
(2) Concrete shall be of the specified quality capable of being placed without excessive segregation and, when hardened, of developing all characteristics required by Specifications.

(3) The proportions of ingredients for concrete shall be selected in accordance with ACI 318, Sections 5.2, 5.3, and 5.4, to produce the proper placeability, durability, strength and other required properties. However, total water content, including free moisture in the aggregate and all liquid admixtures shall not exceed 40 gallons per cubic yard, or as specified in the General Structural Notes, whichever is more restrictive.

(4) Limit slump as indicated on the drawings.

(5) All concrete shall be mechanically mixed until uniformly distributed. Each batch shall be mixed at least one minute after all the materials are in the mixer, and the mixer must be completely discharged before recharging. No ready-mix concrete shall be used which has been in the truck more than 90 minutes (60 minutes if air temperature exceeds 85 degrees) from the batch plant. All ready-mix concrete shall be prepared in conformance with ASTM C94.

B. Joints

(1) Construction Joints in Structural Members: Location and detail of all construction joints in structural members, including structural slabs, piers, walls, grade beams, and footings shall be subject to the approval of the Engineer of Record.

(2) Joints in Slabs on Grade: Install contraction, construction, and expansion joints as shown in slabs on grade.
   a. Provide one layer 30 pound felt at all locations where interior slabs on grade abut a vertical surface, and 1/2 inch preformed joint filler where exterior slabs as shown in slabs on grade.
   b. Control (contraction) joints in slabs shall be located as detailed on the plans.
   c. Joints in exterior concrete walks, slabs, etc., shall be placed as follows except as otherwise noted:
      1) Expansion Joint - 15'-0" o.c. each way.
      2) Cut Joints or Contraction Joints - 5'-0" o.c. each way.

C. Placing Concrete
(1) Inspection: All concrete excavations, trenches, forms, reinforcing miscellaneous steel and anchor bolt placement related items shall by inspected and approved by the Architect's representative prior to pouring any concrete. For this purpose the Architect shall be notified 24 hours in advance by the Contractor of his intention to pour concrete.

(2) Concrete shall be placed in approximately horizontal layers not to exceed 12" in depth and the concrete pour shall be carried on in a continuous operation until the placing in the section or monolith is completed. Concrete shall be deposited at or near its final position to avoid segregation caused by rehandling or flowing. No concrete shall be dropped freely into place from a greater height than five feet. Tremies shall be used for placing concrete where the drop is in excess of such a height.

(3) Concrete shall be placed with the aid of approved mechanical vibrating equipment. Vibration shall be transmitted directly to the concrete, sufficiently intense to cause the concrete to settle readily into place and to visible affect the concrete over a radius of at least 18". Vibrators shall not, however, be used to transport concrete or force concrete to flow horizontally. Vibration shall be supplemented by manual forking or spading adjacent to the forms on exposed faces in order to secure smooth, dense surfaces. If, for any reason, the surfaces or interiors have voids or are in any way defective, such concrete shall be patched or repaired as directed by the Architect, and no defective work shall be patched or repaired without the prior inspection and approval of the Architect.

(4) Concrete placing shall continue without avoidable interruption unless otherwise specified, until the predetermined limit of the placement has been attained.

(5) Placing of concrete in which initial set has occurred or placing of retempered concrete will not be permitted. Concrete which has contained water for more than 90 minutes will not be accepted.

(6) When placing fresh concrete against old concrete, the latter shall be cleaned of all objectionable matter, and a proper bond shall be made by grouting with neat cement or painting with "Weldcrete".

D. Hot Weather Requirements

(1) Steps shall be taken as necessary to reduce concrete temperatures and water evaporation by proper attention to ingredients, production methods, handling, placing, and curing. During hot weather, concrete pours shall be scheduled for the early morning hours to maximum extent possible, to allow for placing, finishing
and protection of the entire monolith poured by a time not later than 12:00 noon. Details of hot weather concrete pours shall be in accordance with ACI 305.

(2) Contractor shall provide fog spraying during placement of slabs-on-grade, or other methods approved by the architect, when the rate of evaporation equals or exceeds 0.2 pounds per square foot per hour as specified on the drawings.

E. Cold Weather Requirements

(1) Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.

(2) No concrete shall be placed if anticipated temperatures of the surrounding air are to go below 30 degrees F, unless provisions are made for a heated enclosure for protection. Removal of forms during cold weather concreting shall be based on strength tests of field cured cylinders as directed and approved by Architect.

(3) When air temperature has fallen to or is expected to fall below 40 degrees F, uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 50 degrees F, an not more than 80 degrees F at point of placement.

(4) Do not use frozen materials or materials containing ice or snow. Do not place concrete or frozen subgrade or on subgrade containing frozen materials.

(5) Do not use calcium chloride, salt or other materials containing antifreeze agents or chemical accelerators.

F. Curing Concrete

(1) Concrete shall be protected against loss of moisture, rapid drying or temperature changes, mechanical injury or injury from rain or flowing water for a period of at least seven days in accordance with requirements of ACI 308 and ACI 305, as specified herein. Curing shall commence as soon as free water has disappeared from the surfaces after finishing.

(2) Formed Surfaces: Forms in contact with concrete during the curing period shall be kept wet. If forms are removed during the curing period, a curing method and/or material, approved by the Architect, shall be employed immediately. Such curing shall be continued for the remainder of the curing period.
(3) Curing may be accomplished by any of the following methods:

a. Moist Curing: Surfaces shall be kept continuously set by covering with burlap, mats or sand, thoroughly saturated with water and covering kept wet by spraying or hosing. Place materials to provide complete surface coverage and lap all joints minimum 3".

b. Moisture-Retaining Cover Curing: Surfaces shall be thoroughly wetted with a fine spray of water and then covered with waterproof paper, polyethylene sheeting or polyethylene coated waterproof paper. Edges and ends of sheeting shall be overlapped not less than 4" and securely cemented or taped to form a continuous cover. Sheetng shall be weighted down to prevent displacement and shall be repaired or replaced if torn, damaged, or removed during curing period.

c. Liquid Membrane Forming Curing Compound: Compound shall not penetrate, stain, or have any deleterious effect on finish. Compound shall not be used on floors to receive dust preventative treatment or on slabs to receive additional concrete fill. Immediately following removal of forms, loose materials and debris shall be removed from surfaces, the surfaces thoroughly moistened with a light spray of water, and expansion joints and other joint openings covered to prevent compound from entering. Compound shall be applied on damp surfaces as soon as moisture film has disappeared. Power spraying equipment shall be used. Material shall be applied in a two-coat, continuous operation at a coverage of not more than 200 square feet per gallon for each coat. Second coat shall be applied in a direction at right angles to application direction of first coat. Compound shall provide a uniform, continuous, adherent film that shall not check, crack, or peel, and shall be free from pinholes or other imperfections. Surfaces subjected to heavy rainfall within 3 hours after compound has been applied or surfaces damaged by subsequent construction operations within curing period shall be resprayed at specified rate. Coated surfaces shall be kept free of foot and vehicular traffic and other sources of abrasion during curing period. After compound is dry, all surfaces to be subjected to traffic shall be covered with waterproof Kraft Paper, lapped 9", and covered with sand.

G. Finishing After Removal of Forms

(1) Vertical Surfaces:
a. Immediately after removal of forms and before the concrete is dry, all excess projections and loose materials shall be removed; honeycomb, aggregate pockets, voids over 1/2" diameter and holes left by form ties cut back or undercut to solid concrete shall be thoroughly wetted, brush-coated with grout consisting of equal parts of Portland cement to two parts fine aggregate. When dry, mortar shall match concrete in color. Holes extending entirely through the walls shall be filled from back, forcing the mortar through the wall. Patching shall be damp cured for period as specified under CURING. Exposed patchwork shall be finished to match texture of adjacent concrete surfaces. All new surfaces adjacent to existing surfaces shall match existing finishes.

b. Smooth Finish: All exterior and interior exposed surfaces not otherwise noted shall be finished smooth. Mix 1-part Portland cement and 1-1/2 parts fine aggregate with water to produce a grout having the consistency of thick paint. White or light-colored Portland cement shall be used to obtain the desire color. Wet surface to prevent absorption of water from grout. Apply grout uniformly, completely, filling air bubbles and holes. Immediately after applying grout, float the surface with cork or wood floats, scouring the wall vigorously. While grout is still plastic, surface shall be finished with a sponge rubber float, removing excess grout. The finishing shall be done at the time when grout will not be pulled from holes or depressions. After the surfaces have dried thoroughly, rub vigorously with dry burlap to completely remove dried grout. There shall be no visible film of grout remaining after rubbing. The entire finishing operation for any area shall be completed the day it is started. Grout shall not be left on the wall overnight. Finished surfaces shall be uniform in color and texture, without lap marks or clouding. Spots or streaks shall be retreated.

(2) Finishing Concrete Slabs:

a. Surface of concrete fill and slabs shall be at elevation to receive finish specified and noted. Finished fill and slabs shall be struck off true and level surfaces with a tolerance of 1/8 inch in 10 feet as measured with a 10 foot straightedge and the Floor flatness and Floor Levelness criteria specified on the drawings. Upon completion of leveling, all screeds shall be removed and spaces filled with concrete. Finished work shall permit the free drainage of water from surface at all points. Finishing may be by hand or power finishing machines. Joints and edges shall be straight and finished with jointing and edging tools.
b. Float Finish for interior slabs shall be obtained by screeding to finish elevation and all surface water and laitance removed. Floating shall commence as soon as screeded surface has sufficiently set. Floating may be performed by hand using a wood float, or by power driven floats to produce a smooth, even textured surface. Slabs in all areas which are to receive ceramic or quarry tile shall be float finished.

c. Monolithic Finish for interior slabs shall be obtained by striking off to true surface at finished elevation, then screeding and floating with straightedges to bring surface to finish level. While concrete is still green but sufficiently hardened to bear a man’s weight without deep imprint, it shall be wood-floated to a true, even plane with no coarse aggregate visible. Sufficient pressure shall be used on floats to bring moisture to the surface. After surface moisture has disappeared, surfaces shall be steel-troweled to a smooth, even, impervious finish, free from trowel marks. When the concrete has sufficiently set to ring the trowel, the surface shall receive a second steel-troweling to a burnished finish except that surfaces receiving resilient flooring shall not receive the second steel troweling. All slab areas shall receive a monolithic finish except those specifically excluded under other finishes specified herein. Coordinate efforts where the concrete floor is the exposed surface to control finish and cracks.

d. Broomed Finish for exterior sidewalks, slabs, platforms, stair treads and ramps shall be finished by tamping the concrete to force coarse aggregate away from the surface, screeding and floating to bring surface to finish level, steel troweling to an even, smooth surface and then brooming with a fine hair broom in a direction transverse to that of the principal traffic, or in the patterned direction as indicated on the drawings.

e. Float Finish for exterior sidewalks shall be obtained by screeding to finish elevations and all surface water and laitance removed. Floating shall commence as soon as screened surface has sufficiently set. Floating may be performed by hand using a wood float, or by power driven, floats to produce a smooth, even textured surface. All slab edges, including those of formed joints, shall be finished carefully with an edger having a radius of 1/8 inch.

f. Chemical-Hardener Finish: In addition to finishing as specified for monolithic finish, apply chemical-hardener finish to interior concrete floors where shown on Drawings or on schedules as "exposed concrete".
1) Apply liquid chemical-hardener after complete curing and drying of the concrete surface. Dilute liquid hardener with water, and apply in three coats; first coat, 1/3 strength; second, 1/2 strength; third coat, 2/3 strength. Evenly apply each coat, and allow 24 hours for drying between coats. Apply proprietary chemical hardeners in accordance with manufacturer’s printed instructions.

H. Cement Mortar or Grout

(1) Cement mortar for the repair of imperfect concrete work, the filling of holes left by form bolts and ties, and the filling of voids, around piping through concrete shall consist of cement and sand mixed in the same proportion as used for the concrete being repaired, with only sufficient water to give the required consistency, but in no case shall the water-cement ratio be more than that specified for Class "A" concrete. Bolt holes shall be filled with dry pack mortar, well tamped down into holes.

(2) Grout for spreading over the surfaces of construction joints shall consist of water and cement mixed in the ratio of not to exceed seven gallons per sack with sufficient sand added to produce the desired workability of the mass.

(3) Cement mortar or grout that has not been placed within 30 minutes after mixing shall be wasted.

I. Inserts

(1) Pipes, anchor bolts, sleeves, reglets, casings and other inserts, as shown on the plans, or as required, shall be encased in the concrete unless otherwise noted.

(2) Contractor shall notify all subcontractors and other prime contractors who have items to be embedded in or pass through the concrete at least five days in advance of the placing of concrete.

(3) The Contractor shall leave any openings through the walls or floors as shown on Mechanical and Electrical drawings and other required openings as directed by the Architect. In case of any conflict with structural members, the Contractor shall notify the Architect and suitable solution resolved before the concrete is placed.

J. Cleaning

(1) After the concrete work is complete, carefully remove all excess concrete and all protective materials and broom the surfaces and
remove all mortar and other foreign materials. All concrete inserts, anchors bolts, etc., shall be cleaned of all concrete after forms are removed.

K. Waste Management

(1) Separate and recycle waste materials to the maximum extent economically feasible.

(2) Before concrete pours, designate locations or uses for excess concrete. Options include:
   a. Additional paving
   b. Post footing anchorage
   c. Swale, riprap reinforcing
   d. Flowable fill
   e. Footing bottom, retaining wall footing ballast
   f. Storm structure covers
   g. Underground utility pipe kickers
   h. Storm pipe flared end section
   i. Toe wash protection, and shoulder and toe outfall restraints for temporary erosion pipes

(3) Before concrete pours designate a location for cleaning out concrete trucks. Options include:
   a. Company-owned site for that purpose (meeting environmental standards)
   b. On-site area to be paved later in project.

END OF SECTION
033500 – DENSIFIED CONCRETE FINISH

1. GENERAL:

A. Description of Work

(1) Work as evident on the drawings and specified herein or required for furnishing all labor, materials, equipment, and services necessary for the application of concrete densifier, sealer, and water and oil repellant, in conjunction with Section 033000, Cast-In-Place Concrete.

B. Related Work

(1) Section 033000: Cast-In-Place Concrete.

(2) Drawings: General Structural Notes and Room Finish Schedule.

C. Submittals

(1) Product data: Submit manufacturer’s product data and installation instructions. Include both published data and any specific data prepared for this project.

D. References and Standards

(1) American Concrete Institute (ACI):
   a. ACI 302.1 R-15, Guide for Concrete Floor and Slab Construction.

(2) American Society for Testing and Materials (ASTM):
   a. ASTM C805, Impact Strength.
   b. ASTM 1028, Co-efficient of Friction.
   c. ASTM C150, Type II Portland cement.

E. Quality Assurance

(1) Test Area: Test a representative area of 4 feet by 4 feet to confirm surface preparation procedures, coverage rates, reaction time, finished appearance, etc. Use the manufacturer’s application instructions. Let test area cure and dry thoroughly before inspection. Keep test area available for comparison throughout the project.
2. PRODUCTS:

A. Acceptable Manufacturers

(1) PROSOCO, Inc., 3741 Greenway Circle, Lawrence, KS 66046.
    Phone: (800) 255-4255; Fax: (785) 830-9797. E-mail: CustomerCare@prosoco.com.

(2) Approved equal by Architect. Manufacturers must have a complete
    system of products that match the types and descriptions below.

B. Product Descriptions

This specification is based upon the Consolideck system manufactured by
PROSOCO, Inc. Other systems may be approved at the architect’s
discretion provided it meets the performance characteristics of the basis
system.

(1) Concrete Sealer, Hardener, and Densifier: Consolideck LS lithium
    silicate treatment or approved equal.

(2) Concrete Protective Treatment: Consolideck LS Guard lithium
    silicate hardener or approved equal.

3. EXECUTION:

A. Preparation

(1) Surfaces to be treated must be clean and structurally sound.
    Remove all foreign materials including bond breakers, curing
    agents, surface grease and oil, and construction debris using the
    appropriate manufacturer’s surface prep cleaner.

(2) Read “Preparation” and “Safety Information” sections in the
    manufacturer’s Product Data Sheet for the product.

B. Placement

(1) Apply each product in strict accordance with manufacturer’s
    instructions. Make note of the placement order, timing and critical
    interactions between the different products to ensure a properly
    stained densified concrete finish.

END OF SECTION
054000 – LIGHT GAUGE STRUCTURAL STEEL STUD SYSTEM

1. GENERAL

A. Description of Work

(1) Work as evident on the drawings and specified herein or required to furnish and install the load bearing metal stud system, complete.

B. Standards

(1) Comply with the latest editions in effect of the following codes and standards, except as otherwise shown or specified:

a. IBC International Building Code, Chapter 22, Section 2210-2211
b. ICC Research Committee Recommendations
c. ASTM American Society for Testing and Materials Standards
d. AISI Specification for Design of Cold-Formed Steel Structural Members
e. AWS D1.3 Structural Welding Code.

C. Submittals

(1) Manufacturer's Data: Submit 3 copies of manufacturer's specifications for products to be used.

(2) Shop Drawings: Submit shop drawings in accordance with Section 013300 Shop Drawings and Samples showing all shop drawings for fabrication and erection of light gage steel structural framing. Include plans, elevations, details of sections and connections, shop anchorage and accessory items.

(3) In reviewing shop drawings, the Architect / Engineer will attempt to detect omissions and major errors, but neither failure of the Architect / Engineer to do this nor the review of the shop drawings shall relieve the Contractor of their responsibility to comply with the Drawings and Specifications. Approval of shop drawings in no way relieves the Contractor or fabricator of their responsibility for all errors of detailing, fabrication and erection, and for the correct fitting of structural members.

(4) Certification: Certified copies of mill test reports, including names and locations of mills and shops, shall be furnished for all light gauge structural steel.
Weld Procedures Specifications: WPS in conformance with AWS requirements shall be submitted for each type of weld to be constructed.

D. Delivery, Storage and Handling

(1) Deliver materials to the site at such intervals to insure uninterrupted progress of the work.

(2) Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. Repair or replace damaged materials as directed.

2. PRODUCTS

A. Light Gage Steel Structural Framing

(1) Members include, but not necessarily limited to, studs, tracks, bridging connections and anchorages, and all accessory items required by the work.

(2) These members and accessories shall be of the type, size, and gage as shown on drawings by design; and shall be cold-formed from steel meeting the following requirements:

   a. Painted 12, 14, and 16 gage structural studs, joists, tracks and diagonal straps: ASTM A1008, Grade 50, with a minimum yield stress of 50,000 psi.
   b. Painted 18 and 20 gage structural studs, joists and tracks; all painted bridging, end closures and accessories shall be formed from steel that corresponds to the requirements of ASTM A1003, Grade C with a minimum yield of 33,000 psi.
   c. Galvanized 12, 14, and 16 gage structural studs, joists, tracks and diagonal straps: ASTM A653, Grade D, with a minimum yield stress of 50,000 psi.
   d. Galvanized 18 and 20 gage structural studs, joists and tracks; bridging, end closures and accessories shall be formed from steel that corresponds to the requirements of ASTM A653, with a minimum yield of 33,000 psi.
   e. The minimum structural properties for structural studs to comply with the requirements shown on the drawings.

(3) All painted materials and accessories shall be primed with rust inhibitive paint.
3. EXECUTION

A. Framing

(1) Studs shall be seated squarely in upper and lower tracks with the stud web and flanges abutting the track web, and against structural steel members as shown on drawings. The studs shall be plumbed or aligned, and securely attached to the upper and lower tracks.

B. Connections

(1) Connections and attachments of similar members and components shall be done by screw attaching as shown on Drawings. Dissimilar members and components shall be attached by welding, screw attaching, or bolting. Wire tying of members and components shall not be allowed.

C. Splices

(1) Splices of runner track shall be made in accordance with details shown on the drawings.

(2) Splices shall not be allowed in vertical structural framing members, except in accordance with details shown on Drawings.

D. Bridging

(1) Provide two rows of bridging at approximately 1/3 height span apart, except where otherwise shown on Drawings.

E. Field Welding

(1) Welding shall be done using manual shielded metal-arc process or a wire feed type welder approved by the Architect. The welding process and details shall conform to the requirements of the Structural Welding Code (AWS D1.3) of the American Welding Society and the approved weld procedures specifications.

(2) Welds shall be made only by welders who have been qualified by tests and hold a current valid certificate, issued by an approved independent testing laboratory, to perform the type of welds required by the work. The qualifying tests shall be as prescribed in the Structural Welding Code (AWS D1.3) of the American Welding Society (AWS). Copies of the welders or welding operators’
certificates shall be furnished by this Contractor upon request of the Architect/Engineer.

(3) All welds shall be fillet, butt, plug, or seam, and shall be sufficient to develop connections.

(4) Prior to commencing welding, the welders shall demonstrate their ability to the Architect that they can satisfactorily produce the welds herein before specified and/or shown on Drawings. In order to demonstrate their ability, the welders shall weld together samples of light gauge steel structural framing members simulating each type of weld (fillet, butt, plug, or seam) that is required by the work.

(5) The subcontractor shall comply with all demands of the Architect/Engineer (welding inspector) to correct improper workmanship and to remove and replace, or correct as instructed, all welds which do not comply with drawings and specifications. In the event that faulty welding, or its removal for rewelding, shall so damage the base metal that its retention is not in accordance with the intent of the drawings and specifications, this subcontractor shall remove and replace the damaged materials or shall compensate for the deficiency in a manner approved by the welding inspector.

F. Field Painting

(1) Shop painted light gauge steel structural framing furnished by the subcontractor, when marred by the work of other trades or welding, bolting, or erection, shall be touch-up painted in a manner approved by the Architect.

END OF SECTION
055000 – METAL FABRICATIONS

1. GENERAL

A. Summary

(1) This Section includes the following:

a. Steel columns and attached base plates
b. Steel ladders
c. Loose bearing and leveling plates
d. Shelf angles
e. Miscellaneous steel framing and supports
f. Miscellaneous steel trim
g. Pipe bollards

B. Submittals

(1) Shop Drawings: Furnish shop drawings in accordance with Section 013300 Shop Drawings and Samples showing all plans, elevations, sections, details of installation, and attachments to other Work. Shop drawings shall be approved before fabrication.

(2) In reviewing shop drawings, the Architect / Engineer will attempt to detect omissions and major errors, but neither failure of the Architect / Engineer to do this nor the review of the shop drawings shall relieve the Contractor of their responsibility to comply with the Drawings and Specifications. Approval of shop drawings in no way relieves the Contractor or fabricator of their responsibility for all errors of detailing, fabrication and erection, and for the correct fitting of structural members.

(3) Templates: For anchor bolts.

2. PRODUCTS

A. Metals

(1) Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.

B. Ferrous Metals:

(1) Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
(2) Hollow Structural Sections (Steel Tube Shapes; TS or HSS): Cold-formed steel tubing complying with ASTM A500, Grade B.

(3) Steel Pipe: ASTM A 53, Type E or S, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

(4) Slotted Channel Framing: Cold-formed metal channels 1-5/8 by 1-5/8 inches with flange edges returned toward web and with 9/16-inch-wide slotted holes in webs at 2 inches o.c. Channels made from galvanized steel complying with ASTM A 653/A 653M, structural quality, Grade 33 with G90 coating; 0.079-inch nominal thickness.

(5) Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A153/A 153M.

C. Paint

(1) Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664 and compatible with finish paint systems indicated.

a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

i. Carboline Company; Carboline 621.


(2) Galvanizing Repair Paint: SSPC-Paint 20, high-zinc-dust-content paint for re-galvanizing welds in steel.

D. Miscellaneous Materials

(1) Fasteners: Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls, of type, grade, and class required by application indicated.
(2) Structural Bolts: ASTM A307 unless indicted otherwise on the drawings.

(3) Anchor Bolts: ASTM F1554, Grade 36

(4) Nonshrink, Nonmetallic Grout: ASTM C 1107, factory-packaged, nonstaining, noncorrosive, nongaseous grout.

E. Fabrication

(1) Connections, General: Use connections that maintain structural value of joined pieces.

a. Shear and punch metals cleanly and accurately. Remove burrs.

b. Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish exposed welds smooth and blended.

c. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes.

d. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.

(2) Steel Ladders: Comply with ANSI A14.3, unless otherwise indicated.

a. Side rails: Continuous, 3" x 5" steel channels, spaced 18 inches apart.

b. Bar Rungs: 1" diameter steel bars, spaced 12" on center.

i. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.

c. Support each ladder at top and bottom and not more than 60 inches o.c. with welded steel angle brackets. Size brackets to support design loads specified in ANSI A14.3.

d. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or riveting.

e. Prime and paint ladder.

(3) Loose Bearing and Leveling Plates: Fabricate loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
(4) Miscellaneous Framing and Supports: Fabricate steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work from structural steel of welded construction. Cut, drill, and tap units to receive hardware, hangers, and similar items.
   a. Where indicated to be cast into concrete or built into masonry, equip with integrally welded anchors at 24 in. o.c.
   b. Fabricate steel columns for supporting wood frame construction with steel baseplates and top plates welded to pipe with fillet welds the same size as column wall thickness (as a minimum), or as indicated on the drawings.

(5) Miscellaneous Steel Trim: Fabricate units with continuously welded joints and smooth exposed edges. Miter corners and use concealed splices where possible. Fabricate cutouts, fittings, and anchorages; coordinate assembly and installation with other work.

(6) Pipe Bollards: Fabricate from Schedule 40 steel pipe.

F. Finishes

(1) Finish metal fabrications after assembly. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Shop prime ferrous-metal items not indicated to be galvanized.

(2) Hot-dip galvanize items indicated to be galvanized to comply with ASTM A123 or ASTM A153/A 153M as applicable.

(3) Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

(4) Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

3. EXECUTION

A. Installation

(1) General: Provide anchorage devices and fasteners for securing metal fabrications to in-place construction. Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal
fabrications accurately in location, with edges and surfaces level, plumb, and true.

a. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

b. Fit exposed connections accurately together. Weld connections, unless otherwise indicated. Do not weld, cut, or abrade galvanized surfaces.

(2) Set bearing and leveling plates on cleaned surfaces using wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts and pack with nonshrink, nonmetallic grout.

(3) Bollards:

a. Anchor in place with concrete footings. Support and brace bollards in position in footing excavations until concrete has been placed and cured.

b. Fill bollards solidly with concrete, mounding top surface.

(4) Touch up surfaces and finishes after erection.

a. Painted Surfaces: Clean field welds, bolted connections, and abraded areas and touch up paint with the same material as used for shop painting.

b. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION

END OF DIVISION
DIVISION 6 – WOOD AND PLASTICS

061000 – ROUGH CARPENTRY

1. SCOPE:
   
   A. Furnish all labor, materials, and equipment necessary to complete all carpentry work as shown on the drawings and/or specified herein. The quality and design of wood members and their fastenings used for load-bearing purposes shall conform to the provisions of Chapter 23 - Wood, of the International Building Code.

   B. Submittals
      
      (1) Submit product data on wood preservative materials, including application instructions.

2. PRODUCTS:

   A. Lumber shall be sound, well manufactured, S4S or rough sawn where noted on drawings, free from warp with a moisture content not exceeding 19% graded according to West Coast Lumber Association Inspection Bureau.

   B. All framing lumber: Douglas Fir-Larch, of Grade as indicated on the drawings.

   C. Cant strips: Plywood or fiber cants.

   D. Joist Hangers and Connectors: Simpson Strong-Tie, or equal.

   E. Builders Hardware as required to properly do all carpentry work. Use non-corrosive bolts, nails, and metal fittings for exposed connections.

   F. Adhesives for Field Gluing Panels to Framing: Formulation complying with ASTM D 3498 that is approved for use with type of construction panel indicated by both adhesive and panel manufacturers. The VOC content shall not be more than 70 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

   G. All wood sill plates resting on concrete slabs on grade, concrete curbs, or masonry stem walls shall be wolmanized by pressure treating or foundation grade redwood.

   H. Roof Sheathing: Plywood or Oriented Strand Board (OSB) as indicated on the drawings.
I. Fire-Treated Plywood (if applicable): 5/8" fire-treated plywood at roof as noted and in communications closets as noted in room finish schedule. Mount with smooth side out. 1/2" fire-treated plywood to support exterior wall mounted light fixtures on metal panel wall locations. Laminate as required to achieve necessary thickness behind panels.

3. WORKMANSHIP:

A. Protect framing and sheathing from moisture during delivery, installation, and use. Allow framing to dry before enclosing in any system – wall, roof, etc.

B. Provide for passage of pipes, ducts, etc., without cutting structural members.

C. Size and set framing to give true surfaces for finish.

D. Accurately locate and secure 2" backing for plumbing fixtures. Use cut-off ends for backing whenever possible to reduce waste.

E. Provide solid blocking at all unsupported edges of each sheet of roof deck sheathing.

F. Sheathing to be laid as per manufacturer's recommendations and nailed at all bearing points and ends. See nailing schedule on drawings.

G. Nailing: All exposed nails to be corrosion resistant. Minimum 2 nails per contact. 10d for 1" material and 16d for 2" material. Conform to IBC Chapter 23. Holes bored where necessary to prevent splitting. All plywood nailing per drawings.

H. Painting: Do not paint fire-treated plywood.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Fiberglass-mat faced, moisture and mold resistant gypsum sheathing.

B. Related Sections:
   1. Section 054000: Light Gauge Structural Steel Stud System
   2. Section 061000: Rough Carpentry
   3. Section 092900: Gypsum Board

1.02 REFERENCES

A. ASTM International (ASTM):
   3. ASTM C1002 Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

1.03 SUBMITTALS

A. Product Data: Manufacturer’s specifications and installation instructions for each product specified.

1.04 WARRANTY

A. Provide products that offer twelve months of coverage against in-place exposure damage (delamination, deterioration and decay) commencing with the date of installation of the product in such structure.

B. Manufacturer’s Warranty:
   1. Five years against manufacturing defects.
   2. Twelve (12) years against manufacturing defects when used as a substrate in architecturally specified EIFS.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Georgia-Pacific Gypsum LLC:
   2. Fiberglass-Mat Faced Gypsum Sheathing, Type X for Fire Rated Designs: DensGlass Fireguard Sheathing.

B. Prior Approved Equal

2.02 MATERIALS

A. Fiberglass-Mat Faced Gypsum Sheathing: ASTM C1177:
   1. Thickness: 1/2 inch.
   2. Width: 4 feet.
   3. Length: 8 feet, 9 feet, or 10 feet as required.
   4. Weight: 1.9 lb/sq. ft.
   5. Edges: Square.
   6. Surfacing: Fiberglass mat on face, back, and long edges.
   7. Racking Strength (Ultimate, not design value) (ASTM E72): Not less than 540 pounds per square foot, dry.
11. R-Value (ASTM C518): 0.56.
14. Acceptable Products:
   a. 5/8 inch DensGlass Sheathing, Georgia-Pacific Gypsum.
   b. Prior approved equal.

B. Fire-Rated Fiberglass-Mat Faced Gypsum Sheathing: ASTM C1177, Type X:
   1. Thickness: 5/8 inch.
   2. Width: 4 feet.
   3. Length: 8 feet, 9 feet, or 10 feet as required.
   4. Weight: 2.5 lb/sq. ft.
   5. Edges: Square.
   6. Surfacing: Fiberglass mat on face, back, and long edges.
   7. Racking Strength (Ultimate, not design value) (ASTM E72): Not less than 654 pounds per square foot, dry.
   14. Acceptable Products:
       a. 5/8 inch DensGlass Fireguard Sheathing, Georgia-Pacific Gypsum.
       b. Prior approved equal.

2.03 ACCESSORIES

A. Screws: ASTM C1002, corrosion resistant treated.
PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:
   1. Inspection: Verify that project conditions and substrates are acceptable, to the installer, to begin installation of work of this section.

3.02 INSTALLATION

A. General: In accordance with GA-253, ASTM C1280 and the manufacturer’s recommendations.
   1. Manufacturer’s Recommendations:
      b. Recommendations from Prior Approved Equal.

3.03 PROTECTION

A. Protect gypsum board installations from damage and deterioration until date of Substantial Completion.

END OF SECTION
061710 – PREFABRICATED WOOD “I” JOISTS

1. GENERAL

A. Description of Work

(1) Work as evident on drawings and specified herein or required to furnish and install prefabricated wood joists, complete.

B. Delivery and Storage

(1) The joists, if stored prior to erection, shall be stored in a vertical position and protected from the weather. They shall be handled with care so that they are not damaged.

C. Submittals

(1) Shop Drawings: Furnish shop drawings in accordance with Section 013300 Shop Drawings and Samples. The joist manufacturer shall submit shop drawings for approval prior to fabrication in accordance with the General Structural Notes. The shop drawings shall include, but are not limited to, the applicable details, design loads, allowable stresses, stress diagrams, structural analysis (calculations), erection drawings, and all the necessary installation instructions, details and other information required for review.

(2) In reviewing shop drawings, the Architect / Engineer will attempt to detect omissions and major errors, but neither the failure of Architect / Engineer to do this nor the review of the shop drawings, shall relieve the Contractor of his responsibility to comply with Drawings and Specifications. Approval of shop drawings in no way relieves the Contractor or fabricator of their responsibility for all errors of detailing, fabrication and erection, and for the correct fitting of structural members.

(3) All design, details, shop, and erection drawings and all calculations submitted to the Architect for review shall bear the seal of a qualified professional Engineer, currently registered in the State of Arizona.

(4) Production: Do not proceed with fabrication and/or cutting until Shop Drawings and Design Calculations (when required) have been reviewed by the Architect and/or Engineer.

D. Code Approvals
(1) These products shall be designed, manufactured and erected in accordance with the applicable CABO or ICC report and ASTM D5055 per IBC section 2303.1.2.

E. Warranty

(1) The products delivered shall be free from manufacturing errors or defects in workmanship and material. The products shall perform to Red Built specifications (or other approved comparable product) for the normal and expected life of the building.

2. PRODUCTS

A. Prefabricated Wood Joists

(1) Joists shall be designed and manufactured by Red Built or other approved comparable product.

a. The joists shall be custom designed to fit the dimensions and loads indicated on the plans.

b. The joists system shall include, but not be limited to, all joists, joist hangers, permanent bridging, load transfer blocks, web stiffeners, blocking panels, metal "X" bracing and other items shown on the Drawings, specified herein, or as required to complete the work. All materials shall be new and free from defects.

(2) Joist manufacturer shall review all contract documents of all disciplines to verify and include loads indicated by the different disciplines including electrical, mechanical, plumbing, fire protection, architectural, and structural.

(3) Joists shall be manufactured with laminated veneer lumber (LVL) flanges and plywood (or equivalent, i.e. OSB, for resistance to swelling) webs only. Solid sawn flanges are not acceptable.

B. Identification

(1) Each of the joists shall be identified by a stamp indicating the joist type, NER or CCMC report number, manufacturer’s name, plant number, and the independent inspection agency’s logo.

3. EXECUTION

A. Installation

(1) The joists shall be erected and installed in accordance with the plans, the approved Red Built (or other approved comparable
product) drawings and installation suggestions. Temporary construction loads, which may create exceeded member stresses, are not permitted. Erection bracing in addition to specified bridging is to be provided to keep the joists straight and plumb as required to assure adequate lateral support for the individual joist and entire system until the sheathing material has been applied. The contractor will give notification prior to enclosing the joists to provide opportunity for inspection of the installation.

END OF SECTION
061800 GLUED-LAMINATED CONSTRUCTION

1. GENERAL

A. Description of Work

(1) Work as evident on drawings and specified herein or required to furnish and install the structural glued laminated timber, complete.

B. Standards

(1) All structural glued-laminated timber construction shall conform to the latest edition in effect of the following publications, other publications hereinafter referred to, and the Drawings and Specifications for the engineering design:

   a. IBC  International Building Code, Chapter 23-Wood
   b. AITC  American Institute for Timber Construction. AITC 117 (Design Standard Specifications for Structural Glued Laminated Timber for Softwood Species), AITC A190.1 (Structural Glued Laminated Timber)
   c. PS  Voluntary Product Standard PS56 “Structural Glued Laminated Timber.”

C. Submittals

(1) Shop Drawings: Furnish shop drawings in accordance with Section 013300 Shop Drawings and Samples. Shop drawings shall show all details required for fabrication and installation of structural glued laminated timber members, and of steel connection hardware for review prior to fabrication of any item.

   a. The Contractor shall coordinate the hardware dimensions with net finished dimensions of the timber members and shall verify all critical dimensions at building site.
   b. In reviewing shop drawings, the Architect/Engineer will attempt to detect omissions and major errors, but neither the failure of the Architect/Engineer to do this nor the review of the shop drawings shall relieve the Contractor of their responsibility to comply with the Drawings and Specifications.

D. Delivery and Storage

(1) Unload at site, place on level supports, off ground, suitably and adequately covered and protected from the elements.
(2) The Contractor shall be responsible for keeping glued laminated timber members from the elements and against damage to surfaces and wrapping.

2. PRODUCTS

A. Lumber

(1) Douglas Fir-Douglas Fir, dry condition of use, with allowable unit stresses of $F_b=2400$ psi and $E=1,800,000$ psi (combination symbol 24F-V4 and 24F-V8 at Cantilevers).

B. Adhesive

(1) Adhesive shall meet the requirements for dry condition of service.

C. Appearance

(1) Appearance of members shall be Industrial Grade and Architectural Grade at exposed locations.

D. Shape and Dimensions

(1) The dimensions shown on Drawings are minimum net finished dimensions; camber beams as noted. Provide standard manufacturers camber when noted on plans.

E. Identification and Quality Control


(2) Factory mark each unit of glued laminated timber with AITC 117 or APA EWS quality inspected mark. Place mark on timber surfaces which will not be exposed in completed work.

F. Surface Sealers

(1) Factory-apply at least one coat of end sealer to the ends of all members immediately after trimming. Surface of members shall be sealed with manufacturer’s standard transparent sealer.

G. Wrapping
(1) Provide water-resistant, reinforced Kraft paper wrapping covering all surfaces of each individual member, and/or bundles of small members wrapped to suitable size bundle.

3. EXECUTION

A. Installation

(1) Avoid cutting GL-Tmb members during erection, to the greatest extent possible, except for fastener drilling and other minor cutting. Coat all cuts with end sealer.

(2) Handle and temporarily support members with protective blocking and slings to prevent surface damage.

(3) Do not remove wrapping on individually wrapped member until it will serve no useful purpose, including protection from the weather, soiling, and damage from the work of other trades.

(4) Repair damaged surfaces finished after completion of erection and removal of wrappings, or replace damaged members as direction where damage is beyond satisfactory repair.

END OF SECTION
064116 – PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

1. GENERAL:
   A. Scope: Furnish and install all millwork and finish carpentry shown on the drawings and specified herein.
   B. The Quality Standards of the Architectural Woodwork Institute (AWI) shall apply to all work covered by this section.
   C. Millwork fabricator shall submit detailed shop drawings to be approved by the architect before fabrication.

2. MATERIALS:
   All products shall be formaldehyde free.
   A. Exposed Cabinet Surfaces: 3/4" laminate-clad medium density particleboard. ½" laminate clad plywood for curved surfaces.
   B. Edge band: 1/8" PVC.
   C. Hardware:
      (1) Butt Hinges: 2-3/4-inch (70-mm), five-knuckle steel hinges made from 0.095-inch- (2.4-mm-) thick metal, and as follows:
         a. Semiconcealed Hinges for Overlay Doors: BHMA A156.9, B01521.
      (2) Wire Pulls: Back mounted, solid metal, 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter.
      (3) Catches: Magnetic catches, BHMA A156.9, B03141.
      (4) Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
      (5) Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.
      (6) Drawer Slides: BHMA A156.9.
         a. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
         b. For drawers more than 3 inches (75 mm) high but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1HD-100.
c. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide Grade 1HD-200.

(7) Door Locks: BHMA A156.11, E07121.

(8) Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18. Matte Stainless Steel.

D. Counter Tops: Counter tops shall be as follows per drawings and schedules:

(1) Plastic laminate clad, 3/4" moisture resistant MDF with .02" laminate backer sheet.
(2) Solid Surface: Corion or Wilsonart _____

E. Plastic laminates shall be as manufactured by Wilson Art, Formica or Nevamar, 1/16" thick standard grade solid colors, unless noted otherwise, as selected by architect. Matte finish. Installation per all manufacturer’s requirements. Science lab counter tops shall be chemical resistant plastic laminate, Wilsonart Chemsurf or equal, unless noted otherwise.

K. Adhesives per all Manufacturer’s requirements.

3. WORKMANSHIP:

A. Details and Special Conditions: All cabinetwork shall be flush overlay construction, Section 400G-2, AWI quality standards. No exposed substrate edges. Where details and methods of construction are not specifically shown on the drawings, contractor shall request clarification from the architect.

B. Work assembled at mill as far as practical and delivered ready for installation. This contractor responsible for measurements taken at job allowing for cutting and fitting. Doors and drawers shall be aligned and flush, 1/8" maximum space between, Section 400A-T-1, AWI quality standards.

C. All cabinetwork shall be custom grade in accordance with the latest edition of The Architectural Woodwork Institute (AWI).

D. Face frame shall be scribed where cabinetwork abuts walls.

E. This contractor shall install all finish hardware.
072100 – THERMAL INSULATION

1. GENERAL:
   A. SCOPE: Furnish and install insulation as indicated on drawings and specifications.
   B. Work Not Included: Duct and pipe insulation, rigid type roof insulation.

2. MATERIALS:
   A. Thermal & Sound Batt Insulation
      (1) Unfaced glass fiber thermal insulation complying with ASTM C665, Type I and ASTM E 136.
      (2) Above ceilings and concealed locations: Reinforced-foil-faced glass fiber thermal insulation complying with ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category I (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.
      (3) Exposed in all other areas: Polypropylene fiberglass / polypropylene blend fabric facing, GYMGUARD by LAMTEC Corp. or approved equal, complying with ASTM E 84.
         a. Black Film: Metalized polypropylene, .0015 inch.
         b. Fabric: Fiberglass / polyester blend, 75 lbs. / 3000 S.F.
         c. Vapor Retarder Perm Rating: .02 Maximum when tested in accordance with ASTM E 96.
         d. Surface Burning Characteristics:
            1) Maximum flame spread: 5
            2) Maximum smoke developed: 40
         e. Bursting Strength: 250 psi per ASTM D 774.
         f. Puncture Resistance: 650 Beach units per ASTM C 1136.
         g. Tensile Strength: 195 lbs. / inch width per ASTM 1136.
   B. Roof Insulation:
      (1) R-Value 38 when tested in accordance with ASTM C 518. Thickness 12".
   C. Wall Insulation:
(1) Rigid Insulation for Stucco System:
   a. Foam Control EPS Bonds per ICC-ESR-1006
   b. Manufactured by Henry, Poly-Foam or equal
   c. Minimum R-3.6 per inch.

(2) R-Value 13 when tested in accordance with ASTM C 518. Thickness 4".

D. Sound Batt Insulation

(1) Unfaced glass fiber insulation complying with ASTM C 665, Type I and ASTM E 136.
   a. R-Value 11 when tested in accordance with ASTM C 518.
   b. Surface Burning Characteristics:
      1) Unfaced Insulation
      2) Maximum flame spread: 10
      3) Maximum smoke developed: 10
         When tested in accordance with ASTM E 84

3. EXECUTION:

A. EPS Board Insulation: seal joints between 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.

B. Blankets shall completely cover enclosed building space between exterior walls and roof and shall fit snugly together to form a uniform continuous, leak free, efficient insulative barrier. Care shall be taken to properly cover protrusions and penetrations.

C. All installations shall be in accordance with the latest edition of the IBC.

D. Comply with manufacturer’s instructions for particular conditions of installation in each case.

E. Under Roof Decks

(1) Apply insulation directly to the interior surface of the underside of roof deck with appropriate anchors per the manufacturer’s recommendations.

F. Between Studs:
(1) Friction-fit insulation between studs after cover material has been installed on one side of the cavity. Use wire or metal straps to hold insulation in place in applications without a cover material or where the stud depth is larger than the insulation thickness. When faced insulation is used, the attachment flanges may be taped to the face of the metal stud prior to applying the interior finish.

(2) Provide supplementary support to hold the product in place until finish surface is applied when insulation is installed in heights over 8 feet.

G. Sound Attenuation Blankets: Install 3" batts in toilet and mechanical room walls and sound rated partitions indicated on drawings. Blankets shall be friction fit and completely fill spaces.

H. Separate and recycle waste materials to the greatest extent possible.

END OF SECTION
072500 – WEATHER BARRIERS

1. GENERAL

A. SUMMARY

(1) Section Includes:
   a. Building wrap.
   b. Flexible flashing.

B. ACTION SUBMITTALS

(1) Product Data: For each type of product.

C. INFORMATIONAL SUBMITTALS

(1) Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

2. PRODUCTS

A. WATER-RESISTIVE BARRIER

(1) Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.

   a. DuPont Tyvek Commercial Wrap or prior approved equal.
   b. Water-Vapor Permeance: Not less than 20 perms per ASTM E 96/E 96M, Method B.
   c. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

(2) Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.
B. FLEXIBLE FLASHING

(1) Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin, as recommended by the building wrap manufacturer.

3. EXECUTION

A. WATER-RESISTIVE BARRIER INSTALLATION

(1) Cover sheathing with water-resistive barrier as follows:
   a. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
   b. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.

(2) Building Wrap: Comply with manufacturer's written instructions and warranty requirements.
   a. Seal seams, edges, fasteners, and penetrations with tape.
   b. Extend into jambs of openings and seal corners with tape.

B. FLEXIBLE FLASHING INSTALLATION

(1) Apply flexible flashing where indicated to comply with manufacturer's written instructions.
   a. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
   b. Lap flashing over water-resistive barrier at bottom and sides of openings.
   c. Lap water-resistive barrier over flashing at heads of openings.

END OF SECTION
072610 – UNDER-SLAB VAPOR BARRIER

1. GENERAL

A. Summary

(1) Products supplied under this section:
   a. Vapor barrier, seam tape, and mastic for installation under concrete slabs.

(2) Related sections:
   a. Section 033000, Cast-in-Place Concrete.

B. References

(1) American Society for Testing and Materials (ASTM):
   a. ASTM E 1745-09 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
   e. ASTM E 1643-09 Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

(2) American Concrete Institute (ACI):
   a. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

C. Submittals

(1) Quality control/assurance:
   a. Summary of test results as per paragraph 8.3 of ASTM E 1745.
   b. Manufacturer’s samples, literature.
c. Manufacturer’s installation instructions for placement, seaming and penetration repair instructions.

2. PRODUCTS

A. Materials

(1) Vapor barrier must have all of the following qualities:
   a. Permeance of less than 0.01 Perms [grains/(ft² · hr · inHg)] as tested in accordance with ASTM E 1745 Section 7.
   b. Other performance criteria:
      i. Strength: ASTM E 1745 Class A.

(2) Vapor barrier products:

B. Accessories

(1) Seam tape:

(2) Vapor-proofing mastic:

3. EXECUTION

A. Preparation

(1) Ensure that base material is approved by Architect or Geotechnical Engineer.
   a. Level and compact base material.

B. Installation

(1) Install vapor barrier in accordance with manufacturer’s instructions and ASTM E 1643.
   a. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement.
b. Lap vapor barrier over footings and/or seal to foundation walls.

c. Overlap joints 6 inches and seal with manufacturer’s tape.

d. Seal all penetrations (including pipes) per manufacturer’s instructions.

e. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.

(2) Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all sides with tape.

END OF SECTION
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074213 – FORMED METAL WALL PANELS

1. GENERAL

A. Summary:
   (1) Factory-formed and field-assembled exposed-fastener, lap-seam metal wall and metal soffit panels.
   (2) All material, labor, and equipment to complete the metal wall and soffit panels including all necessary trim, flashing, seals, copings, and accessories.

B. Performance Requirements:

   (1) Air Infiltration: ASTM E 283.
   (2) Water Penetration under Static Pressure: ASTM E 331.
   (3) Water Penetration under Dynamic Pressure: AAMA 501.1.
   (4) Structural Performance: ASTM E 1592.
      b. Deflection Limits: 1/180.

C. Submittals:

   (1) Shop drawings shall comply with Section 013300 of the specifications and must be in a scale to clearly show all details. Include dimensions of fabricated work, reference dimensions to structure, type, size and spacing of fasteners, metal thickness and finish, layout showing panel length used in each area, and coordination with other trades. Shop drawings must be approved by the architect prior to the commencement of work.

   (2) Performance data of each panel type, fasteners, and material samples or mock-ups as required.

   (3) Submit samples for verification purposes. Provide 12” long by actual panel width. Provide finish, color, and texture on 2” x 5” metal color chips.
D. Warranty

(1) Materials and Workmanship: Ten (10) years.

(2) Finishes: Ten (10) years.

2. PRODUCTS

A. Acceptable Manufacturer and Installers:

(1) The panel manufacturer shall have been in business as a panel manufacturer for at least 15 years.

(2) The manufacturer shall authorize the installer and actual work shall be supervised by personnel trained by the manufacturer in the proper application of the product.

(3) The installer shall have a minimum of five (5) years experience with similar type products. The installer must list five similar projects prior to the commencement of work.

B. Approved Products:

(1) Flush-Profile, Concealed Fastener Metal Wall Panels: MBCI FW-120 Panel or equal.
   a. Profile: Smooth, 1-1/2” panel thickness, 12” wide.
   c. Exterior Finish: MBCI Kynar 200 & 300, as noted on drawings. Color to be selected by Architect.

(2) Accessories: Flashing, seals, and trim.
   a. For weather tightness, screws shall have washers with hot bonded neoprene faces and pop rivets shall be set in wet sealant. Exposed fasteners shall be a minimum of #14 size screw or 3/16” diameter pop rivet. These fasteners shall be color matched to the wall panels. Snap-on color caps shall not be used.
   b. Precut profile closures shall be closed cell rubber meeting ASTM D-1056 EPT. Metal profile closures, of the same material and color as the wall panel, shall be placed in front of all rubber closures that have UV exposure.
c. Sealant used with the wall system shall be applied between surfaces with a minimum amount of UV exposure on the complete installation. All sealants shall have an indicated service life of 20 years.

Concealed sealant shall be a non-curing, non-skinning butyl polyisobutylene or butyl tape of sufficient thickness to make full contact with both surfaces. The caulk must meet Federal Specification TT-C-1796A, Type I, Class A, and the tape must meet Federal Specification TT-C-1796A, Type II, Class B.

Exposed sealant shall be a curing type with excellent resistance to ultra-violet radiation (sunlight), and will not crack, chalk, or lose adhesion to the substrate after exposure to 6,000 hours of weatherability testing and meet ASTM G-53 and C793. In addition, the sealant must meet Federal Specification TT-S-00230C, Type II, Class A, Type NS, One Component, ASTM C-920 and be USDA acceptable. The sealant must have excellent adhesion to Galvalume and Kynar 500 substrates. Color shall be as selected by the architect and shall match the metal wall panels. Apply in accordance with the sealant manufacturer's recommendations.

3. EXECUTION

A. EXAMINATION

(1) Examine metal panel system substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panels.

a. Inspect framing that will support insulated metal panels to determine if support components are installed as indicated on approved shop drawings and are within tolerances acceptable to metal panel manufacturer and installer. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of metal panels.

(2) Correct out-of-tolerance work and other deficient conditions prior to proceeding with insulated metal panel installation.

(3) Storage and Handling: Protections shall be provided during shipment, site storage, and installation to prevent mechanical abuse, stains, discoloration, and corrosion. The jobsite storage
shall be in a clear dry area, out of direct contact with the ground, under cover, and sloped for drainage, protected from abuse by traffic and from contamination by corrosive or staining materials. Stored materials and unfinished work shall be secured against damage from wind. The general contractor shall protect installed material from abuse by other trades.

B. METAL PANEL INSTALLATION

(1) All work shall be installed in accordance with the approved layout drawings under the direct supervision of an experienced sheet metal craftsman trained in the installation of the product. Flashing and trim shall be installed in strict accord with the recommended practice of AA, NRCA, SMACNA sheet metal manuals and manufacturers guidelines.

(2) Concealed-Fastener Formed Metal Panels: Install metal panel system in accordance with manufacturer's written instructions, approved shop drawings, project drawings, and referenced publications. Install metal panels in orientation, sizes, and locations indicated. Anchor panels and other components securely in place. Provide for thermal and structural movement.

(3) Fasten metal panels to supports with fasteners at each location indicated on approved shop drawings, at spacing and with fasteners recommended by manufacturer. Fasten panel to support structure through leading flange. Snap-fit back flange of subsequent panel into secured flange of previous panel. Where indicated, fasten panels together through flush-fitted panel sides.
   a. Cut panels in field where required using manufacturer's recommended methods.
   b. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by metal panel manufacturer.

(4) Attach panel flashing trim pieces to supports using recommended fasteners and joint sealers.

(5) Joint Sealers: Install liquid sealants where indicated and where required for weatherproof performance of metal panel assemblies.
   a. Seal panel base assembly, openings, panel head joints, and perimeter joints using joint sealers indicated in manufacturer's instructions.
b. Seal perimeter joints between window and door openings and adjacent panels using elastomeric joint sealer.

c. Prepare joints and apply sealants per requirements of Division 07 Section "Joint Sealants."

C. ACCESSORY INSTALLATION

(1) General: Install metal panel accessories with positive anchorage to building and weather tight mounting; provide for thermal expansion. Coordinate installation with flashings and other components.

a. Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.

b. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.

c. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.

D. Completed work shall be plumb, true, and free of dents. Panel ribs shall be on the module indicated on the approved layout drawings and within the tolerance as set forth in the Metal Construction Association “Prefomed Metal Guidelines” and allowed by the actual construction dimensions. Excess sealant shall be removed. Any panels that are badly damaged and, in the judgment of the architect, cannot be repaired shall be removed from the jobsite and replaced with acceptable material.

E. CLEANING AND PROTECTION

(1) Clean finished surfaces as recommended by metal panel manufacturer.

(2) Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

(3) Upon completion of all work under this section of the specifications, the installing contractor shall remove all excess material and equipment from the jobsite.

END OF SECTION
075423 – THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1. GENERAL

A. SECTION INCLUDES

(1) Induction welded TPO membrane roofing system.
(2) Cover board.
(3) Roof insulation.

B. RELATED SECTIONS

(1) Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counter flashings.

C. REFERENCES

(1) Roofing Terminology: Refer to the following publications for definitions of roofing work related terms in this Section:
   c. Roof Consultants Institute “Glossary of Building Envelope Terms.”

D. DESIGN CRITERIA

(1) General: Installed roofing membrane system shall remain watertight; and resist specified wind uplift pressures, thermally induced movement, and exposure to weather without failure.
   i. Material Compatibility: Roofing materials shall be compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.
(2) Installer must comply with current code requirements based on authority having jurisdiction.
(3) Wind Uplift Performance: Roofing system shall be identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist wind uplift pressure calculated in accordance with ASCE 7.

(4) Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
   a. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.

E. SUBMITTALS

(1) Product Data: Manufacturer’s data sheets for each product to be provided.

(2) Detail Drawings: Provide roofing system plans, elevations, sections, details, and details of attachment to other Work, including:
   a. Base flashings and membrane terminations.
   b. Tapered insulation, including slopes.
   c. Crickets, saddles, and tapered edge strips, including slopes.
   d. Insulation fastening patterns.

(3) Verification Samples: Provide for each product specified.

(4) Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.


(6) Guarantees: Provide manufacturer's current guarantee specimen.

(7) Prior to beginning the work of this section, roofing sub-contractor shall provide a copy of the final System Assembly Letter issued by Johns Manville Roofing Systems indicating that the products and system to be installed shall be eligible to receive the specified manufacturer's guarantee when installed by a certified JM
contractor in accordance with our application requirements, inspected and approved by a JM Technical Representative.

(8) Prior to roofing system installation, roofing sub-contractor shall provide a copy of the Guarantee Application Confirmation document issued by Johns Manville Roofing Systems indicating that the project has been reviewed for eligibility to receive the specified guarantee and registered.

a. Swaim Associates Ltd. must be listed as the Specifier/Consultant of record in the appropriate fields on the Guarantee Application Confirmation.

F. QUALITY ASSURANCE

(1) Installer Qualifications: Qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive the specified manufacturer's guarantee.

(2) Manufacturer Qualifications: Qualified manufacturer that has UL listing for roofing system identical to that used for this Project.

(3) Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 329.

(4) Test Reports:

a. Roof drain and leader test or submit plumber's verification.

(5) Source Limitations: Obtain all components from the single source roofing manufacturer guaranteeing the roofing system. All products used in the system must be labeled by the single source roofing manufacturer issuing the guarantee.

G. DELIVERY, STORAGE, AND HANDLING

(1) Deliver roofing materials in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.

(2) Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.

(3) Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources.
Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

(4) Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

H. PROJECT CONDITIONS

(1) Weather Limitations: Proceed with installation only when current and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and guarantee requirements.

I. GUARANTEE

(1) Provide manufacturer's system guarantee equal to Johns Manville's Peak Advantage No Dollar Limit Roofing System Guarantee.

a. Single-Source special guarantee includes roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners, cover board, walkway products, manufacturer's edge metal products, and other single-source components of roofing system marketed by the manufacturer.

b. Guarantee Period: 20 years from date of Substantial Completion.

c. Contractor is required to list Swaim Associates Ltd. as the Specifier/Consultant of record in the appropriate fields ("Specifier Account") when applying for the manufacturer's warranty.

(2) Installer's Guarantee: Submit roofing Installer's guarantee, including all components of roofing system for the following guarantee period:

a. Guarantee Period: Two years from date of Substantial Completion.

(3) Existing Guarantees: Guarantees on existing building elements should not be affected by scope of work.

a. Installer is responsible for coordinating with building owner's representative to verify compliance.
PART 2. PRODUCTS

J. THERMOPLASTIC POLYOLEFIN ROOFING MEMBRANE - TPO


a. Membrane Thickness: 60 mils (1.52 mm), nominal.

b. Exposed Face Color: White

(2) Equal Product: GAF TRBN160 – Ever Guard TPO – 60 mil

(3) Other: Equal products by prior approval prior to bid.

K. AUXILIARY ROOFING MATERIALS – SINGLE PLY

(1) General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

a. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

(2) Sheet Flashing (Self-Adhered): 60 mil (1.5 mm) thick, manufacturer's internally reinforced or scrim reinforced with weldable selvage edges on each side of roll, one encapsulated edge and self-adhering capabilities in a wide installation temperature range. Basis of Design: JM TPO SA – Flashing Membrane

a. Serviceable Installation Temperature: 20°F (-7°C) and above.

(3) Self-Adhered Primer: One-part penetrating primer solution to enhance the adhesion of self-adhering membranes. SA Primer

(4) Metal Termination Bars: Manufacturer’s standard predrilled stainless-steel or aluminum bars, with anchors. Basis of Design: JM Termination Systems

(5) Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer. Basis of Design: High Load Fasteners
(6) Induction Welding Plate: A round specially coated Galvalume® plate with a recessed center and raised flat bonding surface specifically designed for induction welding application. Basis of Design: JM TPO RhinoPlates


L. AUXILIARY ROOFING SYSTEM COMPONENTS

(1) Coping System: Manufacturer’s factory fabricated coping consisting of a base piece and a snap-on cap. Provide product from single-source roofing system supplier that is included in the No Dollar Limit guarantee. Basis of Design: Presto-Lock Coping

(2) Fascia System: Manufacturer’s factory fabricated fascia consisting of a base piece and a snap-on cover. Provide product from single-source roofing system supplier that is included in the No Dollar Limit guarantee. Basis of Design: Presto-Tite Fascia

(3) Metal Edge System: Manufacturer’s factory fabricated metal edge system used to terminate the roof at the perimeter of the structure. Provide product from single-source roofing system supplier that is included in the No Dollar Limit guarantee. Basis of Design: JM TPO-Coated Metal

(4) Metal Flashing Sheet: Metal flashing sheet is specified in Division 07 Section "Sheet Metal Flashing and Trim."

M. COVER BOARD

(1) High-Density Polyisocyanurate: ASTM C 1289, Type II, Class 4, Grade 3, High-density Polyisocyanurate technology bonded in-line to mineral-surfaced, fiber glass reinforced facers with greater than 140 lbs of compressive strength. Basis of Design: Invinsa Roof Board
N. ROOF INSULATION

(1) General: Preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

(2) Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 (20 psi), Basis of Design: ENRGY 3
   a. Provide insulation package with minimum R Value: 10
   b. Provide insulation package with minimum thickness: 2.0”
   c. Provide insulation package in multiple layers.
   d. Minimum Long-Term Thermal Resistance (LTTR): 5.7 per inch.
   e. Determined in accordance with CAN/ULC S770 at 75°F (24°C)

O. TAPERED INSULATION

(1) Tapered Insulation: ASTM C 1289, Type II, Class 1, Grade 2 (20 psi), provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48), unless otherwise indicated. Basis of Design: Tapered ENRGY 3

P. INSULATION ACCESSORIES

(1) General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

(2) Provide factory preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated. Basis of Design: Diamondback Pre-Cut Cricket, Tapered Fesco Edge Strip

(3) Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and furnished by roofing system manufacturer. Basis of Design: UltraFast Fasteners and Plates

(4) Wood Nailer Strips: Comply with requirements in Division 06 Section "Miscellaneous Rough Carpentry."
PART 3. EXECUTION

Q. EXAMINATION

(1) Examine substrates, areas, and conditions for compliance with the requirements affecting performance of roofing system.

a. General:
   i. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
   ii. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

b. Ensure general rigidity and proper slope for drainage.

c. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units more than 1/16 inch (1.6 mm) out of plane relative to adjoining deck.

(2) Unacceptable panels should be brought to the attention of the General Contractor and Project Owner’s Representative and must be corrected prior to installation of roofing system.

(3) Proceed with installation only after unsatisfactory conditions have been corrected.

R. PREPARATION

(1) Clean and remove from substrate sharp projections, dust, debris, moisture, and other substances detrimental to roofing installation in accordance with roofing system manufacturer’s written instructions.

(2) Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.

(3) Proceed with installation only after unsatisfactory conditions have been corrected.

S. INSULATION INSTALLATION

(1) Coordinate installation of roof system components so insulation and cover board is not exposed to precipitation or left exposed at the end of the workday.
(2) Comply with roofing system manufacturer's written instructions for installation of roof insulation and cover board.

(3) Install tapered insulation under area of roofing to conform to slopes indicated.

(4) Install insulation boards with long joints in a continuous straight line. Joints should be staggered between rows, abutting edges and ends per manufacturer’s written instructions. Fill gaps exceeding 1/4 inch (6 mm) with like material.

(5) Install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

(6) Trim surface of insulation boards where necessary at roof drains so completed surface is flush and does not restrict flow of water.

(7) Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

(8) Preliminarily Fastened Insulation: Install insulation with fasteners at rate required by roofing system manufacturer or applicable authority, whichever is more stringent.
   a. Fasten top layer to resist uplift pressure at corners, perimeter, and field of roof.

(9) Proceed with installation only after unsatisfactory conditions have been corrected.

T. COVER BOARD INSTALLATION

(1) Coordinate installing membrane roofing system components so cover board is not exposed to precipitation or left exposed at the end of the workday.

(2) Comply with membrane roofing system manufacturer's written instructions for installing roof cover board.

(3) Install cover board with long joints in a continuous straight line. Joints should be staggered between rows, abutting edges and ends per manufacturer’s written instructions. Fill gaps exceeding 1/4 inch (6 mm) with cover board.
   a. Cut and fit cover board within 1/4 inch (6 mm) of nailers, projections, and penetrations.
(4) Trim surface of cover board where necessary at roof drains so completed surface is flush and does not restrict flow of water.
   
a. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

(5) Preliminarily Fastened Insulation for Mechanically Fastened Systems: Install cover board with fasteners at rate required by roofing system manufacturer or applicable authority, whichever is more stringent.

(6) Proceed with installation only after unsatisfactory conditions have been corrected.

U. ROOFING MEMBRANE INSTALLATION, GENERAL

(1) Install roofing membrane in accordance with roofing system manufacturer's written instructions, applicable recommendations of the roofing manufacturer and requirements in this Section.

(2) Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.

(3) Coordinate installing roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is imminent.
   
a. Provide tie-offs at end of each day’s work to cover exposed roofing membrane sheets and insulation.

b. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.

   c. Remove and discard temporary seals before beginning work on adjoining roofing.

(4) Proceed with installation only after unsatisfactory conditions have been corrected.

V. INDUCTION WELDED ROOFING MEMBRANE INSTALLATION

(1) Install roofing membrane over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.
(2) Accurately align roofing membranes and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

(3) Always install membrane laps perpendicular to the steel deck flutes. “Picture Frame” installation method is not permitted.

(4) Apply roofing membrane with side laps shingled with roof slope, where possible.

(5) Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.

   a. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.
   
   b. Verify field strength of seams a minimum of twice daily and repair seam sample areas.

      i. Remove and repair any unsatisfactory sections before proceeding with Work.

   c. Repair tears, voids, and lapped seams in roofing membrane that do not meet requirements.

(6) Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

(7) Induction Welding Installation:

   a. Perform calibration and set-up as detailed by the Induction Welder Owner’s Manual

   b. Center the Induction Welder over the first plate in pattern and activate the weld.

      i. Induction Welder must be centered over the plate to create a 100% bond.

      ii. If an error occurs during activation, refer to the induction welder owner’s manual for corrective action.

   c. Prior to every use, clean face of Heat Sink Magnet.

   d. Place Heat Sink Magnet over the welded plate.
i. Keep Heat Sink Magnet in place at least 45 seconds while the assembly cools.

e. Repeat process for each plate.

(8) Proceed with installation only after unsatisfactory conditions have been corrected.

W. BASE FLASHING INSTALLATION

(1) Install sheet flashings and preformed flashing accessories and adhere to substrates per membrane roofing system manufacturer's written instructions.

(2) Self-Adhere membrane to smooth approved substrates, when substrate temperatures are 40°F (4.5°C) and rising.

a. The use of SA Primer or SA LVOC Primer is required for flashing applications on curbs and parapet walls for temperatures between 40°F (4.5°C) and 20°F (-7°C).

b. The use of SA Primer or SA LVOC Primer is required for flashing applications over approved substrates with a porous or rough surface, including: Dens Deck Prime, Dens Deck, DEXcell, concrete and smooth faces CMU.

(3) Flash penetrations and field-formed inside and outside corners per manufacturer’s installation instructions.

(4) Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

(5) Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

(6) Proceed with installation only after unsatisfactory conditions have been corrected.

X. FIELD QUALITY CONTROL

(1) Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

(2) Final Roof Inspection: Arrange for roofing system manufacturer’s Registered Roof Observer (RRO) to inspect roofing installation on completion and submit report to Architect.
a. Notify Architect or Owner 48 hours in advance of date and time of inspection.

(3) Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

(4) Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

Y. PROTECTION AND CLEANING

(1) Protect roofing system from damage and wear during remainder of construction period.

(2) Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

(3) Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION
076200 – SHEET METAL FLASHING AND TRIM

1. GENERAL

A SUMMARY

(1) Section Includes:
   a. Manufactured reglets and counterflashing.
   b. Formed roof drainage sheet metal fabrications.
   c. Formed low-slope roof sheet metal fabrications.
   d. Formed wall sheet metal fabrications.

B ACTION SUBMITTALS

(1) Product Data: For each type of product indicated.

(2) Shop Drawings: Show installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.

   a. Include details for forming, joining, supporting, and securing sheet metal flashing and trim, including pattern of seams, termination points, fixed points, expansion joints, expansion-joint covers, edge conditions, special conditions, and connections to adjoining work.

C CLOSEOUT SUBMITTALS

(1) Maintenance data.

D QUALITY ASSURANCE

(1) Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

(2) Preinstallation Conference: Conduct conference at Project site.

E WARRANTY

(1) Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-
applied finishes within 20 years from date of Substantial Completion.

2. PRODUCTS

A SHEET METALS

(1) General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

(2) Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

a. Exposed Coil-Coated Finish:

   i. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.

b. Color: As selected by Architect from manufacturer's full range.

B MISCELLANEOUS MATERIALS

(1) General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

(2) 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 or manufactured item.

   a. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

   i. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.

(3) Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
(4) Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

(5) Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

(6) Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

(7) Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

C REGLETS

(1) Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated.
   a. Material: Galvanized steel, 0.022 inch (0.56 mm) thick.
   b. Finish: Mill.

D FABRICATION, GENERAL

(1) General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
   a. Obtain field measurements for accurate fit before shop fabrication.
   b. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
   c. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

(2) Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

(3) Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not
less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.

(4) Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

(5) Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

E  ROOF DRAINAGE SHEET METAL FABRICATIONS

(1) Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- (2400-mm-) long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.

(2) Downspouts: Fabricate from sheet metal. See drawings.

(3) Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch- (100-mm-) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fabricate from the following materials:
   a. Galvanized Steel: 0.028 inch (0.71 mm) thick.

(4) Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape indicated complete with outlet tubes, exterior flange trim, and built-in overflows. Fabricate from the following materials:
   a. Galvanized Steel: 0.028 inch (0.71 mm) thick, pre-finished.

F  LOW-SLOPE ROOF SHEET METAL FABRICATIONS

(1) Roof-Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Furnish with 6-inch- (150-mm-) wide, joint cover plates. Fabricate from the following materials:
   a. Galvanized Steel: 0.028 inch (0.71 mm) thick, pre-finished.

(2) Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to
support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight. Fabricate from the following materials:

a. Galvanized Steel: 0.040 inch (1.02 mm) thick, pre-finished.

(3) Counterflushing and Flashing Receivers: Fabricate from the following materials:

a. Galvanized Steel: 0.022 inch (0.56 mm) thick.

(4) Roof-Penetration Flashing: Fabricate from the following materials:

a. Galvanized Steel: 0.028 inch (0.71 mm) thick.

3. EXECUTION

A UNDERLAYMENT INSTALLATION

(1) Polyethylene Sheet: Install polyethylene sheet with adhesive for anchorage. Apply in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches (50 mm).

(2) Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

(3) Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.

B INSTALLATION, GENERAL

(1) General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement so that completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

a. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
b. 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.

c. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

d. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

e. Install sealant tape where indicated.

f. Torch cutting of sheet metal flashing and trim is not permitted.

(2) Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

a. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.

(3) Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.

(4) Fastener Sizes: Use fasteners of sizes that will penetrate metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

(5) Seal joints as shown and as required for watertight construction.

(6) Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except reduce pre-tinning where pre-tinned surface would show in completed Work.

a. Do not solder metallic-coated steel and aluminum sheet.

b. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
(7) Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.

C ROOF DRAINAGE SYSTEM INSTALLATION

(1) General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

(2) Conductor Heads: Anchor securely to wall with elevation of conductor head rim 1 inch (25 mm) below scupper discharge.

D ROOF FLASHING INSTALLATION

(1) General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

(2) Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch (75-mm) centers.

(3) Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated.
   a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch (600-mm) centers.
   b. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch (600-mm) centers.

(4) Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.

(5) 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 a minimum of 4 inches (100 mm) and bed with sealant.
(6) Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with butyl sealant and clamp flashing to pipes that penetrate roof.

E CLEANING AND PROTECTION

(1) Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

(2) Clean and neutralize flux materials. Clean off excess solder and sealants.

(3) 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
077200 – ROOF ACCESSORIES

1. GENERAL

A. SUMMARY

(1) Section Includes:
   a. Roof hatches.
   b. Safety railing.
   c. Ladder up safety post.

B. ACTION SUBMITTALS

(1) Product Data: For each type of roof accessory indicated.
(2) Shop Drawings: For roof accessories.
(3) Samples: For each exposed product and for each color and texture specified.

C. INFORMATIONAL SUBMITTALS

(1) Warranty: Sample of special warranty.

D. CLOSEOUT SUBMITTALS

(1) Operation and maintenance data.

E. WARRANTY

(1) Special Warranty on Painted Finishes: Manufacturer’s standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within 20 years from date of Substantial Completion.

2. PRODUCTS

A. METAL MATERIALS

(1) Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 (AZM150) coated.
   a. Exposed Coil-Coated Finish: Two-coat fluoropolymer finish; AAMA 621; system consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight
B. MISCELLANEOUS MATERIALS

(1) General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

(2) Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.

(3) Fasteners: Roof accessory manufacturer’s recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.

(4) Sealants: As recommended by roof accessory manufacturer for installation indicated.

C. ROOF HATCH

(1) Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

b. Basis-of-Design Product: Subject to compliance with requirements, provide J.L. Industries RHG-STH Series or comparable product by one of the following:

   i. AES Industries, Inc.
   ii. Babcock-Davis.
   iii. Bilco Company (The).
   iv. Bristolite Skylights.
   v. Custom Solution Roof and Metal Products.
   vi. Dur-Red Products.
   viii. J.L. Industries, Inc.
   ix. Metallic Products Corp.
   x. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
   xi. Naturalite Skylight Systems; Vistawall Group (The).
   xii. Nystrom.
   xiii. O’Keeffe’s Inc.
xiv. Pate Company (The).

xv. Precision Ladders, LLC.

(2) Type and Size: Single-leaf lid, 30 by 36 inches (750 by 900 mm).

(3) Loads: Minimum 40-lbf/sq. ft. (1.9-kPa) internal uplift load.

(4) Hatch Material: Aluminum-zinc alloy-coated steel sheet, 0.079 inch (2.01 mm) thick.
   a. Finish: Two-coat fluoropolymer.
   b. Color: As selected by Architect from manufacturer's full range.

(5) Construction:
   a. Insulation: Polyisocyanurate board.
   b. Hatch Lid: Opaque, insulated, and double walled, with manufacturer’s standard metal liner of same material and finish as outer metal lid.
   c. Curb Liner: Manufacturer’s standard, of same material and finish as metal curb.
   d. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
   e. Fabricate curbs to minimum height of 12 inches (300 mm) unless otherwise indicated.

(6) Hardware: Galvanized-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.
   a. Provide two-point latch on lids larger than 84 inches (2130 mm).

(7) Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.

(8) Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder. Post locks in place on full extension; release mechanism returns post to closed position.
3. EXECUTION

A. INSTALLATION

(1) General: Verify dimensions of roof openings for roof accessories. Install roof accessories according to manufacturer’s written instructions.

   a. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

   b. Anchor roof accessories securely in place so they are capable of resisting indicated loads.

   c. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.

   d. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

(2) Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

   a. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.

   b. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.

(3) Seal joints with sealant as required by roof accessory manufacturer.

B. REPAIR AND CLEANING

(1) Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.

(2) Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
(3) Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION
079200 – JOINT SEALANTS

1. SCOPE:

A. Sealant shall be installed at all intersections of dissimilar materials and elsewhere to provide an entirely weather-tight building. Color as selected by Architect to blend with surrounding surfaces.

B. Related Sections:

(1) Section 033000: Cast-in-Place Concrete
(2) Section 042000: Unit Masonry
(3) Section 064116: Plastic Laminate Faced Architectural Cabinets
(4) Section 081113: Metal Doors and Frames
(5) Section 084113: Aluminum Entrance and Window Frames
(6) Section 092900: Gypsum Wallboard
(7) Section 099000: Painting

C. Submittals:

(1) Product data for interior sealants including printed statement of VOC content.

2. MATERIALS:

A. General: VOC of interior sealants and sealant primers must comply with the following limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

(1) Sealants: Not more than 250 g/L
(2) Sealant Primers for Nonporous Substrates: Not more than 20 g/L
(3) Sealant Primers for Porous Substrates: Not more than 775 g/L

B. Sealants Type A - Silicone

(1) GE - Silpruf 2000
(2) Dow Corning - 795
(3) Tremco - Spectrem 2

C. Sealants Type B – Silicone-Urethane Hybrid (paintable)

(1) Sika – Sika Hi-flex 150 LM

D. Sealants Type C - Siliconized Acrylic

(1) GE
(2) Tremco

3. INSTALLATION:
   A. Install all sealants in strict accordance with manufacturer's requirements.
   B. Sealant selected shall be appropriate for materials adjoining joint and for anticipated movement.
      (1) Type A: Storefront weather seals, storefront perimeter seals, joints with up to 50% anticipated movement.
      (2) Type B: Masonry control joints, masonry perimeter joints, concrete joints, joints with up to 25% anticipated movement.
      (3) Type C: Interior door frame perimeter, intersections between millwork and walls, surfaces requiring painting, joints with up to 7.5% anticipated movement.
      (4) Type D: Joints between concrete and aluminum shapes and joints between irregular surfaces and machined surfaces.
      (5) Type E: Provide mildew resistant caulking at all damp areas.
   C. Drive compound into joint grooves with enough pressure to force out all air and solidly fill joint. Deep voids shall be filled with backer rod so that the tooled thickness of the caulk is approximately ½ the width of the joint.
   D. Exposed sealant shall be free from wrinkles and uniformly smooth. Caulking around openings shall mean entire perimeter.
   E. Adjoining surfaces shall be cleaned of any smears of compound.
DIVISION 8 - DOORS AND WINDOWS

081113 – METAL DOORS AND FRAMES

1. GENERAL:

   A. Scope:

      (1) Provide all labor and material for a complete installation at locations shown on the drawings and/or as described in the door schedule.

   B. Related Sections:

   C. Submittals

      (1) Shop drawings: Submit shop drawings for approval prior to fabrication.

      (2) Both doors and frames shall be provided by the same manufacturer.

2. MATERIALS:

   A. Hollow Metal Doors & Frames shall be made per NAAMM Standard HMMA 862 (with the modifications listed below) as manufactured by Southwestern Door, Commercial Door and Hardware, or any door company that is a member of the Hollow Metal Manufacturers Association.

   B. Doors:

      (1) Face Sheets; Interior and Exterior Doors: 16 gage.

      (2) Minimum thickness: 1 3/4"

      (3) Stiffeners: 18 gage, 6" spacing, spot-welded to both face sheets 5" O.C. (Alternate #5 - Doors shall be reinforced, stiffened and sound deadened with polystyrene slab core, 1.5 pound per cubic foot density, completely filling the inside of the door and laminated to the inside faces of panels.)

      (4) Vertical Edge: Continuous weld.

      (5) Top and bottom edges: Closed with 14 gauge continuous steel channel. Flush, top and bottom, not recessed.
(6) Glass Molding and Stops: Fixed moldings welded to door on security side, all stops 16 gage. All screws shall be countersunk.

C. Frames:

(1) Interior and Exterior: 14 gauge.

(2) Construction: Welded units with integral stop and trim.

(3) Floor Anchors: 14 gauge weld inside jambs.

(4) Jamb anchors: In masonry 14 gauge steel. For stud partitions 16 gauge steel anchors.

D. Hardware reinforcement:

(1) Door hinges: 3/16" plate.

(2) Lockface, flush bolts and closures L12 gauge steel.

(3) Frame hinge: 3/16" plate.

3. INSTALLATION:

A. Install in accordance with manufacturer’s recommendations. Field verify all conditions. Anchor frames with four anchors each side.

B. Grout frames solid in masonry walls.

C. Pack frames solid with monocote in framed walls.

END OF SECTION
1. GENERAL:

A. Related Sections

(1) Division 8 Section "Glazing" for glass view panels in flush wood doors.

(2) Section 081113 Metal door and frames.

(3) Section 087100 Door Hardware

(4) Section 088000 Glazing.

B. Submittals

(1) Submit under provisions of Division 1.

(2) Shop Drawings: Illustrate door opening criteria, elevations, sizes, types swings, special blocking for hardware, identify cutouts for glazing.

(3) Product Data: Indicate door core materials and construction; veneer species, type and characteristics; factory machining criteria, factory finishing criteria.

(4) Manufacturer's Instructions: Submit instructions regarding care of door during shipping, unloading, storage, preparation for hanging.

C. Delivery, Storage and Handling

(1) Deliver, store, protect and handle products to job site per manufacturer's instructions.

(2) Accept doors at job site in manufacturer's standard packaging. Inspect for damage.

(3) Do not store in damp or wet areas. (Cover stored doors with opaque covering material where sunlight might bleach veneer.) Seal top and bottom edges if stored more than one week.

(4) Break seal at job site to permit ventilation.
D. Coordination

(1) Coordinate work under provisions of Division 1.

(2) Coordinate the work with door opening construction, door frame and door hardware installation.

E. Warranty

(1) Provide manufacturer's warranty including replacement, refinishing, and re-hanging, under provisions of Division 1 to the following term:
   a. Interior Solid Core Doors: "Life of Original Installation".
   b. Include coverage for de-lamination of plastic laminate, warping beyond specified installation tolerances, defective materials.

2. PRODUCTS

A. Manufacturer

(1) Weyerhaeuser Company, Marshfield Series

(2) Other acceptable manufacturers:
   a. VT Industries
   b. Algoma

B. Door Materials

(1) 1-3/8" engineered hardwood top and bottom rails.

(2) 1-3/8" engineered hardwood or mill option hardwood stile.

(3) 28-32 lb./cu. ft. particle core.

(4) Veneer: AWI Type I, good quality, 1/32 to 1/41 inch thick, mechanically spliced birch species wood, rotary cut with book-matched grain. Paint-grade masonite where noted.

(5) Stiles stained and lacquered to match wood veneer.

C. Fabrication

(1) Fabricate fire-rated, doors in accordance with specified
manufacturer's and UL requirements.

(2) Provide inner blocking at top, intermediate or bottom for positive attachment of specialized hardware. Note: Special hinges used on these doors - coordinate with hardware specification.

D. Factory Finish

(1) Clear 0-95 Rotary Natural Birch.

3. INSTALLATION:

A. Examination

(1) Verify opening conditions under provisions of Division 1.

(2) Verify that opening sizes and tolerances are acceptable.

(3) Do not install doors in frame openings that are not plumb or are out of tolerance for size or alignment.

B. Installation

(1) Install fire-rated and non-rated doors in accordance with NFPA 80 manufacturer’s instructions and to UL requirements.

(2) Trim non-rated door width by cutting equally on both jamb edges.

(3) Trim door height by cutting bottom edges to a maximum of 3/4 inch. Trim fire-rated door height at bottom edge only, in accordance with fire-rating requirements.

(4) Pilot drill screw and bolt holes using templates provided.


(6) Coordinate installation of doors with installation of frames specified Section 081113 and hardware specified in Section 087100.

(7) Coordinate installation of glass and glazing specified in Division 8.
C. Installation Tolerances

(1) Maximum Diagonal Distortion (Warp): 1/8 inch measured with straight edge or taut string, corner to corner, over a maximum 42 x 28 inch surface area.

(2) Maximum Vertical Distortion (Bow): 1/8 inch measured with straight edge or taut string, top to bottom, over a maximum 42 x 28 inch surface area.

(3) Maximum Width Distortion (Cup): 1/8 inch measured with straight edge or taut string, edge to edge, over a maximum 42 x 84 inch surface area.

D. Adjusting

(1) Adjust door for smooth and balanced door movement.

END OF SECTION
083113 – ACCESS DOOR

1. GENERAL:
   A. Scope: Furnish and install access doors at locations shown on the drawings, or as required by code for mechanical, electrical or plumbing access.

2. MATERIALS:
   A. Manufacturers: Access doors shall be manufactured by Williams Brothers, J.L. Industries or equal.

3. INSTALLATION:
   A. Install in strict accordance with manufacturer’s recommendations.

END OF SECTION
084113 – ALUMINUM ENTRANCE AND WINDOW FRAMES

1. GENERAL

A. Furnish all necessary materials, labor and equipment for the complete installation of aluminum framing as indicated on the drawings.

B. Submittals:

(1) Submit shop drawings to the architect for approval in accordance with general conditions. Obtain approval of shop drawings prior to fabrication.

2. MATERIALS

A. Aluminum window frames and related items shall be as manufactured by Kawneer Company, Arcadia, U.S. Aluminum, Southwest Aluminum, EFCO or approved equal.

(1) Exterior Aluminum Storefront System: Arcadia 2" x 4½ ", center plane, outside glazed, or equal. Provide thermal break.

(2) Doors shall be “Wide Stile” Arcadia, or equivalent of the above listed manufacturers.

B. Finish: All exposed framing surfaces shall be free of scratches and other serious blemishes. Color shall be clear anodized.

C. Hardware: Refer to Section 087100.

3. INSTALLATION

A. All framing shall be set in correct locations as shown in the details and shall be level, square, plumb, and in alignment with other work in accordance with the manufacturer's installation instructions and the drawings.

B. All joints between the framing and the building structure shall be sealed to secure a water-tight installation. Head sections of storefront shall accommodate ¼" deflection of structure. Provide expansion / construction of installed system. Provide wegos as required to ensure positive drainage of water to the exterior.

C. After installation, all exposed aluminum surfaces shall be protected from damage.
D. All sills shall be set in a continuous bed of sealant.

E. Installation shall be in accordance with manufacturer's standard windload charts. Members shall be sized utilizing windloads @ 15 PSF up to 40 feet and 20.2 PSF for 40 to 60 feet.


END OF SECTION
087100 – DOOR HARDWARE

1. GENERAL:

A. Scope:

(1) Section Includes: Furnish and install Door Hardware as shown on Drawings and as specified herein, unless specifically excluded and specified in other Sections.

B. Definitions:

(1) Door Hardware includes items known commercially as builders hardware which are required for swing, sliding and folding doors, gates and miscellaneous items as indicated, except special types of unique and non-matching hardware specified in the same Section as the door and door frame. Types of items in this Section include, but are not necessarily limited to, the following:

C. System Description:

(1) General Requirements: While the Hardware Schedule is intended to cover doors and other movable parts of the building and establish a type and standard of quality, examine drawings and specifications and furnish proper hardware for openings whether listed or not. Hardware must meet applicable handicapped access standards, ordinances and codes. Omissions or corrections in hardware groups shall be brought to the attention of the Architect prior to bid opening. No extras will be allowed for omissions, changes or corrections necessary to facilitate proper installation.

(2) If an item is not specified but will be required in a similar situation, furnish equal hardware to that specified for similar locations if practicable. If no similar location is specified, then use hardware in keeping with that specified.

(3) The Work of this Section shall be the total responsibility of one firm herein identified as the Supplier/Installer. If the Supplier and Installer are not one firm then the Supplier shall be the responsible party and shall cover the complete coordination of related work in other Sections.

D. Submittals:

(1) General: Submittals requirements are specified in Section 01300 Shop Drawings and Samples.
(2) Materials List: As soon as practical after award of contract, submit a complete listing of materials to be furnished. Submit in quantities as directed by the Architect, showing each item proposed for installation use and quantities to be furnished. Supplier/installer bidders shall state in their bid the delivery date to Contractor.

(3) Product Data: Submit manufacturer's technical information for each item of hardware. Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and maintenance of operating parts and finish.

(4) Hardware Schedule: Submit final hardware schedule in manner indicated below. Hardware schedules are intended for coordination of work. Hardware schedule shall include a summary of individual items of hardware and related material used on the project, complete with the name of the manufacturer of each item. The Hardware Schedule shall be prepared in vertical format.

a. Final Hardware Schedule Content: Based on builders hardware indicated, organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:

1) Catalog number, type, style, function, size and finish of each hardware item.
2) Name and manufacturer of each item.
3) Fastenings and other pertinent information.
4) Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
5) Explanation of abbreviations, symbols, codes, etc. contained in schedule.
6) Mounting locations for hardware.
7) Door and frame sizes and materials.
8) Keying information.
9) Any other pertinent data.

b. Submittal Sequence: Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames) which is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by builders hardware, and other information essential to the coordinated review of hardware schedule.
(5) Samples: When requested by the Architect, prior to submittal of the final hardware schedule and prior to final ordering of hardware, submit one sample of each type of exposed hardware unit, finished as required, and tagged with full description for coordination with schedule. Samples will be returned to the supplier/installer. Units which are acceptable and remain undamaged through submittal, review and field comparison procedures may, after final check of operation, be used in the work, within limitations of keying coordination requirements.

(6) Templates: Supply templates to door and frame manufacturers, as required, to enable proper and accurate sizing and locations of cut-outs for hardware and door reinforcement. Delivery of templates shall be timely to prevent delays in construction.

a. Shipment of hardware prepaid to manufacturers requesting that hardware be incorporated in their work.

b. Where cylindrical locks are used in hollow metal doors, furnish lock information to the door manufacturer for reinforcing in the door at the time of manufacture.

E. Quality Assurance:

(1) Qualifications:

a. Manufacturer: Obtain each kind of hardware (latch and lock sets, hinges, closers, etc.) from only one manufacturer, although several may be indicated as offering products complying with requirements. Manufacturer shall have five years experience in manufacture of comparable hardware.

b. The hardware consultant shall be, on a full-time basis, a regular member of the Door and Hardware Institute (DHI) and a registered Architectural Hardware Consultant (AHC) to properly detail work, order and supervise installation.

c. The supplier/installer shall be a recognized architectural finish hardware supplier/installer who has been furnishing hardware within a 300 mile radius of the project for a period of not less than five years, and who is, or employs an experienced hardware consultant who shall be available to the Owner, Architect and Contractor at reasonable times during the course of the work for consultation about the project’s hardware requirements. The supplier/installer shall also be a factory authorized distributor for the items specified.
(2) Regulatory Requirements:
   a. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA Standard No. 80 and national or local building code requirements. Provide only hardware which has been tested and listed by UL or FM for types and sizes of doors required and complies with requirements of door and door frame labels.
   b. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors UL or FM labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL or FM label on exit devices indicating "Fire Exit Hardware".
   c. Comply with other applicable fire, handicapped and building codes, guidelines and regulations. Hardware supplied and installed shall meet the requirements of Arizona Revised Statutes, Title 34 Handicapped Requirements.

(3) Certifications: At the completion of installation, certify that material is properly installed, according to manufacturer's printed instructions. Submit certification in duplicate to the Architect after installation of hardware in accordance with Section 01700 Project Close-out.

F. Delivery, Storage and Handling:

(1) Packaging of hardware is the responsibility of the supplier/installer. As material is received by the hardware supplier/installer from the various manufacturers, sort hardware as necessary. Deliver hardware in original and individual containers, complete with necessary fastenings, keys, instructions and templates for spotting mortising tools. Items particular to a specific door shall be clearly marked by door number and heading number on the package.

(2) The hardware supplier/installer shall inventory hardware and verify that the count is correct. Each carton of hardware shall be marked with item numbers, corresponding to the item numbers on the Finish Hardware Schedule.

(3) Provide secure lock-up for hardware delivered to the project, but not yet installed. Control and handling and installation of hardware items which are not immediately replaceable, so that the completion of the work will not be delayed by hardware losses, both before and after installation. Store materials off the ground in dry, protected areas.
(4) The Contractor shall tag and index keys, manuals, schematics, operating instructions and factory diagrams for release and use by the Owner.

(5) Containers holding keyed locks and cylinders shall be marked with the following:
   a. Heading Number
   b. Door Number
   c. Hand of Door (when required)
   d. Key Symbol

G. Maintenance:

(1) Provide Owner with manufacturer's parts list and maintenance instructions for each type of hardware supplied, including necessary wrenches and tools required for proper maintenance and adjustment of hardware, as supplied with hardware when shipped to General Contractor. The General Contractor shall gather parts lists, tools, etc. as supplied with the hardware at the time of installation and hold these items until close-out.

(2) Tools for Maintenance: Furnish a complete set of specialized tools as needed for Owner's continued adjustment, maintenance, and removal and replacement of builders hardware.

(3) Maintenance Service: Approximately six months after the acceptance of hardware in each area, the Hardware Installer, accompanied by the representative of the latch and lock manufacturer, shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures.

(4) Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware. The supplier /installer shall not be responsible for adjustments, corrections or replacements due to abuse, vandalism of lack or required maintenance by the Owner on the hardware.
2. MATERIALS:

A. Manufacturers:

(1) Acceptable Manufacturers:
   b. Geared Hinges: Ives, Roton, Pemko.
   c. Locksets: Schlage.
   d. Cylinders/Cores: Schlage.
   e. Exit Devices: Von Duprin, Ives VR pulls
   f. Closers: LCN.
   g. Over Head Stop/ Holders: Rixson, Glynn Johnson.
   h. Threshold, Door bottom, Seals: National Guard, Pemko, Reese.
   i. Stops, Kickplates: Ives, Trimco, Rockwood.
   j. Pull, Push Plates, Misc.: Ives, Trimco, Rockwood.
   k. Key Cabinet: Lund, Telkee.

B. Hardware:

(1) Scheduled Hardware: Requirements for design, grade, function, finish, size and other distinctive qualities of each type of builders hardware is indicated in the Builder's Hardware Data Sheet and Hardware Schedule at the end of this Section. The drawings show the direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of the door movement as shown. Products are identified by using hardware designation numbers of the following:

   a. Manufacturer's product designations: One or more manufacturers are listed for each hardware type required. Provide either the product designated, or, where more than one manufacturer is listed, the comparable product of one of the other manufacturers which comply with requirements including those specified elsewhere in this section.

   (2) Fasteners: Manufacture hardware to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.
a. Furnish necessary screws, bolts or other fastenings of suitable size and type to anchor the hardware in position for heavy use and long life, and of compatible material and finish. Furnish fastenings with anchors according to the material to which it is applied, and as recommended by the manufacturer. Fasten closers on wood or mineral core doors with hex nuts and bolts.

b. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match the hardware finish or, if exposed in surfaces of other work, to match the finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.

c. Provide concealed fasteners for hardware units which are exposed when the door is closed, except to the extent no standard units of the type specified are available with concealed fasteners.

(3) Finish: Hardware shall be BHMA-626 (US26D) unless noted otherwise.

C. Hardware Types:

(1) Hinges

a. Geared Hinges: Type as listed in hardware sets.

b. Shall conform to the applicable requirements of Specifications FF-H-116, except as otherwise specified herein. Loose pin hinges for reverse-bevel doors with locks shall be constructed in a manner that will eliminate removal of the pins when the doors are in the closed position. Determine correct clearance from the drawings. Provide non-removable pins on all doors. Provide five knuckle, concealed ball bearing hinges on all doors. Flat Button, top and bottom tips required on all butt hinges. Match existing size where doors or frames are being reused.

1) Butt Hinge Length:

<table>
<thead>
<tr>
<th>Door Thickness</th>
<th>Door Width</th>
<th>Hinge Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 3/4&quot; door</td>
<td>Where Req.</td>
<td>4 1/2&quot;</td>
</tr>
<tr>
<td>1 3/4&quot; door</td>
<td>to 38&quot;</td>
<td>4 1/2&quot;</td>
</tr>
<tr>
<td>1 3/4&quot; door</td>
<td>over 38&quot; to 48&quot;</td>
<td>5&quot;</td>
</tr>
<tr>
<td>1 3/4&quot; door</td>
<td>over 48&quot;</td>
<td>6&quot;</td>
</tr>
</tbody>
</table>

2) Number of Butt Hinges Required:

aa) Doors 60" high and under: 2 butt hinges
bb) Doors over 60" high and not over 90" high: 3 butt hinges
cc) Doors over 90" high and not over 120" high: 4 butt hinges

3) Hinge Types: Shall conform to the applicable requirement of Specification FF-H-121c, except as specified otherwise herein.
   aa) Interior doors: 5BB1
   bb) Exterior doors: 5BB1

(2) Door Locks:
   a. Shall conform to the applicable requirements for Series 161 of Specification FF-H-106, except as otherwise specified herein. The series selected shall, as far as practicable, be used throughout the project. All lock and latch sets of a series shall be the products of a single manufacturer. Lock cylinders shall have not less than six pin tumblers. Accessories such as door coordinators shall conform to the applicable requirements of Specification FF-H-106a (1). Lock and latch design, style and application shall meet handicapped access standards and codes where applicable.
   b. All locksets to be heavy duty. Cylindrical Type: Schlage “ND” Rhodes design or as listed in hardware sets. Functions as listed in hardware sets.
   c. Provide locks and latchsets with 2-3/4" backset, unless otherwise noted. Provide strikes with extended lip where required to protect trim from being marked by latch bolt. Provide at wood frames and/or wood doors (when in pairs) wrought boxes.

(3) Door Closers:
   a. Door closers shall meet handicapped access standards and codes. Complying with ANSI A117.1 for door opening force and delayed action closing.
   b. Surface mounted LCN 4041 Series 689 Finish, spray to match other hardware, with three (3) separate control valves (including back check), ANSI Grade I. Closers to be equipped with size adjustment (1 thru 6). All closers shall be mounted on the inside of the room wherever possible. Where parallel arm closers are used extra duty (EDA/CUSH) arms shall be used.

(4) Kickplates: Shall be .050 (minimum) stainless steel 12 inches high, by 1 ½" inches less than door width for single doors and one inch less
than the width for double doors. Finish, 630.

(5) Stops and Bumpers: Wall type WS401/WS402 series with proper anchor selected for substrate. Floor stops FS18S shall be used on exterior doors where required.

(6) Silencers: Supply 3 each at jambs of single doors and 2 each at pairs of doors.

(7) Flush Bolts:
   a. Flush bolts: Type FB458 series as required.
      Furnish flush bolts with dust proof strikes DP2, not required when used with thresholds.

(8) Weatherstrip and Seals:
   a. Door Bottoms shall be Type 600A or as listed in hardware sets.
   b. Weatherstrip shall be Type 160S or as listed in hardware sets.

(9) Thresholds: Shall be type 425 or as detailed on plans or listed in the Hardware Sets.

(10) Push Plates: Shall be .050 thick (minimum), 6 x 16 type 8200 finish 630 all edges beveled or as listed in hardware sets.

(11) Pull Plates: Shall be .050 thick (minimum), 6 x 16, edges beveled, Type 8302-10. Mount with thru-bolts, or as listed in hardware sets. Solid material finish 630.

D. Hardware Finishes:

(1) Provide matching finishes for hardware units at each door or opening, to the greatest extent possible, except as otherwise indicated. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening. In general, match items to the manufacturer’s standard finish for the latch and lock set (or push-pull units if no latch-lock sets) for color and texture.

(2) Provide finishes which match those established by BHMA or, if none established, match the Architect’s sample.

(3) Provide quality of finish, including thickness of plating or coating (if any), composition, hardness and other qualities complying with
manufacturer’s standards, but in no case less than specified for the applicable units of hardware by referenced standards.

(4) Provide protective lacquer coating on exposed hardware finishes or brass, bronze and aluminum, except as otherwise indicated. The suffix "-NL" is used with standard finish designations to indicate "no lacquer".

(5) The designations used in schedules and elsewhere to indicate hardware finishes are those listed in "Materials & Finishes Standard 1301" by BHMA, including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.

E. Lock Cylinders and Keying:

(1) General: All doors this project shall be master keyed as directed by owner. Supplier shall meet with Owner to finalize keying requirements and obtain final instructions in writing. Use Schlage IC Cores, No Substitutions.

(2) Provide construction keying at all doors. Permanent keys shall not be under any circumstance made available to the General Contractor. Furnish 6 construction keys to the Contractor.

(3) Comply with Owner's Instructions for master keying and, except as otherwise indicated, provide individual change key for each lock which is not designated to be keyed alike with a group of related locks.

(4) Key Quantity: Furnish 3 change keys for each lock; 6 master keys for each master system.

3. INSTALLATION:

A. Examination:

(1) Prior to hardware installation, the supplier/installer shall examine the hollow metal door frames and other surfaces to receive hardware for accuracy of installation and alignment. The supplier/installer shall report in writing to the Contractor with a copy to the Architect, of detrimental conditions. Failure to perform this requirement constitutes a waiver to subsequent claims to the contrary and holds the supplier/installer responsible for corrections the Architect may require. Commencement of Work shall be construed as acknowledgment by the supplier/installer that doors and frames and other surfaces to receive hardware are in compliance with the requirements of the Contract Documents.
B. Preparation:

(1) The supplier/installer shall meet with the Owner, Architect, and related trades prior to the Commencement of Work. Tag items or packages with identification related to the final hardware schedule, and include basic installation instructions in the package.

(2) Deliver hardware items at the proper times to the proper locations (ship to project site) for installation.

C. Installation:

(1) Install each hardware item in compliance with the manufacturer's instructions and recommendations.

(2) Mount hardware units at heights as recommended per SDI-100, except as specifically indicated or required to comply with governing regulations, and except as may be directed otherwise by Architect.

(3) Application of Hardware: Hardware shall be installed in a neat, workmanlike manner following the manufacturer's instructions. Fasteners, supplied with the hardware, shall be used to secure the hardware in place. Wood screws shall be used for securing hardware to wood surfaces. Machine screws, set in expansion shields, shall be used for securing hardware to concrete or masonry surfaces. Thru-bolts shall be used where specified or where necessary for satisfactory installation.

(4) Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protection with finishing work specified in Division 9. Do not install surface-mounted items until finishes have been completed on the substrate. The Supplier/Installer shall be responsible for correct application according to factory installation instructions.

(5) Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry.
D. Field Quality Control:

(1) Inspection: The supplier/installer shall provide a final inspection with the Owner, and Architect at the completion of the installation.

(2) After hardware is checked, keys shall be tagged, identified and delivered to the Owner by registered mail, or delivered in person after receiving a signed receipt from a responsible representative of the Owner. Errors in cutting or fitting, or damage to adjoining work shall be repaired, as directed.

E. Adjusting:

(1) Check and adjust each operating item of hardware and each door, to ensure proper operation or function for each unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

(2) Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of hardware items in such space or area. Adjust door control devices to compensate for final operation of heating and ventilating equipment. Instruct Owner's personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

F. Cleaning:

(1) Insure that after installation, the materials furnished and installed will be free of paint or lacquer as may appear from the Work of other subcontractors. Clean operating items as necessary to restore proper function and finish of hardware and doors.

(2) During the course of the Work and on completion of the Work, remove excess materials, equipment and debris and dispose of away from premises. Leave Work in clean condition in accordance with Section 01500 Temporary Facilities.

G. Protection:

(1) After application, hardware shall be protected from paint, stains,
blemishes and damage until acceptance of the Work.

H. Hardware Schedule:

(1) While the following hardware sets are intended to cover doors and establish a type and standard of quality, it shall be the specific duty and responsibility of the hardware supplier to examine the drawings and specifications and furnish proper hardware for openings. The hardware supplier shall compare the specifications with the door schedule and notify the Architect of errors, inconsistencies or omissions during the bid period.

Acceptable Manufacturers:

Hinges: Ives, McKinney, Stanley
Locksets: Schlage
Cylinders/Cores: Schlage
Exit Devices: Von Duprin
Closers: LCN
Over Head Stop/ Holders: Rixson, Glynn Johnson
Thresholds, Door bottom, Seals: National Guard, Pemko, Reese
Door Trim, Stops, Kickplates: Ives, Trimco, Rockwood
Gate Hardware: Hoover Fence Company

HARDWARE GROUP NO. 1

Provide each SGL door(s) with the following:

<table>
<thead>
<tr>
<th>QTY</th>
<th>DESCRIPTION</th>
<th>CATALOG NUMBER</th>
<th>FINISH</th>
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<tr>
<td>1</td>
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<td>112HD</td>
<td>628</td>
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<tr>
<td>1</td>
<td>VANDL CLASSROOM SEC</td>
<td>ND95TD RHO XN12-035</td>
<td>626</td>
<td>SCH</td>
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<tr>
<td>2</td>
<td>FSIC CORE</td>
<td>23-030 (GMK, MATCH EXISTING KEYWAY))</td>
<td>626</td>
<td>SCH</td>
</tr>
<tr>
<td>1</td>
<td>SURFACE CLOSER</td>
<td>4111 SCUSH</td>
<td>689</td>
<td>LCN</td>
</tr>
<tr>
<td>1</td>
<td>MOUNTING PLATE/BRKT AS REQUIRED</td>
<td>4110-XX AS REQ'D</td>
<td>689</td>
<td>LCN</td>
</tr>
<tr>
<td>1</td>
<td>KICK PLATE</td>
<td>8400 10&quot; X 2&quot; LDW B-CS</td>
<td>630</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>DRIP CAP</td>
<td>16A</td>
<td>A</td>
<td>NGP</td>
</tr>
<tr>
<td>1</td>
<td>SEALS</td>
<td>160S</td>
<td>AL</td>
<td>NGP</td>
</tr>
<tr>
<td>1</td>
<td>DOOR SWEEP</td>
<td>600A</td>
<td>CL</td>
<td>NGP</td>
</tr>
<tr>
<td>1</td>
<td>THRESHOLD</td>
<td>425 MS/LA</td>
<td>AL</td>
<td>NGP</td>
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OMIT DRIP CAP AT OVERHANG LOCATIONS.
### HARDWARE GROUP NO. 2
110C

Provide each SGL door(s) with the following:

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<td>EA PANIC HARDWARE</td>
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<td>626</td>
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</tr>
<tr>
<td>1</td>
<td>EA MORTISE CYLINDER</td>
<td>20-061 ICX XQ11-948(CD)</td>
<td>626</td>
<td>SCH</td>
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<tr>
<td>1</td>
<td>EA RIM CYLINDER</td>
<td>20-057 ICX</td>
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<td>2</td>
<td>EA FSIC CORE</td>
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<td>626</td>
<td>SCH</td>
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<tr>
<td>1</td>
<td>EA DOOR PULL</td>
<td>VR910 NL</td>
<td>630</td>
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<td>1</td>
<td>EA SURFACE CLOSER</td>
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<td>1</td>
<td>EA FLOOR STOP</td>
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<td>BLK</td>
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<td>EA DRIP CAP</td>
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<td>CL</td>
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### HARDWARE GROUP NO. 3
109

Provide each SGL door(s) with the following:

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<td>EA MOP PLATE</td>
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<td>EA KICK PLATE</td>
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<td>IVE</td>
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<tr>
<td>1</td>
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<td>WS401/402CCV</td>
<td>626</td>
<td>IVE</td>
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<tr>
<td>3</td>
<td>EA SILENCER</td>
<td>SR64</td>
<td>GRY</td>
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### HARDWARE GROUP NO. 4
107

Provide each SGL door(s) with the following:

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<td>EA FSIC CORE</td>
<td>23-030 (GMK, MATCH EXISTING KEYWAY)</td>
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<td>EA WALL STOP</td>
<td>WS401/402CCV</td>
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<td>IVE</td>
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<tr>
<td>3</td>
<td>EA SILENCER</td>
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<td>WALL STOP</td>
<td>WS401/402CCV</td>
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<td>IVE</td>
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**HARDWARE GROUP NO. 6**

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<tr>
<td>1</td>
<td>OH STOP</td>
<td>90S</td>
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**HARDWARE GROUP NO. AL-1**

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<tr>
<td>1</td>
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</tr>
<tr>
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<td>626</td>
<td>SCH</td>
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<td>RIM CYLINDER 20-057 ICX</td>
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<td>SCH</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>FSIC CORE (GMK, MATCH EXISTING KEYWAY)</td>
<td>626 SCH</td>
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<tr>
<td>1</td>
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<td>630</td>
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<td>1</td>
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<td>LCN</td>
</tr>
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<td>4110-XX AS REQ'D</td>
<td>689</td>
<td>LCN</td>
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<tr>
<td>1</td>
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<td>16A</td>
<td>A</td>
<td>NGP</td>
</tr>
<tr>
<td>1</td>
<td>DOOR SWEEP</td>
<td>600A</td>
<td>CL</td>
<td>NGP</td>
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<tr>
<td>1</td>
<td>THRESHOLD</td>
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<tr>
<td>1</td>
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</table>

OMIT DRIP CAP AT OVERHANG LOCATIONS.
### HARDWARE GROUP NO. AL-2

**110A**  
**110B**

Provide each PR door(s) with the following:

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<tr>
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<tr>
<td>1</td>
<td>REMOVABLE MULLION</td>
<td>KR4954 STAB</td>
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<td>VON</td>
</tr>
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<td>1</td>
<td>PANIC HARDWARE</td>
<td>CD-XP99-EO</td>
<td>626</td>
<td>VON</td>
</tr>
<tr>
<td>1</td>
<td>PANIC HARDWARE</td>
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<tr>
<td>1</td>
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<th>FINISH</th>
<th>MFR</th>
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<td>626</td>
<td>SCH</td>
</tr>
<tr>
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<td>DOOR PULL</td>
<td>VR910 DT</td>
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<td>DOOR PULL</td>
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<td>2</td>
<td>OH STOP</td>
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<td>630</td>
<td>GLY</td>
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<tr>
<td>2</td>
<td>SURFACE CLOSER</td>
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<td>689</td>
<td>LCN</td>
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<th>FINISH</th>
<th>MFR</th>
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<td>MULLION SEAL</td>
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<td>NGP</td>
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<tr>
<td>2</td>
<td>DOOR SWEEP</td>
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<td>WEATHERSTRIP</td>
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### HARDWARE GROUP NO. G-1

Provide each SGL door(s) with the following:

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<th>CATALOG NUMBER</th>
<th>FINISH</th>
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</tr>
<tr>
<td>1</td>
<td>REMOVABLE MULLION</td>
<td>KR4954 STAB</td>
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<td>VON</td>
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<tr>
<td>2</td>
<td>FSIC CORE</td>
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<td>SCH</td>
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<th>MFR</th>
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<td>SURFACE CLOSER</td>
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<td>689</td>
<td>LCN</td>
</tr>
<tr>
<td>1</td>
<td>MOUNTING PLATE</td>
<td>4040XP-18 SRI</td>
<td>689</td>
<td>LCN</td>
</tr>
</tbody>
</table>

GATE VENDOR TO PROVIDE ANGLE STOP

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END OF SECTION

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087100 DOOR HARDWARE  16
088000 – GLAZING

1. SCOPE:

Furnish all labor, equipment, and material required for the complete installation of all glass and glazing.

2. MATERIALS:

   A. Glass, factory labeled, each panel, and not removed until final cleaning. Pittsburgh, Viracon, St. Gobain, P.P.G., Guardian or equal.

   B. Exterior Insulated Glass:

      (1) 1” thick insulating glass.

      (2) Interior light shall be ¼” clear.

      (3) Exterior light shall be ¼” Solarban Z75 Clear low reflectance, low emissivity glass, tempered where required, as manufactured by PPG, Viracon, HGP or equal.

         a. UV Transmittance: 6%
         b. Visible Light Transmittance: 48%
         c. Solar Energy Transmittance: 19%
         d. Visible Light Reflectance: 9%
         e. Solar Energy Reflectance: 29%
         f. U-Value (winter): 0.28
         g. U-Value (summer): 0.26
         h. Shading Coefficient: 0.28
         i. Solar Heat Gain Coefficient: 0.24
         j. Light to Solar Gain (LSG): 2.00

   C. Interior Insulated Glass Assembly (in acoustical walls):

      (1) Two 1/8” panes laminated glass one side.

      (2) One 3/8” pane tempered glass opposite side.

   D. Mirrors: 1/4” Polished plate glass, polished edge.


   F. Interior Fixed Glass: ¼” clear, tempered where required.

3. INSTALLATION:

A. Glazing: Per Glazing Manual of Plate Glass Jobbers Association and plan details.

B. Cleaning: Remove excessive glazing compound. General cleaning by General Contractor.

C. Breakage: All glass breakage shall be the responsibility of the Contractor until the work has been completed and the contract fully performed.

END OF SECTION
END OF DIVISION
DIVISION 9 – FINISHES

092216 – NON-STRUCTURAL METAL FRAMING

1. SCOPE:
   
   A. Include all labor, materials and equipment necessary for a complete installa
tion as shown or specified.
   
   B. Install all materials in accordance with manufacturer’s requirements.
   
   C. Related Sections: All work in this section shall be coordinated with
the following sections:
   
   (1) 092900 Gypsum Board

2. MATERIALS:
   
   A. Manufacturer: Milcor, Keene, Western Metal, or approved equal.
   
   B. Wall track at ceiling and floor shall be 20 gage, as detailed, hot dipped
galvanized steel with not less than 1-1/4” flanges and of proper width
for studs selected.
   
   C. Studs shall be 20 gage, as detailed, hot dip galvanized steel. Webs
shall be pre-punched at 24” o.c. Contractor shall consult
manufacturer’s limiting height tables and shall adjust gauge as
necessary to be in conformance therewith.
   
   D. Resilient Furring Channels: RC-1.
   
   E. Metal Furring Channels: DWC-25 or DWC-20 as required.
   
   F. 1-1/2” x 16 gauge cold rolled channels.
   
   G. 1-1/2” x 12” gauge cold rolled channels.
   
   H. Furring Channel clips.
   
   I. 8 gauge galvanized tie wire.
   
   J. Screws: 3/8” Type S, self-drilling, self-tapping, pan head.
   
   K. Additional accessories, clips, braces, etc. as may be required by the
manufacturer.
L. Acoustical Sealant

   (1) Non-hardening, non-drying, non-bleeding, synthetic rubber-based material conforming to ASTM D-217.

3. INSTALLATION:

A. Attach framing securely to building structure. Fasten partition track at 2'-0" o.c. in accordance with manufacturer’s requirements. Use fasteners suitable for material track is fastened to. The use of powder driven anchors is allowed if installed with minimum 1" long shot pins (.145 shank size) used with the correct load. Set partition track in a continuous bead of sealant.

B. Provide double 20 gauge studs at all openings anchor to structure above, in accordance with the details shown in the drawings. Integ rally reinforce.

C. Maximum stud spacing shall be 16" o.c.

D. Coordinate with other trades for provisions for blocking, metal backing plates, special anchors, etc.

E. Install all components and accessories in strict accordance with the manufacturer's recommendations.

F. Some partitions extend to the bottom of the structure above. Refer to drawings. Provide for expansion and deflection of the building structure as recommended by the manufacturer.

G. Provide 16 gauge studs and solid 2x fire treated wood blocking at all walls supporting shelving or cabinets.

H. Provide channel bracing at mid-height of all walls, or at 6'-0" o.c. vertically where walls exceed 12'-0" in height. Minimum 3/4" cold rolled channel with clips at each stud.

I. Framing of Intersections:

   (1) Provide three studs or floating stud at all exterior and interior corners.

   (2) Provide floating corner at ceiling/wall intersections, except at fire rated walls.
J. Provide acoustical sealant around entire perimeter of sound rated partitions.

K. Provide 3 beads sealant. One at the center of the floor or ceiling track and end wall studs, one at the edge of gypsum wallboard at each face.

L. Caulk perimeter of all electrical junction boxes, and pipe penetrations. Coordinate with fire stopping requirements.

M. Separate and recycle waste materials to the greatest extent possible.

END OF SECTION
092400 – CEMENT PLASTERING

1. GENERAL:

   A. Scope: Provide all labor and materials for a complete installation in locations shown on the drawings.

   B. Quality: Materials, mixing, and workmanship shall be in accordance with the following:

      (1) ASA standard specifications and IBC, Chapter 47.


      (3) “Specifications for Metal Lathing and Furring” published by the Metal Lath/Steel Framing Association, a division of the NAAMM.

      (4) “Plaster/Metal Framing Systems/Lath Manual” distributed by the Plastering Information Bureau of California.

2. MATERIALS:

   A. Accessories: Galvanized trim as recommended by manufacturer as follows:

      (1) #15 “M” shaped expansion joint

      (2) #1-A corner bead

      (3) #66 square edge

      (4) F-reveal reglet

      (5) Portland Cement

   B. Sand: Clean, well graded, and free from soluble salts and organic matter.

   C. Water: Clean, fresh, and free from alkali.

   D. Self-furring, paper-backed metal lath: “K” lath or equal. “Gunlath” on soffits. 3.4 lbs./sq.yd., diamond mesh, galvanized steel sheet.

3. INSTALLATION:

   A. Protection: Protect work of other trades, repair or replace at own expense any damaged or soiled work.

   B. Application:

      (1) 3/8” scratch coat, brown coat as required, ¼” final coat. Material proportions of each coat shall be in accordance with IBC Table 47-F. Final coat applied per Portland Cement Assoc., “Plasterer’s Manual.”
Install metal trim at all exposed edges and at intersections with dissimilar materials.

(2) Three coats, total thickness 7/8”.

(3) Finish: Smooth sand finish. Submit sample for approval.

(4) Moist cure stucco in accordance with the requirement of ASTM C926, including “Annex A2 Design Considerations.”

END OF SECTION
092900 – GYPSUM BOARD

1. GENERAL:

A. The Contractor shall furnish all labor and materials to render a complete gypsum wallboard system installation.

B. Submit painted sample of finish texture on 24" x 24" piece for approval prior to commencing work. Finish level shall be Gypsum Association Level 3 on all walls except those receiving graphics. Walls receiving graphics shall have a Level 5 Finish Level.

C. Related Sections: All work described in this Section shall be coordinated with the following Sections:

   (1) Section 092216: Non-structural Meal Framing

D. Reference Standards:


2. MATERIALS:

A. Gypsum Wallboard:

   (1) Typical: 5/8" thick, Type 'X', ASTM C-36, SW tapered edges.

   (2) Wet Locations: 5/8" thick, Type 'X', moisture and fire resistant wallboard, mold resistant and paperless, complying with ASTM C1178C and 1178M: National Gypsum Gold Bond eXP Tile Backer, Georgia Pacific DensShield Tile Backer, Certainteed M2 Tech Moisture and Mold Resistant Gypsum Board or similar.

B. Gypsum Sheathing: 5/8" DensGlass Gold or equal


D. Sound Board: ½" Homasote 440 Sound Barrier

E. Wallboard Casings: (galvanized)

   (1) Corner bead: #800 Durabead
(2) "L" metal edge trim #200-B

(3) "U" metal edge trim #200-A

F. Screws: 1-1/4" Type "S" Buglehead.

G. Tape and Cement: Approved manufacturer's materials.

H. Texture: Light hawk and trowel in all other areas except walls receiving graphics.

3. INSTALLATION:

A. Walls: Apply board, in maximum practical lengths, perpendicular to framing with ends occurring over firm bearing, end joints staggered ½ panel, field bearings screwed at 12" centers (5 per 48" width). End bearings screwed on 6" centers. Start at center of boards and work toward ends. Provide full panels over doors, no joints permitted.

B. Screw apply casings per manufacturer's directions and install at all outside edges and at intersections with dissimilar materials.

C. Wallboard panels shall be installed continuous over openings and extend at least one (1) full stud beyond the opening edge.

D. Wallboard corners shall overlap utilizing floating corner and floating stud techniques, as required, with no gaps under corner bead. Corner bead shall be attached with screws, crimping is not permitted.

E. Tape, cement, and sand wallboard surfaces. Apply thin cement layer, set tape into cement, let dry for 24 hours, and sand joints, texture entire area to uniform finish.

F. Complete installed system shall conform to all manufacturer's requirements for support size and spacing and lateral bracing.

G. Separate and dispose of and/or recycle gypsum products to the greatest extent possible.

END OF SECTION
093013 – CERAMIC TILING

1. GENERAL:

A. Scope: Furnish and install all labor, materials and accessories as required for a complete waterproof installation. Tile to be installed on floor and walls with patterns as specified.

B. All materials and workmanship shall be in strict accordance with current American Standard Specifications for installation of ceramic tile of the Tile Council of America.

C. Submit samples of each type and color tile required.

D. Provide 20 S.F. of each type and color for surplus material.

2. MATERIALS:

A. Manufacturers: Tile shall be as manufactured by Dal Tile, American Olean, Florida Tile or approved equal. Floor and base tile shall be by the same manufacturer and shall be modular together.

B. Floor Tile

(1) 6” X 6” Porcelain tile, Crossville Ceramic
   a. Style: Color Blox with 6” sanitary cove base

C. Floor Tile

(1) Ceramic wall tile: Daltile, Unity 12” x 24”

D. Dryset Mortar: ANSI A118.1.

E. Latex: Portland Cement Mortar - ANSI A118.4

F. Water: Potable

G. Bond Coat: Dryset mortar.

H. Adhesive: ANSI A136.1, Type I.

I. Tile Backer Board: Acrylic coated mold and moisture resistant gypsum panel substrate complying with ASTM C1178C and 1178M: National Gypsum Gold Bond eXP Tile Backer, Georgia Pacific DensShield Tile Backer, Certainteed M2 Tech Moisture and Mold Resistant Gypsum Board or similar.
J. Metal Lath: Self-furring.

K. Grout: Latex - Portland cement, sanded or non-sanded as appropriate for joint width. Submit color samples for approval. ANSI A118.6.

L. Trim: Satin anodized aluminum or stainless steel finish with profile that is suitable for the application at open edges of tile.

M. Shapes: Form all vertical exterior corners with surface bullnose, intersections of walls and floors with 3/8" radius cove. All trim shapes to be of equal size as field tiles. Use factory manufactured integral angles to form all trim corners.

3. INSTALLATION:

A. All tile installed per Tile Council of North America Standard Specifications over applicable substrate and conditions shown and described below:

   (1) Stud Walls - wet areas: W 244-19

   (2) Stud Walls - dry areas: W 244-19

B. Tile Backer Board: Install in accordance with manufacturer's recommendations.

C. Align joints in wall tile, vertically and horizontally. No staggered joints permitted. Lay out work so that no tile is less than one-half size. Consult with architect before commencing work concerning layout and specific trim shapes.

D. Cleaning and Protection: Tile shall be left clean after grouting and protected with suitable covering. Acid shall not be used on any glazed tile.

E. Seal all grout with penetrating sealant that is colorless, stain-resistant, and will not affect the color and physical properties of ceramic tile and stone surfaces.

F. Separate and recycle waste to the greatest extent possible.

END OF SECTION
095113 – SUSPENDED ACOUSTICAL CEILING

1. GENERAL:
   A. Scope: Furnish all necessary materials, labor, and equipment for the complete installation of a suspended system.
   B. Upon completion of the work, furnish owner with 20 tiles for future maintenance.
   C. Related Section 092900 Gypsum Wallboard.
   D. Submit samples of grid and panel material as well as manufacturer literature in accordance with Section 013000.

2. MATERIALS:
   A. Suspension System:
      (1) Exposed grid, Prelude XL as manufactured by Armstrong CLG Systems for 2x4 grid. Components shall have 5/16” exposed capped face and be “intermediate duty”. Main beams item no. 7300 (12 feet long). Use Axiom 4” vertical trim system where noted on Drawings.
         Cross Tee:       Item no. XL7342 (48”)
                          Item no. XL7328 (24”)
         Wall moldings:  Item no. 7800 (12 feet long)
      (2) Color: White
      (3) Hanger Wire: 12 gage, galvanized.
   B. Acoustical Materials:
      (1) Lay-in panels 5/8”x24”x48” and 5/8” x 24” x 24”, Cortega by Armstrong. Color: Matte white.
      (2) Equal products by USG, Armstrong or prior approved equal.

3. INSTALLATION:
   A. Furnish and install all framing for suspended ceilings in accordance with manufacturer’s directions.
B. All components, fastenings, and methods shall be selected for the actual ceiling loading and the specific structural conditions. Size to prevent deflection in excess of 1/360th of the span of any member.

C. Surface shall be level and true to 1/8" tolerance in 10 feet.

D. Finished work shall be free from dirt, discoloration, defects or objectionable variation in color.

E. Install continuous edge molding at all edges where tile intersects walls.

END OF SECTION
096513 – RESILIENT BASE AND ACCESSORIES

1. GENERAL

A. Scope: Furnish all necessary materials, labor and equipment for the complete installation of rubber base and vinyl composition tile as indicated on the drawings.

B. Maintenance Materials: Upon completion of the work, furnish Owner with 10 linear feet of base for future maintenance.

C. Submittals:
   (1) Submit product data and samples.

2. MATERIALS

A. Rubber Base: Base shall be 4" cove, 1/8" thick type 700 Series TPR rubber compound by Roppe, Flexco, Johnsonite or approved equal. It shall be constructed of 10% post-industrial waste, and shall be smooth and free from imperfections which detract from its appearance. The base shall conform fully to the requirements of Standard Specification F-1861, Group 1 (solid). Use pre-molded outside corners. Color as selected by the Architect.

B. Reducer Strips: Roppe, Flexco or Johnsonite. Color to be selected by Architect.

C. Adhesives: All resilient flooring and cove base shall be installed using Envirotec Healthguard series adhesives as manufactured by W.F. Taylor Co., Inc., Santa Fe Springs, CA; Chicago, IL; Dalton, GA approved equal, or as recommended by the manufacturer.

Adhesives shall be non-toxic, low odor and solvent free with no alcohol, glycol, or ammonia. Adhesives shall be antimicrobial with no hazardous vapors and contain no carcinogenic materials per OSHA Regulation 29 CFR 1910-1200.

Compatibility of W.F. Taylor Envirotec Healthguard adhesives with specified floor covering shall be warranted by W.F. Taylor Company. A written letter of guarantee shall be obtained by Contractor prior to installation of flooring products. Letters of guarantee are required to accompany all flooring submittals.
3. INSTALLATION

A. Rubber Base:

(1) Install per Asphalt and Vinyl Tile Institute Specifications and manufacturer's directions. Commencing work by this Contractor indicates acceptance of surfaces. Use pre-molded outside corners. Miter inside corners. Minimum length of any run of base shall be 48”.

(2) Install rubber base at all walls and cabinets.

B. Provide reducer strips at all flooring transitions.

C. Separate and recycle waste materials to the greatest extent possible.

END OF SECTION
096813 – TILE CARPET

1. GENERAL

A. SUMMARY
   (1) Section includes modular carpet tile.

B. PREINSTALLATION MEETINGS
   (1) Preinstallation Conference: Conduct conference at Project site.

C. ACTION SUBMITTALS
   (1) Product Data: For each type of product indicated.
   (2) Shop Drawings: Show the following:
       a. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
       b. Type of subfloor.
       c. Type of installation.
       d. Pattern of installation.
       e. Pattern type, location, and direction.
       f. Pile direction.
   (3) Samples: For each exposed product and for each color and texture specified.

D. INFORMATIONAL SUBMITTALS
   (1) Product test reports. Including, but not limited to:
       a. ASTM 5252 hexapod test results for carpet tile only.
       b. Flame spread characteristics.
       c. VOC content.
   (2) Sample warranty.
   (3) Installer qualifications.

E. CLOSEOUT SUBMITTALS
   (1) Maintenance data.
(2) As-Built color and material schedule for each carpet installed, including:
   a. Descriptive location.
   b. Manufacturer.
   c. Carpet type (name and number).
   d. Color, style, and pattern (name and number).
   e. Manufacturer’s recommended cleaning procedures.
   f. Warranty provisions.

F. QUALITY ASSURANCE
   (1) Manufacturer Qualifications: Demonstrate at least 5 years successful performance with similar products and installations.
   (2) Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level. Installer must demonstrate at least 5 years successful performance with similar installations.
   (3) Fire-Test-Response Ratings: Provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

G. DELIVERY, STORAGE, AND HANDLING
   (1) Comply with CRI 104.

H. FIELD CONDITIONS
   (1) Comply with CRI 104 for temperature, humidity, and ventilation limitations.

I. WARRANTY
   (1) Carpet Tiles:
      a. Installation Warranty: 2 years from the date of Substantial Completion, signed by the contractor and installer for the repair or replacement of defective materials and workmanship.
      b. Manufacturer’s Warranty: 10 years from the date of Substantial Completion. Warranty shall be non-prorated and cover the following:
         1. Delamination: the backing will not delaminate for the life of the carpet.
2. Edge Ravel: the carpet will not have continuous ends coming out at lengthwise seams for the life of the carpet.

3. Tuft Bind: the carpet shall have an average face yard tuft bind of 19 pounds for the life of the carpet.

4. Static: the carpet will not hive static discharges in excess of 3.5 kV when tested under AATCC Test Method #134-1979 for the life of the carpet.

5. No more than 10% loss of pile by weight.

6. No zippering.

7. Chair pads must not be required to maintain the warranty.

2. PRODUCTS

A. CARPET TILE

   (1) CPT1: Hybrid Tile 59580 by Shaw Contract; color “Water” 64485

B. INSTALLATION ACCESSORIES

   (1) Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

   (2) Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

3. EXECUTION

A. INSTALLATION

   (1) Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

   (2) Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710.
(3) Proceed with installation only after unsatisfactory conditions have been corrected.

(4) Preparation: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

(5) Installation: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

(6) Installation Method: As recommended in writing by carpet tile manufacturer. Install tiles in ashlar method.

(7) Maintain dye lot integrity. Do not mix dye lots in same area.

(8) Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

(9) Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

(10) Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

(11) Install pattern parallel to walls and borders.

(12) Perform the following operations immediately after installing carpet tile:
   a. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
   b. Remove yarns that protrude from carpet tile surface.
   c. Vacuum carpet tile using commercial machine with face-beater element.

(13) Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

END OF SECTION
099000 – PAINTING

1. SCOPE:

A. Paint all surfaces not factory pre-finished, interior and exterior.

B. Regulatory requirements: Comply with applicable codes and regulations of governmental agencies having jurisdiction including those having jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this Specification, comply with the more stringent provisions.

C. Maintenance Materials:

(1) Contractor shall furnish to the Owner one (1) full gallon of each color and each finish.

(2) Containers shall be sealed tight and clearly labeled for identification.

(3) Maintenance material shall be new material, not opened or used material.

D. Submittals:

(1) All materials submitted for approval must be accompanied by product information showing raw material composition.

(2) Contractor shall submit paint chips for color and texture selections. Three sets to the Architect for approval.

(3) When requested by the Architect, the Contractor shall submit a 12 inch by 12 inch sample of any paint finish. Paint finish sample shall be applied to identical type of materials to which it will be applied on the job. Identify samples with color name and number and location on the job.

(4) Paint colors shall be selected by Architect.

E. Delivery, Storage and Handling:

(1) All materials shall be delivered to site in manufacturer's unbroken sealed containers. Each container shall be labeled by the manufacturer giving manufacturer's name, type of paint, label analysis, color and instruction for mixing and reducing.
(2) Provide adequate storage facilities. Store paint materials at minimum ambient temperature of 45°F.

(3) Take precautionary measures to prevent fire hazards and spontaneous combustion.

F. Environmental conditions:

(1) Surfaces to receive paint materials shall be dry.

(2) Minimum application temperature for latex paints is 45°F.

G. Protection:

(1) Adequately protect surfaces not being painted. Repair or replace all items and surfaces damaged as a result of inadequate protection.

(2) Place waste which may constitute a fire hazard in closed metal containers and remove daily from site, or more often, if required.

(3) Remove electrical plates, surface hardware, fittings and fastenings prior to painting. These items shall be stored, cleaned and replaced on completion of work in each area. Solvent used to clean hardware shall not remove permanent lacquer finish.

(4) Provide "WET PAINT" signs to protect newly painted surfaces.

(5) At the completion of work of other trades, touch up and restore damaged painted surfaces interior and exterior.

H. Painting at Patched Areas:

(1) Painting at patched and repaired areas designated on the drawings will be limited to the immediate repaired area and extend two feet beyond the repair in all directions unless noted otherwise. Paint color shall match as closely as possible existing colors.

2. MATERIALS:

A. The following manufacturer's top-of-the-line, first quality products are acceptable. If use of equal products manufactured by others is desired, a list of proposed products including technical brochures shall be submitted for prior approval. Contractor will furnish to the Architect manufacturer's numbered invoices showing material types and quantities used on this project.
(1) Dunn-Edwards Corp.
(2) Sherwin-Williams
(3) ICI
(4) Frazee

B. Manufacturer's catalog names and number of paint types in this Section are based on products of Dunn Edwards and is the standard of quality against which the Architect will judge equivalency. The quantity of titanium dioxide, the use of clays, aluminum silicate, talc and the purity of acrylic materials are some of the criteria which will be used by the Architect in evaluating the equivalency of submitted materials. No lead shall be utilized in the composition of any paint products.

3. INSTALLATION:

A. Workmanship: Preparation, application, workmanship, completion, and acceptance in accordance with manufacturer’s recommendations and applicable provisions of "Painting Specification Manual" by P.D.C.A. for Type 1 Standard Job.

B. Preparation of Surfaces:

(1) Wood: Sandpaper to a smooth and even surface and then dust with a cloth dampened with turpentine in order to completely remove all traces of sanding particles. Nail holes puttied, knots or pitch pockets sealed with shellac.

(2) Concrete: Thoroughly clean surfaces of all loose material land form release agents.

(3) Galvanized Metal: Thoroughly clean with solvent and prime with galvanized metal primer.

(4) Ferrous Metal: Scale and rust removed, cleaned, primed with rust-inhibitive metal primer.

(5) Back Priming: Exposed wood frames and trim, back-primed with one coat of Woodlife.

(6) General: Before painting, remove hardware, accessories, plates, lighting fixtures, and similar items or provide ample protection. Replace all items upon completion of the work.
Where surfaces are to receive aliphatic or epoxy coatings, caulk joint between floor and wall and at all intersections of dissimilar materials.

Previously Painted Surfaces: Wash with tri-sodium phosphate. Remove loose paint and rust and apply primer.

Surface Wireways and Conduits: Sand surfaces to remove sheen. Prime with Versaprimite. Apply final coats within 7 days.

Exterior Metal:

a. Power wash or power sand all areas to be painted, and use a mild detergent solution such as Mi-T-M SURFACE PREP, if required. Then rinse with clear clean water until all residue has been removed from all surfaces.

C. Application:

1. Manufacturer’s representative shall conduct a pre-painting conference to familiarize himself with the work and to verify the compatibility of all products with the substrates.

2. The manufacturer’s representative shall monitor the application of all aliphatic and epoxy coatings and shall provide certification, in writing, that the products have been installed properly.

3. The application of any painting material on any surface shall constitute an acceptance by the Contractor of such surface.

4. Apply paint in accordance with manufacturer’s directions. Use applicators and techniques best suited for the type of material being applied.

5. Apply each coat at the proper consistency according to product manufacturer.

6. All coats shall be thoroughly dry (minimum of 4 hours) before applying succeeding coats.

7. All necessary repairing of nail holes, cracks, plaster, drywall, doors, etc., shall be done after the prime coat. Patch surface with material of same color as finish. Repairs shall be brought flush with and match adjacent surfaces.
(8) Where clear finishes are required, ensure tint fillers match wood. Work fillers well into grain before set. Wipe off excess.

(9) All edges of doors shall be finished same as the faces after fitting.

(10) Hot spots and suction spots noticeable after application of first coat shall be neutralized and touched up before applying second coat. The last coat shall produce an even result.

(11) Exposed piping, ductwork, conduits, and cable trays generally will be painted color and texture to match walls or ceilings next to it.

(12) Final color coat shall show full coverage regardless of number of coats specified.

(13) Paint all sheet metal and mechanical equipment exposed to view on roof as directed. Paint visible portions of flashings, asphaltic coatings, and cant strips to blend with wall surfaces.

(14) All metal work (doors, frames, handrails, etc) and millwork shall be sprayed.

D. Mechanical and Electrical Equipment:

(1) All exposed electrical conduit hangers, outlet boxes, junction boxes, galvanized covers, raceways, gutters, supporting frames, piping, ductwork, grilles, registers, etc. in rooms calling for paint shall be painted to match adjacent surface. Factory finished aluminum registers are to remain unpainted unless so noted.

(2) Remove grilles, registers, covers and access panels from location and paint separately. Clean the back surfaces of all foreign matter.

(3) Replace identification markings on mechanical and electrical equipment when painted or spattered.

(4) Fire pull levers and fire control boxes shall not be painted; if painted by accident, replace at no expense to the Owner.

(5) Sprinkler heads and smoke detectors shall not be painted. If painted, they shall be replaced.

(6) Paint interior of air ducts that are visible through diffusers and registers with one (1) coat of flat black paint to the limit of sight line.
(7) Paint exposed dampers to match face panels.

E. Cleaning:

(1) Remove paint where spilled, splashed, or spattered immediately.

(2) During progress of work, keep premises free from any unnecessary accumulation of tools, equipment, surplus materials and debris.

(3) Upon completion of work, leave premises neat and clean to the satisfaction of the Architect.

F. Paint Schedule:

(1) Paint schedule lists minimum coats. Additional coats may be required to obtain color and uniformity and to hide, at no additional cost to the Owner.

(2) Interior Work:

a. Interior Gypsum Drywall (typical):
   1 coat: Vinylastic Select (VNSL00), low-odor/zero-VOC interior latex primer
   2 coats: Spartazero Eggshell (SZRO30) Low Sheen, low-odor/zero-VOC interior latex low sheen paint

b. Interior Gypsum Drywall (at wet areas):
   1 coat: Vinylastic Select (VNSL00-1), low-odor/zero-VOC interior latex primer
   2 coats: Carboline Sanitile 255, Semi-Gloss, interior acrylic-epoxy eggshell paint

c. Interior Metal, Ferrous:
   1 coat: Bloc-Rust Premium (BRPR00-1-WH), interior/exterior waterborne alkyd rust-preventative metal primer
   2 coats: EverShield (EVSH50-3), low-odor / low-VOC interior/exterior acrylic semi-gloss paint

d. Interior Metal, Non-Ferrous:
   1 coat: Ultra-Grip Premium (UGPR00), acrylic multi-purpose primer
   2 coats: EverShield (EVSH50-3) low-odor / low-VOC interior/exterior acrylic semi-gloss paint
e. Interior Wood:
   1 coat: Inter-Kote Premium (IKPROO) Primer, low-odor/zero-VOC interior latex primer
   2 coats: Spartazero Eggshell (SZRO30) Low Sheen, low-odor/zero-VOC interior latex low sheen paint

(3) Exterior Work:

a. Exterior Metal, Ferrous:
   1 coat: Corrobar (43-5)
   2 coats: SynLustro (10) Alkyd

b. Exterior Metal, Non-Ferrous:
   1 coat: Versapride (42-44)
   2 coats: SynLustro (10) Alkyd

c. Exterior Stucco:
   1 coat: Eff-Stop Premium (ESPR00), acrylic masonry primer/sealer
   2 coats: EverShield (EVSH10-3), low-odor/low-VOC exterior acrylic flat paint

END OF SECTION

END OF DIVISION
101400 – SIGNAGE

1. GENERAL:
   A. Scope: Provide all labor and materials required for a complete installation where shown on the drawing.
   B. Shop Drawings: Submit shop drawings and color samples for approval prior to installation.

2. MATERIALS:
   A. Wall Mounted Signs:
      (1) Wall signs shall be Series 200A sand engraved on ES Plastic and per the details as manufactured by Mohawk Sign Systems, Signsource, Best or approved equal. Colors as selected by the architect from the full line of available colors.
   B. Door Frame Tags:
      (1) Door identification numbers shall be engraved "ES" plastic on all frames.
      (2) Refer to the door schedule sheets for sizes and information.
   C. Building Names and Numbers: Cast aluminum letters and numbers, black anodized finish, Helvetica MEDIUM, flush mount with threaded studs set in adhesive, as manufactured by A.R.K. Ramos, Gemini Inc., Leeds, Mathews, or equal. Sizes as shown on drawing.

3. INSTALLATION:
   A. Install per manufacturer's recommendations and as shown on the drawings.
   B. Letters and Numbers: Concealed mounting: Threaded studs inserted into tapped lugs on back of plaque and set in predrilled holes filled with quick-setting cement.
   C. Wall mounted signs and doorframe tags: Mechanical fastening required.
   D. Cleaning and Protection: At completion of installation, clean soiled sign surfaces in accordance with manufacturer’s instructions. Protect units
from damage until acceptance by Owner.

END OF SECTION
102800 – TOILET, BATH & LAUNDRY ACCESSORIES

1. GENERAL:
   A. Scope: Furnish and install accessories where shown on the drawings.

2. MATERIALS:
   A. Acceptable Manufacturers: Bobrick, Bradley, McKinney / Parker Model numbers reference Bobrick products.
      (1) Grab Bars: B-5806, Lengths as required.
      (2) Recessed Trash Receptacle: B-3644
      (3) Mirror: B-165, 24”x36”

3. INSTALLATION:
   A. Mount all items per handicap accessibility requirements.
   B. Coordinate with other trades to provide correct blocking and openings. Provide solid blocking for anchorage.
   C. Seal all connections to walls with caulking as required by code.

END OF SECTION
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104413–FIRE PROTECTION CABINETS

1 GENERAL

A. SUMMARY
   (1) Section includes fire-protection cabinets for portable fire extinguishers.

B. ACTION SUBMITTALS
   (1) Product Data: For each type of product.
   (2) Shop Drawings: For fire-protection cabinets.

C. CLOSEOUT SUBMITTALS
   (1) Maintenance data.

D. COORDINATION
   (1) Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
   (2) Coordinate sizes and locations of fire-protection cabinets with wall depths.

2 PRODUCTS

A. PERFORMANCE REQUIREMENTS
   (1) Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

B. FIRE-PROTECTION CABINET
   (1) Cabinet Type: Suitable for fire extinguisher.
      a. Basis of Design: Larsen’s Architectural Series, model 2409-5R and 2409-SM.
      b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         i. Fire-End & Croker Corporation
         ii. Guardian Fire Equipment, Inc.
         iii. JL Industries, Inc.
iv. Modern Metal Products
v. Potter roemer LLC

(2) Cabinet Construction: Nonrated.
(3) Cabinet Material: Cold-rolled steel sheet.
(4) Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
   a. Rolled-Edge Trim: 2-1/2-inch backbend depth.
(5) Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.
(6) Cabinet Trim Material: Steel sheet.
(7) Door Material: Steel sheet.
(8) Door Style: Vertical duo panel with frame.
(9) Door Glazing: Acrylic sheet.
(10) Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
(11) Accessories:
   a. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
   b. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
      i. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
         1 Location: Applied to cabinet door.
         2 Application Process: Silk-screened.
         3 Lettering Color: Red.
         4 Orientation: Vertical.
(12) Materials:
   a. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
i. Finish: Baked enamel or powder coat.
ii. Color: As selected by Architect from full range of industry colors and color densities.

b. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 3 mm thick, with Finish 1 (smooth or polished).

C. FABRICATION

(1) Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

3 EXECUTION

A. INSTALLATION

(1) Prepare recesses for semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

(2) Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

(3) Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

(4) Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

END OF SECTION
104416 – FIRE EXTINGUISHERS

1. GENERAL

A. SUMMARY
   (1) Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

B. ACTION SUBMITTALS
   (1) Product Data: For each type of product.

C. INFORMATIONAL SUBMITTALS
   (1) Warranty: Sample of special warranty.

D. CLOSEOUT SUBMITTALS
   (1) Operation and maintenance data.

E. COORDINATION
   (1) Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

F. WARRANTY
   (1) Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
      a. Warranty Period: Six years from date of Substantial Completion.

2. PRODUCTS

A. PERFORMANCE REQUIREMENTS
   (1) NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
   (2) Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
B. PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

(1) Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.


b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   i. Amerex Corporation
   ii. Ansul Incorporated
   iii. Guardian Fire Equipment, Inc.
   iv. JL Industries, Inc.
   v. Larsens Manufacturing Company
   vi. Potter Roemer LLC.

c. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

(2) Multipurpose Dry-Chemical Type: UL-rated nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

3. EXECUTION

A. INSTALLATION

(1) Examine fire extinguishers for proper charging and tagging.

a. Remove and replace damaged, defective, or undercharged fire extinguishers.

(2) Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

a. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.

(3) Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION
DIVISION 12 – FURNISHINGS

122113 – HORIZONTAL LOUVER BLINDS

1. GENERAL:

   A. Scope: Furnish and install blinds at all window locations shown on the drawings. All components of these blinds shall be as outlined in the following specifications.

2. MATERIALS:

   A. Horizontal Blinds:

      (1) 1" audio visual aluminum blinds as manufactured by Levelor, Inc., Bali, Hunter Douglas or approved equal.

      (2) Colors shall be selected by Architect.

      (3) Component Specifications:

         a. Aluminum Slats:

            1) The slats shall be first-quality 5000 series aluminum alloyed to ensure maximum resistance against corrosion. The slats shall be .085" thick before coating and 1" wide plus .003 or minus .000". For installations on walls, the slats shall overlap the window opening by ± 2" on each side. Field verify conditions.

         b. Cords:

            1) The lift cord shall be braided nylon cord approximately .141" diameter and shall have a tensile strength of 225 lbs. or more before breaking. Ends of the cords shall be sealed to prevent raveling.

         c. Head and Bottom Rail:

            1) The head rail and the bottom bar shall be roll formed from steel at least .125" thick. The cord lock shall have a cord separator. The design of the bottom bar and its tape attachments shall ensure full closure of light gap at the sill.
and between the slats above. The length of the blind shall be sufficient to let the bottom rail rest flat on the sill when the slats are fully closed.

3. INSTALLATION:

A. Brackets for head rail shall be installed with not less than two (2) screws in each bracket.

B. Install in strict accordance with manufacturer’s recommendations.

C. All operation cords required shall be the proper length to operate the blinds.

D. Blinds shall be installed so that there is no interference with window hardware. Provide all brackets as required.

END OF SECTION
1. GENERAL

A. RELATED WORK

(1) General Conditions
(2) Special Conditions
(3) Supplementary General Conditions
(4) Architectural, Structural, Civil, Electrical and Mechanical Drawings & Specifications

B. SCOPE OF WORK

(1) The work covered by the Specifications shall include the furnishing of all materials, labor, transportation, tools, permits, fees, inspections, utilities and incidentals necessary for the complete installation of all mechanical and plumbing work required in the Contract Drawings.

(2) It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction is required for work indicated or specified in this Section or work specified in other sections, it shall be the responsibility of the Contractor to provide all material and equipment which is usually furnished with such systems in order to complete the installation, whether mentioned or not.

(3) The Contractor shall visit the premises and thoroughly familiarize himself with all the details of the work and working conditions and to verify all dimensions in the field. The Contractor shall advise the Architect of any discrepancy prior to bidding. The submission of bids shall be deemed evidence of the Contractor's site visit, the coordination of all existing conditions, and the inclusion of all considerations for existing conditions.

C. PLANS AND SPECIFICATIONS

(1) These Specifications are accompanied by drawings of the building and details of the installations indicating the locations of equipment, piping, ductwork, outlets, etc. The drawings and these specifications are complementary to each other, and what is required by one shall be as binding as if required by both.
(2) If departures from the drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Architect for review. No departures shall be made without prior written acceptance of the Architect.

(3) The interrelation of the specifications, the drawings, and the schedules is generally as follows: The specifications determine the nature and setting of the materials, the drawings establish the quantities, dimensions, and details, and the schedules give the performance characteristics.

(4) Should the drawings disagree in themselves or with the specifications, the contractor shall immediately notify the architect and shall perform and/or furnish the better quality or greater quantity of work or materials unless otherwise directed by the architect in writing. In case the specifications should not fully agree with the schedules, the latter shall govern. Figures indicated on drawings govern scale measurements and large scale details govern small scale drawings. In case of disagreement between specifications and drawings, see Division I of these specifications for clarifications.

(5) Items specifically mentioned in the specifications but not shown on the drawings and/or items shown on the drawings but not specifically mentioned in the specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

D. QUALITY ASSURANCE

(1) All work shall comply with the applicable rules of the following:

a. 2018 International Building Code
b. 2018 International Mechanical Code
c. 2018 International Plumbing Code
d. 2018 International Fire Code
e. 2018 International Energy Conservation Code
f. National Fire Protection Association Codes
g. State Fire Marshall
h. All applicable city, county, state, and federal rules, codes, and ordinances.

(2) In any instance where these specifications call for materials for construction of a better quality or larger size than required by the
codes, the provisions of these specifications shall take precedence. None of the terms or provisions of this specification shall be construed as waiving any rules, regulations, or requirements of these authorities. The codes shall govern in case of direct conflict between the codes and the Drawings.

E. SUPERVISION

(1) A competent foreman or superintendent, initially approved by the Architect, shall be assigned to the project to receive instructions and to act for the Contractor. Once this superintendent has been approved, no change shall be made without approval of the Architect. Architect's authorized representative and/or owner's observer shall have the right to observe the work at any time. The Contractor shall have a representative present when his work is being observed, and he shall give assistance, as may be required, to the Architect's representative. Recommendations made by the observer shall be promptly carried out, and all unsatisfactory material and/or workmanship shall be replaced at once, to the satisfaction of the Architect.

F. GUARANTEE

(1) The Contractor shall guarantee all materials and workmanship for a period of two (2) years after the final acceptance of work.

G. UTILITIES

(1) The contract documents reflect the general location, size, and elevations of sewer line, location, size and pressure of water and other lines and manner of routing for all utilities known to be required on this project. It shall be the responsibility of the Contractor to visit the site, meet with the local utility companies in order to coordinate and confirm the exact requirements for each utility to provide a complete and operative system. The bid submitted by the Contractor shall include costs for all such utility company charges and/or fees.

H. BUILDING CONSTRUCTION AND LAYOUT OF WORK

(1) It shall be the responsibility of the Contractor to consult the architectural and engineering drawings and details so as to thoroughly familiarize himself with the type and quality of construction to be provided on this project.

(2) The Drawings are diagrammatic in character and cannot show every connection in detail or every pipe and duct in its exact location.
These details are subject to the requirements of ordinances and also structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases or above suspended ceilings, etc., in finished portions of the building, unless specifically noted or indicated to be exposed. Work shall be installed to avoid crippling of structural members; therefore, inserts to accommodate hangers shall be set before concrete is poured, and proper openings through floor, walls, beams, etc., shall be provided as hereinafter specified or as otherwise indicated or required before concrete is poured. All work shall be run parallel or perpendicular to the lines of the building unless otherwise noted.

(3) The approximate location of each item is indicated on the drawings. These drawings are not intended to give complete and exact details in regard to location. Exact locations are to be determined by actual measurements at the building and will in all cases be subject to the approval of the Architect, and he reserves the right to make any reasonable changes in the locations indicated without additional cost.

I. SHOP DRAWINGS AND BROCHURES

(1) After the Contract is awarded, but prior to proceeding with the Work, the Contractor shall obtain, check, certify, and submit complete Shop Drawings and Brochures from Manufacturers, Suppliers, Vendors, etc., for all materials and equipment specified herein. Submit Shop Drawings and Brochures in sufficient time so as not to impede the progress of work. At least two weeks will be required for the processing of Shop Drawings and Brochures in the Engineer's office, exclusive of transmittal time. This time shall be considered by the Contractor when scheduling submittal data.

(2) The Engineer's review of Shop Drawings and Brochures shall not relieve the Contractor of the responsibility for dimensions, errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the Engineer's noting some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the submittal data review.

(3) Each Shop Drawing shall indicate in the lower right hand corner and each Brochure shall indicate on the front cover the following: the Title
of the Sheet or Brochure; name and location of the building; names of the Architect, Engineer, Contractor, Manufacturer, Supplier, Vendor, etc., the date of submittal; and the date of each correction and revision. So far as is practical, each Shop Drawing and/or Brochure shall bear a cross-reference note to the sheet number or numbers of the Contract Drawings and/or Specifications showing the same work. Shop Drawings and Brochures shall be prepared as follows:

a. Shop Drawings: Drawings shall be drawn to a scale that can be easily read and shall contain sufficient plans, elevations, sections, and isometrics to describe clearly the items in question. Drawings shall be prepared by skilled technicians experienced in this type of work. All piping, equipment layouts, ductwork and similar Shop Drawings shall be drawn to at least $\frac{1}{4}" = 1'0"$ scale.

b. Brochures: Brochures shall be published by the Manufacturers and shall contain complete and detailed engineering and dimensional information to show that the equipment will fit into the allotted space. Brochures not compiled in the manner described below shall be returned for resubmittal.

c. Brochures submitted shall contain only information which is relevant to the particular equipment or materials to be furnished. Do not submit catalogs that describe several different items other than those items to be used unless all irrelevant information is marked out or relevant information is clearly marked.

(4) The submittal format shall follow the Specifications format with a submittal required for each section of Division 21. Each major category of equipment such as fans or pumps or air devices being submitted under a separate cover letter. The first submittal shall be accompanied by a three-ring hard back binder for the A/E to use in retaining copies of the submittals. Copies of each submittal shall be three-hole punched and arranged (or folded if required) for the A/E's filing convenience. Provide one copy of updated TABLE OF CONTENTS and progressive-tabbed manila index sheets also for the A/E's filing convenience.

(5) Submit Shop Drawings and Brochures for review and approval in accordance with the Division 1 – General Requirements.

(6) Minimum size of submittal data shall be 8-1/2" x 11".
(7) Any submittal that is disapproved must be resubmitted within two (2) weeks following notification of such disapproval. If no satisfactory material is submitted within the two-week period, the Architect reserved the right to require the Contractor to furnish items exactly as described in the Contract Documents.

(8) No allowances will be made for submittals which are not made in a timely fashion or which are turned down because they are not equal. Should delivery problems arise due to the above, affecting the completion time of the project, the Contractor will furnish and install acceptable alternates until the proper materials arrive and then replace the alternate materials with the approved materials, all at no cost to the Owner. If the Contractor is not able to furnish an acceptable alternate until the proper materials arrive, he will assume all costs for furnishing and installing all alternates as directed by the Architect and/or will pay a suitable penalty for the inconvenience experienced by the Owner. This penalty will be set by the Architect based on the particular circumstances.

J. SUBSTITUTIONS

(1) The listing of product manufacturers, catalog numbers, etc., in the various sections of the specifications is intended to establish a standard of quality only, and is not intended to preclude open, competitive bidding. The Contractor may at his option submit substitute materials or methods which he feels are equal or superior to those specified. If the Contractor does submit alternate materials or methods, it shall be understood that the Contractor:

a. Has personally investigated the proposed substitute product and determined that it has all the same accessories and is equal or superior in all respects to the item specified.

b. Will provide the same guarantee for the substitution that he would for that specified.

c. Has coordinated the installation of the equipment which he proposes to substitute with all other trades especially in regard to electrical requirements and to operating weights trades and includes the costs for any changes required for the work to be complete in all respects. The Contractor will prepare shop drawings where required by the Architect or where dimensions vary.

d. Waives any and all claims for additional costs related to the substitution.
K. SPARE PARTS DATA

(1) As soon as practicable after approval of materials and equipment, and, if possible, not later that one months prior to the date of beneficial occupancy, the Contractor shall furnish spare parts data for each different item of equipment listed. The data shall include a complete list of parts and supplies, with current unit prices and sources of supply; a list of parts and supplies that are either normally furnished at no extra cost with the purchase of the equipment or specified hereinafter to be furnished as part of the contract. The foregoing shall not relieve the Contractor of any responsibilities under the guarantee specified.

L. RECORD DRAWINGS

(1) The Contractor shall keep a set of Drawings of the job, noting daily all changes made in the Drawings in connection with the final installation including exact dimensioned locations of all new and uncovered existing active and inactive utilities outside the building and shall turn over a clean, neatly marked set of sepia reproducible Drawings showing "as-built" work to the A/E for delivery to the Owner. All underground utilities and services and systems shall be accurately located by the Contractor and dimensioned on the "as-built" Drawings.

M. OPERATING AND MAINTENANCE MANUAL

(1) Prepare and submit to the Architect for delivery to the Owner an indexed manual with complete technical data for every piece of equipment and material installed under this contract.

a. Complete fire suppression submittals as approved by Architect.

b. Manufacturer's installation instruction brochures.

c. Manufacturer's local representative and/or Distributor's name, address and phone number.

d. Manufacturer's operating and maintenance brochures.

(2) This manual shall include all of the listed data bound into a permanent hard-back binder identified on the cover as "Operating and Maintenance Manual" with additional cover display of the names and location of the Building, the Owner, the Architect, the Engineers, the General Contractor, and the Sub-Contractors installing equipment represented in the brochure.
(3) Contents of the Manual shall be grouped in sections according to the various sections of Division 21 and shall be listed in a Table of Contents.

2. PRODUCTS

A. STANDARDS FOR MATERIALS

(1) All materials, in general, shall conform to the requirements of all agencies of publications hereinbefore specified under the paragraph QUALITY ASSURANCE and shall be listed, inspected, and approved by the Underwriters Laboratories and shall bear the U.L. label where labeling service is available. The label or listing of the Underwriters Laboratories, Inc. will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this listing, the Contractor may submit a statement from a nationally recognized testing agency indicating that the items have been tested in accordance with required procedures, and that the materials and equipment comply with all contract requirements.

B. STANDARD PRODUCTS

(1) Materials and equipment to be provided shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications, and shall essentially duplicate materials and equipment that have been in satisfactory use at least two years.

C. MANUFACTURERS INSTRUCTIONS

(1) The responsibility for the furnishing of the proper equipment and/or material and the responsibility for seeing that it is installed as intended by the manufacturer, rests entirely upon the Contractor. If needed for proper installation, operation, or startup, the Contractor shall request advice and supervisory assistance from the representative of the specific manufacturer. The manufacturers' published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufactured materials or equipment, unless otherwise indicated. The Contractor shall promptly notify the Architect in writing of any conflict between the requirements of the contract documents and the manufacturers' directions and shall obtain the Architect's instructions before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturers' directions or such
instructions from the Architect, he shall bear all costs arising in connection with the deficiencies.

D. RUST PREVENTION

(1) All metallic materials shall be protected against corrosion. Exposed metallic parts of outdoor apparatus made of ferrous metals but not of corrosion-resistant steel, shall be zinc-coated in accordance with ASTM A123 or A153, except where other equivalent protective treatment is specifically approved in writing.

E. STORAGE ON SITE

(1) The Contractor shall not receive material or equipment at the job site until ready for installation or until there is a suitable space provided to properly protect equipment from rust, weather, humidity, dust, or physical damage.

F. CAPACITIES

(1) Capacities shall be not less than those indicated and shall be such that no component or system becomes inoperative or is damaged because of startup or other overload conditions.

G. NAMEPLATES

(1) Each major component of equipment shall have the manufacturer's name, address, and catalog number on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of final inspection.

H. CONDITION OF MATERIAL AND APPURTENANCES

(1) All pipe, fittings, appurtenances, and other material required for complete installation of these systems shall be new to conform to manufacturer's recommendations, unless otherwise specified. All equipment injured or damaged in transit from factory, during delivery to premises, while in storage on premises, while being erected and installed, and while being tested, until time of substantial completion, shall be replaced by the Contractor without extra cost to Owner.

3. EXECUTION

A. INSTALLATION OF SYSTEMS
(1) Provide and install unions at proper points to permit removal of pipe and various equipment items without injury to other parts of system. No union will be required in welded lines or lines assembled with solder joint fittings, except at equipment items, and other special pieces or apparatus. Companion flanges on lines at various items of equipment, machines and pieces of apparatus, shall serve as unions to permit removal of the particular items. Unions connecting ferrous pipe to copper or brass pipe shall be dielectric type.

B. SPACE AND EQUIPMENT ARRANGEMENT

(1) All equipment shall be installed in a manner to permit access to parts requiring service without disassembly of other equipment.

(2) Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through stairways, doorways, or shafts shall be brought to the job and placed in the space before the enclosing structure is completed. Following placement in the space, such apparatus shall be thoroughly protected against damage.

C. PRECEDENCE OF WORK

(1) This contract includes many different systems furnished and installed by different trades. Each trade shall coordinate their work with that of all other trades so that it may be installed in the most direct and workmanlike manner without hindering or handicapping any other trades.

D. EXCAVATION AND BACKFILL

(1) The Contractor shall perform all excavation of every description required in the execution of his work. Excavation shall be through whatever substance encountered, to the depths indicated on the drawings, or as required. Excavated material suitable for backfill shall be piled in an orderly manner a sufficient distance from the trench to prevent overloading sides and causing cave-ins. Excavated materials not suitable for backfill shall be removed or stored as directed. Such grading shall be done as is necessary to protect the excavation from surface water. Trenches shall be maintained in a dry condition by bailing, pumping, or other approved methods. Pipe shall not be laid in wet trenches. Sheeting and shoring shall be provided as required for the protection of the work and the safety of personnel.

(2) Trenches shall be of the necessary width and depth to provide for proper laying of pipe and appurtenances, with banks as nearly
vertical as possible. Bottoms of trenches shall be excavated to the grade and depth indicated or required, and barrel of pipe shall be laid on firm and undisturbed soil. Bell holes, of a size to permit proper grading, shall be provided as required. Over-depth excavations shall be backfilled to proper level with sand. When rock or other soil not suitable for bedding the pipe is encountered, it shall be removed to a depth of not less than 1' below grade, and backfilled with sand to grade, to provide a suitable bed for pipe. Existing underground piping shall be protected from damage during excavation and backfilling, and if damaged, shall be repaired to the Architect's satisfaction, at the Contractor's expense.

(3) Trenches shall not be backfilled until all required tests have been performed. This requirement does not preclude sectional testing and backfilling of the various systems. Trenches shall be carefully backfilled with a minimum 6" sand cover over piping then backfilled with material (free from large earth clods, rocks, and/or foreign materials), laid in 6" layers, compacted to 90 percent of maximum dry density as determined by ASTM D698 (compaction shall be to 95 percent below structures, including sidewalks and roadways).

(4) Open trenches abutting foundation or basement excavations, building walls, and grade beams, will not be permitted, but shall be backfilled and completed, for as distance of not less than 10' from the above features, as soon as possible. All damage resulting from flooding due to open trenches shall be paid for by the Contractor.

(5) Where excavation requires, existing walks, street, drives, or other existing pavement shall be cut to install new lines and to make new connections to existing lines. The size of the cut shall be held to a minimum, consistent with the work to be accomplished. After the installation of the new materials is completed and the excavation has been backfilled, the paving shall be patched, using materials to match those cut out. The patches shall be thoroughly bound with the original surfaces, and shall be level with them.

E. CUTTING AND PATCHING

(1) Where it becomes necessary to cut through any wall, floor, or ceiling to permit installation of any work under this section of the specifications or to repair any defects that may appear, up to the expiration of the guarantee period, such cutting shall be done under the observation of the Architect by the Contractor. The Contractor shall not be permitted to cut or modify any structural members without the written direction of the Architect.
(2) Patching of all openings cut by the Contractor, or repairing of any damage to the work of other trades occasioned by the cutting operations, or occasioned by the failure of any part of work installed under this contract, shall be performed by the trade whose work is involved, but shall be paid for by the Contractor.

(3) Any openings cut through exterior walls or roofs shall be provided with suitable covers, while they are left open, to protect the property or materials involved. Any openings cut through walls below grade shall be properly protected to prevent entrance of water or other damaging elements.

F. HOISTING, SCAFFOLDING, AND TRANSPORTATION

(1) The Contractor shall provide his own hoisting facilities to set his materials and equipment in place in the building, as indicated on drawings and for subsequent cleaning, testing, and adjusting.

(2) The Contractor shall provide necessary transportation to facilitate the delivery of all materials, equipment, tools, and labor to the job, in accordance with intent of these documents.

G. CLEANING

(1) The Contractor shall, at all times, keep the premises free from accumulations of waste material or rubbish caused by him, his employees, or his work. This debris shall be removed, not only from the building, but also from the project site.

(2) At completion of the job, the Contractor shall remove all of his tools, scaffolding, and surplus materials. He shall leave the area "broom clean."

H. ELECTRICAL WIRING OF MOTORS AND EQUIPMENT

(1) Unless specifically shown, indicated, or specified to the contrary, each item shown or required by the Mechanical Drawings or specified in the Mechanical Specifications shall be accompanied by all motors and starting and controlling equipment necessary for the items' proper operations. These motors shall be integrally attached to and/or installed with their associated equipment item and electrically connected as specified in Electrical Specifications. Equipment controlled from motor control centers shall be supplied with motors only. Motor control centers are specified in the Electrical Specifications and shown on the Electrical Drawings.
210523 - VALVES FOR FIRE SUPPRESSION

1. GENERAL

   A WORK INCLUDED

   (1) Ball Valves
   (2) Check Valves
   (3) Butterfly Valves

   B RELATED WORK

   (1) Section 210500 – Common Work Results For Fire Suppression
   (2) Section 211313 - Wet Pipe Sprinkler Systems

   C SHOP DRAWINGS

   (1) Submit product data in accordance with Section 210500 Common Work results For Fire Suppression.

2. PRODUCTS

   A ACCEPTABLE MANUFACTURERS

   (1) Valves as manufactured by KITZ, Nibco, Crane, Apollo, Watts or approved equal are acceptable provided they meet or exceed these specifications.
   (2) Provide valve types of same manufacturer throughout where possible.
   (3) Provide valves with manufacturer's name and pressure rating clearly marked on outside of body.
   (4) Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by installer to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube and equipment connections. Where more than one type is indicated, selection is Installer's option. Valves shall be of same make for all these services.
B  VALVE CONNECTIONS

(1) Provide valves suitable for connection to adjoining piping as specified for pipe joints. Use pipe size valves unless otherwise indicated.

(2) Provide threaded valves for pipe sizes 2 inches and smaller.

(3) Provide flanged valves for pipe sizes 2 1/2 inches and larger.

(4) Solder or screw to solder adaptors for copper tubing.

(5) Use valve body suitable for mechanical coupling jointed piping.

(6) Provide butterfly valves with full tapped lug bodies.

C  BALL VALVES

(1) Select with full port opening, blow out proof stem, hard chrome plated forged brass vented ball, adjustable packaging nut, rated not less than 600# W.O.G., 150 W.S.P.

(2) Comply with the following standards:

Ball Valves:    MSS SP - 110

(3) Threaded ends 3" and smaller: 600# W.O.G., 150 W.S.P., bronze two piece body, hard chrome plated full port forged brass ball, true adjustable packing nut, blow-out proof stem: Kitz #68, Nibco T-585-70, Apollo 77-100 Series, Watts B-6080 or equal.

(4) Solder ends 3" and smaller: 600# W.O.G., 150 W.S.P., bronze two piece body, hard chrome plated full port forged brass ball, true adjustable packing nut, blow-out proof stem: Kitz #68, Nibco T-585-70, Apollo 77-200 Series, Watts B-6081 or equal.

D  BUTTERFLY VALVES

(1) Where butterfly valves are used as shut-off for termination, or equipment removal or repair, select ductile iron lug type valves, bi-directional, dead-end service rated to the full working pressure of the valve. Provide gear operators on butterfly valves 8" and larger. Valve bodies to have extended necks to provide for 2-1/2" insulation as needed. Butterfly valves 12 inch and smaller rated to 200 psi, 14 inch and larger to 150 psi.

(2) Comply with the following standards:
Butterfly Valves: MSS SP - 67

(3) Lug type 2" and larger: Ductile iron body, lever operated, 10-position throttling handle 2-6 inch, 8 inch and larger gear operated, bronze disc, type 400 Series stainless steel stem, EPDM seat. Butterfly valves 12 inch and smaller rated to 200 psi, 14 inch and larger 150 psi.

(4) Manufacturer subject to compliance with requirements, provide butterfly valves with one of the following: Kitz #6122E (Lug type), Milwaukee, ML233E (Lug), Nibco LD2000 (Lug) or equal.

E CHECK VALVES

(1) Comply with the following standards for design, workmanship, material and testing:

Bronze Valves: MSS SP - 80
Cast Iron Valves: MSS SP - 71

(2) Construct valves of pressure casting free of any impregnating materials

(3) Threaded ends 2" and smaller: Class 125, bronze body, screwed cap, "Y" pattern swing, Teflon disc: Kitz #22T, Nibco T-413Y, Crane 141 or equal.

(4) Soldered ends 2" and smaller: Class 125, bronze body, screwed cap, "Y" pattern swing, Teflon disc: Kitz #23T, Nibco T-433Y, Crane 37 or equal.

(5) Flanged ends 2-1/2" and larger: Class 125, iron body, bronze mounted, horizontal swing, cast-iron disc: Kitz #78, Nibco F918-B, Crane 373 or equal.

F VALVE FEATURES

(1) Provide valves with features indicated and where not otherwise indicated, provide proper valve features as outlined in this specification. Comply with ANSI B31.1.

(2) Flanged valve ends comply with ANSI B16.1 (cast iron), ANSI B16.24 (bronze).

(3) Threaded valve ends comply with ANSI B2.1.
(4) Solder Joint valve ends complying with ANSI B16.18.

(5) Fabricate pressure-containing components of valves, including stems and seats from brass or bronze materials; of standard alloy recognized in valve manufacturing that resist de-zincification.

(6) Butterfly valve designed for flow regulation and manufactured to be tight in closed position. Test pressures in accordance with MSS SP-67 as follows: Seat 2-12” 220 psi. No leakage permitted under test.

G VALVE OPERATORS

(1) Provide suitable handwheels for gate, globe and butterfly valves.

3. EXECUTION

A INSTALLATION

(1) Install valves with stems upright or horizontal, not inverted.

(2) Install ball valves for shut-off and isolating service, to isolate equipment, part of systems, or vertical risers.

(3) Install check valves in horizontal position with pin horizontally perpendicular to center line of pipe. Install for proper direction of flow. Installations on any vertical piping must be up flow only.

(4) Use U.L. approved butterfly valves in fire protection systems.

(5) All valves shall be located so that the bonnets can be removed.

(6) Where valves are installed concealed in pipe chases provide Zurn Z-1460-4 or approved equal access doors with concealed hinge and key operated locks. Door shall be large enough to service valves and shall be installed flush with finished walls.

(7) Provide brass tag for each valve labeling the fluid in the pipe, the area served, and the normal operating position.

END OF SECTION
210529 -SUPPORTS, ANCHORS AND SLEEVES FOR FIRE SUPPRESSION

1. GENERAL

A. WORK INCLUDED

(1) Pipe Hangers and Supports

B. RELATED WORK

(1) Section 210500 – Common Work Results For Fire Suppression
(2) Section 211313 - Wet Pipe Sprinkler System

C. SUBMITTALS

(1) Submit shop drawings in accordance with Section 210500 Common Work Results For Fire Suppression.

D. REFERENCES


2. PRODUCTS

A. ACCEPTABLE MANUFACTURERS

(1) Products shall be as manufactured by Grinnell, Elcen, Fee and Mason, Unistrut or approved equal.

B. PIPE HANGERS AND SUPPORTS

(1) Hangers: Pipe sizes 1/2 inch to 1-1/2 inch: adjustable wrought steel ring.
(2) Hangers: Pipe sizes 2 inches to 4 inches: adjustable wrought steel clevis.
(3) Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
(4) Vertical Support: Steel riser clamp.
(5) Steel Beam Clamps: Elcen Figure 33, Type 3 or approved equal.
(6) Expansion Anchors: Phillips Red Head or approved equal.

(7) Design hangers to impede disengagement by movement of supported pipe.

C. HANGER RODS

(1) Provide cadmium plated steel hanger rods, threaded both ends, threaded one end, or continuous threaded.

D. SLEEVES

(1) Pipes through Walls, Fire Proofing, Footings, Potentially Wet Floor: Form with schedule 40 PVC pipe for all non-rated areas. Use black steel pipe for rated areas.

(2) Size large enough to allow for movement due to expansion and to provide for continuous installation.

3. EXECUTION

A. PIPE HANGERS AND SUPPORTS

(1) All structures and appurtenances employed for the purpose of supporting the pipe and guiding it properly shall be carefully fabricated in such a manner as to preserve the true grade of the pipe without subjecting either the pipe or the supporting and guidance members to any undue strain.

(2) Support horizontal piping as follows:

(3) Space hangers and furnish rods as follows:

<table>
<thead>
<tr>
<th>Nominal Pipe Size (in.)</th>
<th>Span (ft.) Steel</th>
<th>Hanger Rod Diameter (in.)</th>
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<tr>
<td>1/2</td>
<td>5 5</td>
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</tbody>
</table>
(4) Install hangers to provide minimum 1/2 inch clear space between finished covering and adjacent work.

(5) Place a hanger within one foot of each horizontal elbow.

(6) Use hangers which are vertically adjustable 1-1/2 inch maximum after piping is erected.

(7) Support piping at each change or direction, at ends of branches, at base and top of riser pipes and drops, and wherever necessary to prevent sag, bending or vibration, in addition to above-listed hanger spacing.

B. PRIMING

(1) Prime coat non-galvanized steel hangers and supports.

C. SLEEVES

(1) Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.

(2) Extend sleeves through potentially wet floors 1 inch above finished floor level. Caulk sleeves full depth and provide floor plate.

(3) Where piping passes through floor, ceiling or wall close off space between pipe or duct and construction with non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.

(4) Install chrome plated escutcheons where piping passes through finished surfaces.

(5) Provide pipe sleeves for all piping.

(6) Size pipe sleeves to permit placing pipe.

(7) Sleeves for pipes through floor slabs shall be schedule 40 PVC pipe or black steel pipe.

(8) Sleeves for pipe through walls shall be schedule 40 PVC pipe or black steel pipe with ends flush with wall surface.

(9) Seal pipes passing through walls or slabs. Use mastic or oakum seal in the annular space in non-fire-rated walls; use Dow-Corning 3-6548 silicone RTV foam firestop sealant or equal in the annular space in fire-rated walls or other envelopes.
(10) Seal exposed pipe passing through floor slabs with Dow-corning 3-6548 silicone RTV foam firestop sealant or equal and point with caulking compound. Strike off flush at top of sleeve.

(11) Sleeves penetrating exterior walls below grade shall be standard weight, black steel pipe with 1/4" thick steel plate secured to the pipe with a continuous fillet weld. The plate shall be located in the middle of the wall and shall be 4" wider all around than the sleeve it encircles. The entire assembly shall be hot dipped galvanized after fabrication. The pipe passing through the sleeve shall be centered within the sleeve and the annulus opening sealed with "Link Seal" casing seals manufactured by Thunderline Corporation, Wayne, Michigan. Series 300 for pipe sizes 1/2" through 10" and series 400 or 500 for larger pipe sizes or equal.

(12) All piping shall be installed with due regard to expansion and contraction. Type of hanger, methods of support, location of supports, etc., shall be governed in part by this consideration.

END OF SECTION
211313 - WET PIPE SPRINKLER SYSTEMS

1. GENERAL

   A. RELATED DOCUMENTS

      (1) All work performed under this Section of the Specifications shall be in strict accordance with the provisions of the General Conditions and Requirements, and Section 210500 Common Work Results For Fire Suppression.

   B. WORK INCLUDED

      (1) The design and installation of a complete wet pipe automatic sprinkler system including fire riser, exterior and interior water piping, sprinkler heads, valves, hangers and supports, sleeves, Fire Department connections and accessories.

      (2) Verification of all design criteria stated within these documents (including but not limited to Hazard Occupancy Classification, Design Density and Availability of Water) prior to bidding. If a conflict is found between the stated design criteria and any governing agency, the contractor shall notify the Architect prior to bidding.

   C. RELATED WORK

      (1) Section 210500 – Common Work Results For Fire Suppression

      (2) Section 210523 – Valves For Fire Suppression

      (3) Section 210529 – Supports, Anchors and Sleeves For Fire Suppression

   D. REFERENCE STANDARDS

      (1) NFPA No. 13: Sprinkler Systems

      (2) NFPA No. 24: Fire Department Connections

      (3) Local Fire Code and State Fire Marshal Requirements

   E. QUALITY ASSURANCE

      (1) Sprinkler equipment, design and installation shall meet the requirements, recommendations of the local authority having jurisdiction and the Owner's Insurance Underwriters.
(2) The design, equipment furnished and installation shall meet the requirements of NFPA No. 13, "Standard for the Installation of Sprinkler Systems."

(3) Systems shall be tested in accordance with NFPA-13. Test shall be witnessed by Architect and approved in writing prior to activation.

(4) The system shall be designed and installed by a firm regularly engaged in the design and installation of automatic fire protection systems, in accordance with the requirements of the National Fire Protection Association, or by an authorized Agent of such firm. Evidence to support the above requirements may be requested, and any proposed installer who cannot show suitable experience will be rejected.

(5) Standard Products: Materials and equipment shall be standard products of the manufacturer's latest design, and suitable to perform the functions intended. The name of the manufacturer, and the serial numbers, shall appear on all major components and shall bear the UL or FM label or marking. Equipment added to an existing system shall function in the same manner as similar components of the existing system.

(6) Conformance to Agency Standards: Submit evidence of conformance of the entire system to the requirements of NFPA 13 standards, and of the Arizona State Fire Marshal and the Authorities having Jurisdiction. Required changes to meet code, insurance or jurisdictional authority requirements are to be made by the sprinkler contractor at no additional cost to the Owner.

F. SUBMITTALS

(1) Submit shop drawings in accordance with Section 210500.

(2) Fire sprinkler system shop drawings shall be submitted to the Architect prior to any submittals to any AHJ. The Architect's comments shall be incorporated into revised plans as required, shall be revised and resubmitted to the Architect for verification of compliance with design intent, and after Architect approval shall be submitted to the AHJ. If the AHJ makes revisions, the plans shall again be submitted to the Architect for review prior to re-submittal to the AHJ. No installation shall proceed without plans approved by both the Architect and the AHJ.
(3) The shop drawings shall include detailed plans of sprinkler systems, calculations, sections and plot plan indicating the locations of underground supply connections, control valves, fire department connections, and other equipment to be used. Submit manufacturer's data on materials and equipment.

G. SYSTEM DESCRIPTION

(1) System shall provide full coverage for all of the buildings.

(2) Provide a complete hydraulically designed system to meet NFPA 13 standards and occupancy requirements and hazard classifications as indicated on the drawings. Contractor shall be responsible for pressure and flow verification with the jurisdiction having authority prior to final design and system installation.

(3) The location of equipment and piping mains shall conform as closely as possible to that shown on the plans. Contractor is advised, however, that the information shown on the plans is intended to indicate the general intent and scope of the project for bidding purposes only. Contractor shall use the drawings for reference only during bidding, and shall be fully responsible for the actual final arrangement of piping, head locations, and spacing and other system details as required to conform to the requirements of authorities having jurisdiction. Required changes to meet code, insurance, or jurisdictional authority requirements are to be made by the Sprinkler Contractor at no additional cost to the Owner.

2. PART 2 PRODUCTS

A. ACCEPTABLE MANUFACTURERS

(1) Products manufactured by Automatic Sprinkler, ITT Grinnell, Viking, Central or approved equal meeting these specifications are acceptable.

(2) All materials and equipment used in the installation of the fire protection system shall be listed as approved by the underwriters Laboratories, Inc., list of inspected Fire Protection Equipment and Materials, and the Factory Mutual Testing Laboratories list of approved equipment. Fire protection devices and devices involving fire hazard shall be the latest design of the manufacturer.

B. SPRINKLER PIPING AND PIPE FITTINGS

(1) Piping Systems:
a. **Exterior Water Pipe within 5'-0'**: Pipe shall be as shown on detail on the drawings. Refer to the Civil plans and specifications for piping outside of 5'-0" from building.

b. **Interior Water Pipe**: Piping, fitting, valves, and installation shall be as specified in NFPA 13.

C. **SPRINKLER HEADS**

   (1) Unless otherwise specified or indicated on the drawings, sprinkler heads shall be regular automatic closed-type except that sprinkler heads to be installed in the vicinity of heating equipment and lights, shall be of the temperature rating required for such locations by National Fire Protection Association Standard No. 13.

   (2) In finished or suspended ceiling areas, provide recessed type sprinklers to Gem Model FR948 with chrome plated finish and white escutcheon.

   (3) In the Mechanical rooms, or exposed areas, provide upright sprinklers equal to Gem Model F950 in bronze finish.

   (4) For sidewall application, provide sidewall sprinklers equal to Gem F950/Q46 type with chrome plated finish and escutcheon.

D. **VALVES**

   (1) Provide ball valves, butterfly valves and check valves in accordance with Section 210523.

   (2) The fire riser shall have a main indicating butterfly valve for shut off control in accordance with Section 210523.

E. **ALARM DEVICES**

   (1) Riser water flow indicator switch shall be U.L. listed. Potter Model VSR-A or approved equal. Flow switch shall have two sets of contacts.

   (2) Sprinkler system control valves, riser butterfly valve indicator, and other valves required by NFPA- 13 or the local authority shall be furnished with a tamper switch. Tamper switch shall have two sets of contacts.
(3) Furnish and install a 6” electric alarm equal to Central Sprinkler Corp.

F. SIAMESE FIRE DEPARTMENT CONNECTION

(1) Provide two-way standard siamese fire department connection with chrome plated finish and local Fire Department thread. Fire Department Connection shall be marked “Automatic Sprinkler -Fire Department Connection”. Fire Department Connection shall be provided with Knox caps. Contact Golder Ranch Fire Department for specific model and approval.

3. EXECUTION

A. PREPARATION

(1) Coordinate the work of this Section with other affected work. This installation shall not cause interference with that of other trades.

(2) All openings for piping should be anticipated and indicated on the approved and accepted shop drawings. Any additional cutting of openings must have the written approval of the Architect/Engineer.

B. INSTALLATION

(1) Locate the fire department connection with sufficient clearance from walls or obstructions to allow full swing of fire department wrench handle.

(2) Place pipe runs to avoid obstruction and interference with other work. Run piping in concealed spaces above finished ceilings. In exposed areas, piping will be kept at a minimum distance from the ceiling.

(3) Piping shall allow for drainage at the riser. Trapped areas, if unavoidable, shall be provided with drains as required by NFPA 13.

(4) Extend discharge of inspectors test valve, alarm valve and drains to curb or other point to avoid discharge across walks or into occupied areas.

(5) Provide signs as required by Code to identify all items.

(6) The fire protection system shall be tied into the building fire alarm system if a fire alarm system is required.
(7) Support sprinkler piping from building structure with hangers and supports in accordance with NFPA Standard No. 13. All hangers shall be spaced per NFPA No. 13. Furnish and install intermediate steel supports as required. Attach hangers or rods to roof structures with devices compatible with the structural types as approved by architect. Weight of piping and valves must be supported in a manner which does not impose eccentric loads on structural elements.

(8) Actual number, spacing and location of heads, size and routes of piping shall be provided in accordance with the applicable Specifications and acceptable Shop Drawings.

(9) All layouts, head spacing, coverage, etc., as may be required by the referenced authorities and/or Architectural and Structural conditions, shall be made without increase in cost to the Owner or the Architect. Pay careful attention to NFPA beam rules in laying out heads. Ducts, conduit bundles and other building items fall under the beam rules.

(10) Heads shall be located in a symmetrical pattern related to ceiling features such as beams, light fixtures, diffusers, etc., and where applicable, heads shall be located symmetrical with the grid ceiling. Heads shall be centered (both directions) in a 2 x 2 ceiling tile or arranged in a manner acceptable to the Architect prior to installation. Heads protruding below escutcheon are not acceptable. Heads shall be semi-recessed. Carefully coordinate with other trades to avoid conflict with ducts, conduit, lights and structural items.

(11) The Contractor shall provide spare heads equal to one percent of the total number of heads installed under the Contract, but not less than 10.

(12) The heads shall be packed in a suitable sprinkler cabinet and shall be representative of, and in proportion to, the number of each type and temperature rating of heads installed.

(13) In addition to the spare heads, the Contractor shall provide not less than one special sprinkler head-wrench for each type of head. The cabinet shall be located where directed by the Architect, or on the wall near sprinkler valve. One per building.

(14) Run piping above furred ceiling and in joists to avoid obstructions. Coordinate with other trades to insure there are no conflicts or interferences.

(15) Protect sprinkler heads in exposed areas against mechanical injury with standard guards.
(16) Locate outside alarms on the wall of the building above the Fire Department connection.

(17) Fire sprinkler subcontractor shall be responsible for defining the required electrical connection to the Fire Alarm Panel with the electrical subcontractor. Electrical subcontractor will perform electrical installation of conduit and wire. Fire sprinkler subcontractor shall be responsible for coordinating work with the electrical subcontractor.

(18) The service line entering the building shall have all joints strapped flange to flange for kickout protection. The building structure shall not be used as a kick block and full clearance through the building wall or floor shall be maintained.

C. ACCEPTANCE AND TESTING

(1) During the fabrication and assembly of all piping, prior to testing and before connection is made to any equipment, the piping shall be blown with dry, oil-free compressed air to clear the pipe of dirt, welding slag and other materials which may be harmful to sprinkler heads and other equipment.

(2) Prior to connecting to the overhead sprinkler piping, the underground main shall be flushed in the presence of the Architect and a representative of the authorities having jurisdiction and meet with their approval.

(3) After completion of the installation, the entire system shall be tested by the contractor for acceptance by the authorities having jurisdiction.

(4) The contractor shall provide and complete all forms required for testing and acceptance of the system. Copies of these documents shall be provided to the authorities having jurisdiction, the owner and the Architect, in accordance with Section 210500 Common Work Results For Fire Suppression.

END OF SECTION
220500 – COMMON WORK RESULTS FOR PLUMBING

1. GENERAL

A. RELATED WORK

   (1) General Conditions

   (2) Special Conditions

   (3) Supplementary General Conditions

   (4) Architectural, Structural, Civil, Electrical and Mechanical Drawings & Specifications

B. SCOPE OF WORK

   (1) The work covered by the Mechanical and Plumbing Sections of the Specifications shall include the furnishing of all materials, labor, transportation, tools, permits, fees, inspections, utilities and incidentals necessary for the complete installation of all mechanical and plumbing work required in the Contract Drawings.

   (2) It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction is required for work indicated or specified in this Section or work specified in other sections, it shall be the responsibility of the Contractor to provide all material and equipment which is usually furnished with such systems in order to complete the installation, whether mentioned or not.

   (3) The Contractor shall visit the premises and thoroughly familiarize himself with all the details of the work and working conditions and to verify all dimensions in the field. The Contractor shall advise the Architect of any discrepancy prior to bidding. The submission of bids shall be deemed evidence of the Contractor's site visit, the coordination of all existing conditions, and the inclusion of all considerations for existing conditions.

C. PLANS AND SPECIFICATIONS

   (1) These Specifications are accompanied by drawings of the building and details of the installations indicating the locations of equipment, piping, ductwork, outlets, etc. The drawings and these specifications are complementary to each other, and what is required by one shall be as binding as if required by both.
(2) If departures from the drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Architect for review. No departures shall be made without prior written acceptance of the Architect.

(3) The interrelation of the specifications, the drawings, and the schedules is generally as follows: The specifications determine the nature and setting of the materials, the drawings establish the quantities, dimensions, and details, and the schedules give the performance characteristics.

(4) Should the drawings disagree in themselves or with the specifications, the contractor shall immediately notify the architect and shall perform and/or furnish the better quality or greater quantity of work or materials unless otherwise directed by the architect in writing. In case the specifications should not fully agree with the schedules, the latter shall govern. Figures indicated on drawings govern scale measurements and large scale details govern small scale drawings. In case of disagreement between specifications and drawings, see Division I of these specifications for clarifications.

(5) Items specifically mentioned in the specifications but not shown on the drawings and/or items shown on the drawings but not specifically mentioned in the specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

D. QUALITY ASSURANCE

(1) All work shall comply with the applicable rules of the following:

   a. 2018 International Building Code

   b. 2018 International Mechanical Code

   c. 2018 International Plumbing Code

   d. 2018 International Fire Code

   e. 2018 International Energy Conservation Code

   f. National Fire Protection Association Codes

   g. State Fire Marshall
h. All applicable city, county, state, and federal rules, codes, and ordinances.

(2) In any instance where these specifications call for materials for construction of a better quality or larger size than required by the codes, the provisions of these specifications shall take precedence. None of the terms or provisions of this specification shall be construed as waiving any rules, regulations, or requirements of these authorities. The codes shall govern in case of direct conflict between the codes and the Drawings.

E. SUPERVISION

(1) A competent foreman or superintendent, initially approved by the Architect, shall be assigned to the project to receive instructions and to act for the Contractor. Once this superintendent has been approved, no change shall be made without approval of the Architect. Architect's authorized representative and/or owner's observer shall have the right to observe the work at any time. The Contractor shall have a representative present when his work is being observed, and he shall give assistance, as may be required, to the Architect's representative. Recommendations made by the observer shall be promptly carried out, and all unsatisfactory material and/or workmanship shall be replaced at once, to the satisfaction of the Architect.

F. GUARANTEE

(1) The Contractor shall guarantee all materials and workmanship for a period of two (2) years after the final acceptance of work.

G. UTILITIES

(1) The contract documents reflect the general location, size, and elevations of sewer line, location, size and pressure of water and other lines and manner of routing for all utilities known to be required on this project. It shall be the responsibility of the Contractor to visit the site, meet with the local utility companies in order to coordinate and confirm the exact requirements for each utility to provide a complete and operative system. The bid submitted by the Contractor shall include costs for all such utility company charges and/or fees.

H. BUILDING CONSTRUCTION AND LAYOUT OF WORK

(1) It shall be the responsibility of the Contractor to consult the architectural and engineering drawings and details so as to
thoroughly familiarize himself with the type and quality of construction to be provided on this project.

(2) The Drawings are diagrammatic in character and cannot show every connection in detail or every pipe and duct in its exact location. These details are subject to the requirements of ordinances and also structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases or above suspended ceilings, etc., in finished portions of the building, unless specifically noted or indicated to be exposed. Work shall be installed to avoid crippling of structural members; therefore, inserts to accommodate hangers shall be set before concrete is poured, and proper openings through floor, walls, beams, etc., shall be provided as hereinafter specified or as otherwise indicated or required before concrete is poured. All work shall be run parallel or perpendicular to the lines of the building unless otherwise noted.

(3) The approximate location of each item is indicated on the drawings. These drawings are not intended to give complete and exact details in regard to location. Exact locations are to be determined by actual measurements at the building and will in all cases be subject to the approval of the Architect, and he reserves the right to make any reasonable changes in the locations indicated without additional cost.

I. SHOP DRAWINGS AND BROCHURES

(1) After the Contract is awarded, but prior to proceeding with the Work, the Contractor shall obtain, check, certify, and submit complete Shop Drawings and Brochures from Manufacturers, Suppliers, Vendors, etc., for all materials and equipment specified herein. Submit Shop Drawings and Brochures in sufficient time so as not to impede the progress of work. At least two weeks will be required for the processing of Shop Drawings and Brochures in the Engineer's office, exclusive of transmittal time. This time shall be considered by the Contractor when scheduling submittal data.

(2) The Engineer's review of Shop Drawings and Brochures shall not relieve the Contractor of the responsibility for dimensions, errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the Engineer's noting some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings, the requirements of the
Contract Documents shall govern and are not waived or superseded in any way by the submittal data review.

(3) Each Shop Drawing shall indicate in the lower right hand corner and each Brochure shall indicate on the front cover the following: the Title of the Sheet or Brochure; name and location of the building; names of the Architect, Engineer, Contractor, Manufacturer, Supplier, Vendor, etc., the date of submittal; and the date of each correction and revision. So far as is practical, each Shop Drawing and/or Brochure shall bear a cross-reference note to the sheet number or numbers of the Contract Drawings and/or Specifications showing the same work. Shop Drawings and Brochures shall be prepared as follows:

a. Shop Drawings: Drawings shall be drawn to a scale that can be easily read and shall contain sufficient plans, elevations, sections, and isometrics to describe clearly the items in question. Drawings shall be prepared by skilled technicians experienced in this type of work. All piping, equipment layouts, ductwork and similar Shop Drawings shall be drawn to at least 1/4” = 1’0” scale.

b. Brochures: Brochures shall be published by the Manufacturers and shall contain complete and detailed engineering and dimensional information to show that the equipment will fit into the allotted space. Brochures not compiled in the manner described below shall be returned for resubmittal.

c. Brochures submitted shall contain only information which is relevant to the particular equipment or materials to be furnished. Do not submit catalogs that describe several different items other than those items to be used unless all irrelevant information is marked out or relevant information is clearly marked.

(4) The submittal format shall follow the Specifications format with a submittal required for each section of Division 22. Each major category of equipment such as plumbing fixtures, pipe, etc. shall be submitted under a separate cover letter. The first submittal shall be accompanied by a three-ring hard back binder for the A/E to use in retaining copies of the submittals. Copies of each submittal shall be three-hole punched and arranged (or folded if required) for the A/E's filing convenience. Provide one copy of updated TABLE OF CONTENTS and progressive-tabbed manila index sheets also for the A/E’s filing convenience.
(5) Submit all Shop Drawings and Brochures for review and approval in accordance with Division 1 – General Requirements.

(6) Minimum size of submittal data shall be 8-1/2” x 11”.

(7) Any submittal that is disapproved must be resubmitted within two (2) weeks following notification of such disapproval. If no satisfactory material is submitted within the two-week period, the Architect reserved the right to require the Contractor to furnish items exactly as described in the Contract Documents.

(8) No allowances will be made for submittals which are not made in a timely fashion or which are turned down because they are not equal. Should delivery problems arise due to the above, affecting the completion time of the project, the Contractor will furnish and install acceptable alternates until the proper materials arrive and then replace the alternate materials with the approved materials, all at no cost to the Owner. If the Contractor is not able to furnish an acceptable alternate until the proper materials arrive, he will assume all costs for furnishing and installing all alternates as directed by the Architect and/or will pay a suitable penalty for the inconvenience experienced by the Owner. This penalty will be set by the Architect based on the particular circumstances.

J. SUBSTITUTIONS

(1) The listing of product manufacturers, catalog numbers, etc., in the various sections of the specifications is intended to establish a standard of quality only, and is not intended to preclude open, competitive bidding. The Contractor may at his option submit substitute materials or methods which he feels are equal or superior to those specified. If the Contractor does submit alternate materials or methods, it shall be understood that the Contractor:

   a. Has personally investigated the proposed substitute product and determined that it has all the same accessories and is equal or superior in all respects to the item specified.

   b. Will provide the same guarantee for the substitution that he would for that specified.

   c. Has coordinated the installation of the equipment which he proposes to substitute with all other trades especially in regard to electrical requirements and to operating weights trades and includes the costs for any changes required for the work to be complete in all respects. The Contractor will prepare shop
drawings where required by the Architect or where dimensions vary.

d. Waives any and all claims for additional costs related to the substitution.

K. SPARE PARTS DATA

(1) As soon as practicable after approval of materials and equipment, and, if possible, not later that one months prior to the date of beneficial occupancy, the Contractor shall furnish spare parts data for each different item of equipment listed. The data shall include a complete list of parts and supplies, with current unit prices and sources of supply; a list of parts and supplies that are either normally furnished at no extra cost with the purchase of the equipment or specified hereinafter to be furnished as part of the contract. The foregoing shall not relieve the Contractor of any responsibilities under the guarantee specified.

L. RECORD DRAWINGS

(1) The Contractor shall keep a set of Drawings of the job, noting daily all changes made in the Drawings in connection with the final installation including exact dimensioned locations of all new and uncovered existing active and inactive utilities outside the building and shall turn over a clean, neatly marked set of sepias reproducible Drawings showing "as-built" work to the A/E for delivery to the Owner. All underground utilities and services and systems shall be accurately located by the Contractor and dimensioned on the "as-built" Drawings.

M. OPERATING AND MAINTENANCE MANUAL

(1) Prepare and submit to the Architect for delivery to the Owner an indexed manual with complete technical data for every piece of equipment and material installed under this contract.

a. Complete submittals as approved by Architect.

b. Manufacturer's installation instruction brochures.

c. Manufacturer's local representative and/or Distributor's name, address and phone number.

d. Manufacturer's operating and maintenance brochures.
e. Replacement part number listings and/or descriptions.

f. Lubrication materials required, with instructions.

g. Valve tag list.

(2) This manual shall include all of the listed data bound into a permanent hard-back binder identified on the cover as "Operating and Maintenance Manual" with additional cover display of the names and location of the Building, the Owner, the Architect, the Engineers, the General Contractor, and the Sub-Contractors installing equipment represented in the brochure.

(3) Contents of the Manual shall be grouped in sections according to the various sections of the specifications and shall be listed in a Table of Contents.

2. PRODUCTS

A. STANDARDS FOR MATERIALS

(1) All materials, in general, shall conform to the requirements of all agencies of publications hereinbefore specified under the paragraph QUALITY ASSURANCE and shall be listed, inspected, and approved by the Underwriters Laboratories and shall bear the U.L. label where labeling service is available. The label or listing of the Underwriters Laboratories, Inc. will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this listing, the Contractor may submit a statement from a nationally recognized testing agency indicating that the items have been tested in accordance with required procedures, and that the materials and equipment comply with all contract requirements.

B. STANDARD PRODUCTS

(1) Materials and equipment to be provided shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications, and shall essentially duplicate materials and equipment that have been in satisfactory use at least two years.

C. MANUFACTURERS INSTRUCTIONS

(1) The responsibility for the furnishing of the proper equipment and/or material and the responsibility for seeing that it is installed as intended by the manufacturer, rests entirely upon the Contractor. If
needed for proper installation, operation, or startup, the Contractor shall request advice and supervisory assistance from the representative of the specific manufacturer. The manufacturers' published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufactured materials or equipment, unless otherwise indicated. The Contractor shall promptly notify the Architect in writing of any conflict between the requirements of the contract documents and the manufacturers' directions and shall obtain the Architect's instructions before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturers' directions or such instructions from the Architect, he shall bear all costs arising in connection with the deficiencies.

D. RUST PREVENTION

(1) All metallic materials shall be protected against corrosion. Exposed metallic parts of outdoor apparatus made of ferrous metals but not of corrosion-resistant steel, shall be zinc-coated in accordance with ASTM A123 or A153, except where other equivalent protective treatment is specifically approved in writing.

E. STORAGE ON SITE

(1) The Contractor shall not receive material or equipment at the job site until ready for installation or until there is a suitable space provided to properly protect equipment from rust, weather, humidity, dust, or physical damage.

F. CAPACITIES

(1) Capacities shall be not less than those indicated and shall be such that no component or system becomes inoperative or is damaged because of startup or other overload conditions.

G. NAMEPLATES

(1) Each major component of equipment shall have the manufacturer's name, address, and catalog number on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of final inspection.

H. CONDITION OF MATERIAL AND APPURTENANCES

(1) All pipe, fittings, appurtenances, and other material required for complete installation of these systems shall be new to conform to
manufacturer's recommendations, unless otherwise specified. All equipment injured or damaged in transit from factory, during delivery to premises, while in storage on premises, while being erected and installed, and while being tested, until time of substantial completion, shall be replaced by the Contractor without extra cost to Owner.

3. EXECUTION

A. INSTALLATION OF SYSTEMS

(1) Provide and install unions at proper points to permit removal of pipe and various equipment and machinery items without injury to other parts of system. No union will be required in welded lines or lines assembled with solder joint fittings, except at equipment items, machinery items, and other special pieces or apparatus. Companion flanges on lines at various items of equipment, machines and pieces of apparatus, shall serve as unions to permit removal of the particular items. Unions connecting ferrous pipe to copper or brass pipe shall be dielectric type.

B. SPACE AND EQUIPMENT ARRANGEMENT

(1) All equipment shall be installed in a manner to permit access to parts requiring service without disassembly of other equipment.

(2) Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through stairways, doorways, or shafts shall be brought to the job and placed in the space before the enclosing structure is completed. Following placement in the space, such apparatus shall be thoroughly protected against damage.

C. PRECEDENCE OF WORK

(1) This contract includes many different systems furnished and installed by different trades. Each trade shall coordinate their work with that of all other trades so that it may be installed in the most direct and workmanlike manner without hindering or handicapping any other trades.

D. EXCAVATION AND BACKFILL

(1) The Contractor shall perform all excavation of every description required in the execution of his work. Excavation shall be through whatever substance encountered, to the depths indicated on the
drawings, or as required. Excavated material suitable for backfill shall be piled in an orderly manner a sufficient distance from the trench to prevent overloading sides and causing cave-ins. Excavated materials not suitable for backfill shall be removed or stored as directed. Such grading shall be done as is necessary to protect the excavation from surface water. Trenches shall be maintained in a dry condition by bailing, pumping, or other approved methods. Pipe shall not be laid in wet trenches. Sheetimg and shoring shall be provided as required for the protection of the work and the safety of personnel.

(2) Trenches shall be of the necessary width and depth to provide for proper laying of pipe and appurtenances, with banks as nearly vertical as possible. Bottoms of trenches shall be excavated to the grade and depth indicated or required, and barrel of pipe shall be laid on firm and undisturbed soil. Bell holes, of a size to permit proper grading, shall be provided as required. Over-depth excavations shall be backfilled to proper level with sand. When rock or other soil not suitable for bedding the pipe is encountered, it shall be removed to a depth of not less than 1' below grade, and backfilled with sand to grade, to provide a suitable bed for pipe. Existing underground piping shall be protected from damage during excavation and backfilling, and if damaged, shall be repaired to the Architect's satisfaction, at the Contractor's expense.

(3) Trenches shall not be backfilled until all required tests have been performed. This requirement does not preclude sectional testing and backfilling of the various systems. Trenches shall be carefully backfilled with a minimum 6" sand cover over piping then backfilled with material (free from large earth clods, rocks, and/or foreign materials), laid in 6" layers, compacted to 90 percent of maximum dry density as determined by ASTM D698 (compaction shall be to 95 percent below structures, including sidewalks and roadways).

(4) Open trenches abutting foundation or basement excavations, building walls, and grade beams, will not be permitted, but shall be backfilled and completed, for as distance of not less than 10' from the above features, as soon as possible. All damage resulting from flooding due to open trenches shall be paid for by the Contractor.

(5) Where excavation requires, existing walks, street, drives, or other existing pavement shall be cut to install new lines and to make new connections to existing lines. The size of the cut shall be held to a minimum, consistent with the work to be accomplished. After the installation of the new materials is completed and the excavation has been backfilled, the paving shall be patched, using materials to match
those cut out. The patches shall be thoroughly bound with the original surfaces, and shall be level with them.

E. CUTTING AND PATCHING

(1) Where it becomes necessary to cut through any wall, floor, or ceiling to permit installation of any work under this section of the specifications or to repair any defects that may appear, up to the expiration of the guarantee period, such cutting shall be done under the observation of the Architect by the Contractor. The Contractor shall not be permitted to cut or modify any structural members without the written direction of the Architect.

(2) Patching of all openings cut by the Contractor, or repairing of any damage to the work of other trades occasioned by the cutting operations, or occasioned by the failure of any part of work installed under this contract, shall be performed by the trade whose work is involved, but shall be paid for by the Contractor.

(3) Any openings cut through exterior walls or roofs shall be provided with suitable covers, while they are left open, to protect the property or materials involved. Any openings cut through walls below grade shall be properly protected to prevent entrance of water or other damaging elements.

F. HOISTING, SCAFFOLDING, AND TRANSPORTATION

(1) The Contractor shall provide his own hoisting facilities to set his materials and equipment in place in the building, as indicated on drawings and for subsequent cleaning, testing, and adjusting.

(2) The Contractor shall provide necessary transportation to facilitate the delivery of all materials, equipment, tools, and labor to the job, in accordance with intent of these documents.

G. CLEANING

(1) The Contractor shall, at all times, keep the premises free from accumulations of waste material or rubbish caused by him, his employees, or his work. This debris shall be removed, not only from the building, but also from the project site.

(2) At completion of the job, the Contractor shall remove all of his tools, scaffolding, and surplus materials. He shall leave the area "broom clean."
H. ELECTRICAL WIRING OF MOTORS AND EQUIPMENT

(1) Unless specifically shown, indicated, or specified to the contrary, each item shown or required by the Mechanical Drawings or specified in the Mechanical Specifications shall be accompanied by all motors and starting and controlling equipment necessary for the items' proper operations. These motors shall be integrally attached to and/or installed with their associated equipment item and electrically connected as specified in Division 16 - Electrical. Equipment controlled from motor control centers shall be supplied with motors only. Motor control centers are specified in the Electrical Specifications and shown on the Electrical Drawings.

END OF SECTION
220523 - VALVES FOR PLUMBING

1. GENERAL

A. WORK INCLUDED

(1) Ball Valves

(2) Check Valves

(3) Balancing Valves

B. RELATED WORK

(1) Section 220500 – Common Work Results For Plumbing

(2) Section 221100 – Plumbing Piping

C. SHOP DRAWINGS

(1) Submit product data in accordance with Section 220500 Common Work Results For Plumbing.

2. PRODUCTS

A. ACCEPTABLE MANUFACTURERS

(1) Valves as manufactured by KITZ, Nibco, Crane, Apollo, Watts or approved equal are acceptable provided they meet or exceed these specifications.

(2) Provide valve types of same manufacturer throughout where possible.

(3) Provide valves with manufacturer’s name and pressure rating clearly marked on outside of body.

(4) Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by installer to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube and equipment connections. Where more than one type is indicated, selection is Installer’s option. Valves shall be of same make for all these services.
B. VALVE CONNECTIONS

(1) Provide valves suitable for connection to adjoining piping as specified for pipe joints. Use pipe size valves unless otherwise indicated.

(2) Provide threaded valves for pipe sizes 2 inches and smaller.

(3) Provide flanged valves for pipe sizes 2 1/2 inches and larger.

(4) Solder or screw to solder adaptors for copper tubing.

C. BALL VALVES

(1) Select with full port opening, blow out proof stem, hard chrome plated forged brass vented ball, adjustable packaging nut, rated not less than 600# W.O.G., 150 W.S.P.

(2) Comply with the following standards:

Ball Valves: MSS SP - 110

(3) Domestic Water Service

a. Threaded ends 3” and smaller: 600# W.O.G., 150 W.S.P., bronze two piece body, hard chrome plated full port forged brass ball, true adjustable packing nut, blow-out proof stem: Kitz #68, Nibco T-585-70, Apollo 77-100 Series, Watts 6080 or equal.

b. Solder ends 3” and smaller: 600# W.O.G., 150 W.S.P., bronze two piece body, hard chrome plated full port forged brass ball, true adjustable packing nut, blow-out proof stem: Kitz #69, Nibco T-585-70, Apollo 77-200 Series, Watts B-6081 or equal.

(4) Natural Gas Service

a. Threaded ends 2” and smaller: 175# W.O.G., bronze two piece body, hard chrome plated full port forged brass ball, true adjustable packing nut, blow-out proof stem, U.L. listed for natural gas service: Kitz #60, Nibco GB, Watts GBV or equal.

D. SWING CHECK VALVES

(1) Comply with the following standards for design, workmanship, material and testing:
Bronze Valves: MSS SP - 80
Cast Iron Valves: MSS SP - 71

(2) Construct valves of pressure casting free of any impregnating materials.

(3) Threaded ends 2” and smaller: Class 125, bronze body, screwed cap, “Y” pattern swing, bronze disc: Kitz #22, Nibco T-413B, Crane 37 or equal.

(4) Soldered ends 2” and smaller: Class 125, bronze body, screwed cap, “Y” pattern swing, bronze disc: Kitz #23, Nibco T-413B, Crane 1342 or equal.

(5) Flanged ends 2-1/2” and larger: Class 125, iron body, bronze mounted, horizontal swing, cast-iron disc: Kitz #78, Nibco F918-B, Crane 373 or equal.

E. BALANCING VALVES

(1) Manual Balance Valve: Furnish and install as shown on plans, a calibrated (bronze with bronze disc) balance valve equipped with readout valves to facilitate the connecting of a differential pressure meter. Each readout valve shall be fitted with an integral check valve designed to minimize system fluid loss during the monitoring process. The balancing valve shall have an indexing pointer and calibrated nameplate to indicate the degree of closure of the precision machined orifice. Each balancing valve is to be constructed with internal O-ring seals to prevent leakage around the rotating element.

F. VALVE FEATURES

(1) Provide valves with features indicated and where not otherwise indicated, provide proper valve features as outlined in this specification. Comply with ANSI B31.1.

(2) Flanged valve ends comply with ANSI B16.1 (cast iron), ANSI B16.24 (bronze).

(3) Threaded valve ends comply with ANSI B2.1.

(4) Solder Joint valve ends complying with ANSI B16.18.
(5) Fabricate pressure-containing components of valves, including stems and seats from brass or bronze materials; of standard alloy recognized in valve manufacturing that resist de-zincification.

3. EXECUTION

A. INSTALLATION

(1) Install valves with stems upright or horizontal, not inverted.

(2) Install ball valves for shut-off and isolating service, to isolate equipment, part of systems, or vertical risers.

(3) Install check valves in horizontal position with pin horizontally perpendicular to center line of pipe. Install for proper direction of flow. Installations on any vertical piping must be up flow only.

(4) Valves used for natural gas shall be listed for such use.

(5) All valves shall be located so that the bonnets can be removed.

(6) Where valves are installed concealed in pipe chases provide Zurn Z-1460-4 access doors with concealed hinge and key operated locks. Door shall be large enough to service valves and shall be installed flush with finished ceilings or walls.

(7) Provide brass tag for each valve labeling the fluid in the pipe, the area served, and the normal operating position.

END OF SECTION
220529 - SUPPORTS, ANCHORS AND SLEEVES FOR PLUMBING

1. GENERAL

A WORK INCLUDED

(1) Pipe Hangers and Supports

B RELATED WORK

(1) Section 220500 – Common Work Results For Plumbing
(2) Section 221100 – Plumbing Piping

C SUBMITTALS

(2) Submit shop drawings in accordance with Section 220500 Common Work Results For Plumbing.

2. PRODUCTS

A ACCEPTABLE MANUFACTURERS

(1) Products shall be as manufactured by Grinnell, Elcen, Fee and Mason, Unistrut or approved equal.

B PIPE HANGERS AND SUPPORTS

(1) Hangers: Pipe sizes 1/2 inch to 1-1/2 inch: adjustable wrought steel ring.
(2) Hangers: Pipe sizes 2 inches to 4 inches: adjustable wrought steel clevis.
(3) Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
(4) Steel Beam Clamps: Elcen Figure 33, Type 3 or approved equal.
(5) Design hangers to impede disengagement by movement of supported pipe.
(6) Provide copper plated hangers and supports for copper piping or two layers Scotch 33 PVC tape or equal.

C HANGER RODS
(1) Provide cadmium plated steel hanger rods, threaded both ends, threaded one end, or continuous threaded.

D SLEEVES

(1) Pipes through Walls, Fire Proofing, Footings, Potentially Wet Floor: Form with schedule 40 PVC pipe.

(2) Size large enough to allow for movement due to expansion and to provide for continuous installation.

3. 3 EXECUTION

A PIPE HANGERS AND SUPPORTS

(1) All structures and appurtenances employed for the purpose of supporting the pipe and guiding it properly shall be carefully fabricated in such a manner as to preserve the true grade of the pipe without subjecting either the pipe or the supporting and guidance members to any undue strain.

(2) Support horizontal piping as follows:

(3) C. Space hangers and furnish rods as follows:

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<thead>
<tr>
<th>Nominal Pipe Size (in.)</th>
<th>Span (ft.)</th>
<th>Steel Hanger Rod Diameter (in.)</th>
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<td>6</td>
<td>6</td>
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<tr>
<td>1</td>
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<td>1-1/2</td>
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</tr>
</tbody>
</table>

(4) Install hangers to provide minimum 1/2 inch clear space between finished covering and adjacent work.

(5) Place a hanger within one foot of each horizontal elbow.

(6) Use hangers which are vertically adjustable 1-1/2 inch maximum after piping is erected.
(7) Support piping at each change or direction, at ends of branches, at base and top of riser pipes and drops, and wherever necessary to prevent sag, bending or vibration, in addition to above-listed hanger spacing.

(8) Pipe hangers on insulated lines shall be sized to fit the outside of the insulation.

(9) Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers, designed to support loads per ANSI B31.1.

(10) Where practical, support riser piping independently of connected horizontal piping.

B EQUIPMENT BASES AND SUPPORTS

(1) Provide for major equipment minimum four inch thick reinforced concrete house-keeping bases poured directly on structural floor slab pinned in place and extended 6 inches minimum beyond machinery bedplates. Provide templates, anchor bolts and accessories required for mounting and anchoring equipment. Coordinate with other trades.

(2) Construct supports of structural steel members or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

C SLEEVES

(1) Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.

(2) Extend sleeves through potentially wet floors 1 inch above finished floor level. Caulk sleeves full depth and provide floor plate.

(3) Where piping passes through floor, ceiling or wall close off space between pipe or duct and construction with non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.

(4) Install chrome plated escutcheons where piping passes through finished surfaces.

(5) Size pipe sleeves to permit placing pipe and specified insulation material for pipes passing through concrete or masonry walls or concrete slabs.
(6) Sleeves for pipes through floor slabs shall be schedule 40 PVC pipe with top of sleeve projecting 2 inches above finished floor. For waterproof sleeves.

(7) Sleeves for pipe through walls shall be schedule 40 PVC with ends flush with wall surface.

(8) Seal pipes passing through walls or slabs. Use mastic or oakum seal in the annular space in non-fire-rated walls; use Dow-Corning 3-6548 silicone RTV foam firestop sealant or equal in the annular space in fire-rated walls or other envelopes.

(9) Seal exposed pipe passing through floor slabs with Dow-Corning 3-6548 silicone RTV foam firestop sealant or equal and point with caulking compound. Strike off flush at top of sleeve.

(10) Insulated pipe shall be insulated in sleeves, caulked and pointed as above.

(11) Sleeves penetrating exterior walls below grade shall be standard weight, black steel pipe with 1/4” thick steel plate secured to the pipe with a continuous fillet weld. The plate shall be located in the middle of the wall and shall be 4” wider all around than the sleeve it encircles. The entire assembly shall be hot dipped galvanized after fabrication. The pipe passing through the sleeve shall be centered within the sleeve and the annulus opening sealed with "Link Seal" casing seals manufactured by Thunderline Corporation, Wayne, Michigan. Series 300 for pipe sizes 1/2" through 10" and series 400 or 500 for larger pipe sizes or equal.

(12) Pipe sleeves, pitch pockets, and flashings compatible with the roofing installation shall be provided for roof penetrations.

(13) All piping shall be installed with due regard to expansion and contraction. Type of hanger, methods of support, location of supports, etc., shall be governed in part by this consideration.

END OF SECTION
220700 - PLUMBING INSULATION

1. GENERAL

A. WORK INCLUDED

(1) Insulation of Condensate Drain Piping

(2) Insulation of Domestic Hot Water Piping

B. RELATED WORK

(1) Section 220500 – Common Work Results For Plumbing

(2) Section 221116 – Plumbing Piping

C. QUALITY ASSURANCE

(1) All insulation materials required for piping, and mechanical equipment, etc. shall be furnished and installed under this contract. The execution of the work shall be by approved insulation contractor in strict accordance with the best practice of the trade and the intent of this Specification.

(2) It is mandatory that all insulation be applied in a neat and workmanlike manner. Contractor shall be required to remove and replace all insulation not applied in strict accordance with manufacturer’s specifications or not presenting a neat finished appearance.

(3) All insulation on indoor work shall have composite (insulation, jacket or facing, and adhesive used to adhere jacket or facing to the insulation) fire and smoke hazard Ratings, as tested by procedure ASTM E-84, NFPA 255 and UL 73 not exceeding Flame Spread of 25, Fuel Contributed of 50 and Smoke Developed of 50. Accessories, such as adhesives, mastics, cements, tapes and cloths for fittings shall have component ratings as listed above.

(4) Insulation shall be continuous through wall, floor and ceiling openings, hangers and sleeves.

(5) Specified mastics, adhesives and coatings shall be applied in strict accordance with manufacturer’s instructions, including recommended coverages.
D. SUBMITTALS

(1) Submit materials and installation instructions in accordance with Section 220500.

2. PRODUCTS

A. ACCEPTABLE MANUFACTURERS

(1) Products manufactured by Owens-Corning, Knauf, Johns Manville, Certain-Teed, Govain, Benjamin Foster are acceptable provided they meet or exceed these specifications.

B. PIPING

(1) Piping:

a. Insulation thickness - Fiberglass pipe covering.

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<thead>
<tr>
<th>PIPING TYPE</th>
<th>PIPE SIZE</th>
<th>INSULATION SIZE</th>
</tr>
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<tbody>
<tr>
<td>Domestic Hot Water</td>
<td>1-1/4&quot; &amp; under</td>
<td>1&quot;</td>
</tr>
<tr>
<td>Supply &amp; Return</td>
<td>1-1/2&quot; &amp; up</td>
<td>1-1/2&quot;</td>
</tr>
<tr>
<td>Condensate</td>
<td>all sizes</td>
<td>1/2&quot;</td>
</tr>
</tbody>
</table>

b. All fiberglass pipe insulation shall be nominal 5 pcf density.

c. Insulation jacket shall be factory applied white All Service Jacket (ASJ), with factory supplied self-sealing laps.

d. Condensate piping may be insulated with 1/2” thick expanded rubber insulation at the contractor's option.

e. Fittings, Valves and Flanges:

i. Where manufactured, factory premolded fittings (of the same material and thickness as the pipe insulation) shall be used for all fittings, flanges and valves.

ii. Where premolded insulation fittings are not manufactured, all fittings, flanges and valves shall be insulated with mitered segments of nominal 5 lb. density fiberglass pipe covering. Hot Service Finish: embed a 20 x 20 weave white glass reinforcing cloth.
between two 1/16 inch coats of Benjamin Foster 30-36. The glass cloth and second coat shall overlap adjacent covering by at least two inches. Cold Service Finish: same as above except use Benjamin Foster 30-35.

iii. Insulation for removable flanges of pipe strainers shall be fabricated with built-up sections of Fiberglass pipe covering, so arranged as to facilitate servicing of the strainer. Applications for cold services shall be complete with vapor seals.

f. Insulation on pipes shall be protected by saddles from hangers, guides, and rollers.

3. EXECUTION

A. PREPARATION

(1) Do not install covering before piping and equipment has been tested and approved.

(2) Ensure surface is clean and dry prior to installation. Ensure insulation is dry before and during application.

B. INSTALLATION

(1) Ensure insulation is continuous through inside walls, supports, etc. Pack around pipes with fire proof self-supporting insulation material, fully sealed.

(2) Provide a minimum 12" long, high density insulation insert such as calcium silicate or its equivalent at each support. Insert shall be the same thickness as adjacent piping.

(3) Insulate fittings and valves. Do not insulate unions, flanges, strainers, flexible connections and expansion joints. Terminate insulation neatly with plastic material troweled on bevel.

(4) Locate insulation cover seams in least visible locations.

(5) Hot Piping: Cover fittings and valves with equivalent thickness of insulation material. For exposed fittings and valves apply hydraulic setting cement paste over insulating material before applying canvas jacket.

(6) Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship.
221116 - PLUMBING PIPING

1. GENERAL

A. WORK INCLUDED

(1) Sanitary Sewer Piping System
(2) Domestic Water Piping System
(3) Condensate Piping System
(4) Natural Gas Piping System

B. RELATED WORK

(1) Section 220000 – Common Work Results For Plumbing
(2) Section 220523 – Valves For Plumbing
(3) Section 220529 – Supports, Anchors and Sleeves For Plumbing
(4) Section 220640 – Plumbing Fixtures
(5) Section 220719 – Plumbing Piping Insulation
(6) Section 221119 – Plumbing Specialties

C. REFERENCES

(1) ANSI/ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.
(2) ANSI/ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder. Joint Drainage Fittings - DWV.
(3) ANSI/ASME Sec. 9 - Welding and Brazing Qualifications.
(4) ANSI/ASTM B32 - Solder Metal.
(5) ASTM B88 - Seamless Copper Water Tube.
(6) ASTM B306 - Copper Drainage Tube (DWV).
(7) AWS 5.8 - Brazing Filler Metal.
D. QUALITY ASSURANCE

(1) Valves: Manufacturer's name and pressure rating marked on valve body.

E. SUBMITTALS

(1) Submit product data in accordance with Section 220500.

(2) Include data on pipe materials, pipe fittings, and accessories.

2. PRODUCTS

A. SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING


B. SANITARY SEWER PIPING, ABOVE GRADE


C. WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

(1) Copper Tubing: ASTM B88, Type K, annealed. Fittings: NONE. Joints: NONE.


D. WATER PIPING, ABOVE GRADE


E. CONDENSATE PIPING, ABOVE GRADE

F. NATURAL GAS PIPING, ABOVE GRADE


G. FLANGES, UNIONS, AND COUPLINGS

(1) Pipe Size 2 Inches and Under: 150 psig malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.

(2) Pipe Size Over 2 Inches: 150 psig forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping; neoprene gaskets for gas service; 1/16 inch thick preformed neoprene bonded to asbestos.

(3) Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

3. EXECUTION

A. PREPARATION

(1) Ream pipe and tube ends. Remove burrs.

(2) Remove scale and dirt, on inside and outside, before assembly.

(3) Prepare piping connections to equipment with flanges or unions.

B. INSTALLATION

(1) Provide non-conducting dielectric connections wherever jointing dissimilar metals.

(2) Route piping in orderly manner and maintain gradient.

(3) Install piping to conserve building space and not interfere with use of space.

(4) Group piping whenever practical at common elevations.

(5) Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

(6) Provide clearance for installation of insulation and access to valves and fittings.
(7) Provide access doors to match wall or ceiling construction where valves and fittings are not exposed.

(8) Slope water piping and arrange to drain at low points.

(9) Establish elevations of buried piping outside the building to ensure not less than 3 ft of cover.

(10) Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting where exposed.

(11) Establish invert elevations, slopes for drainage to 1/4 inch per foot (2 percent) minimum for sewer piping.

(12) Natural gas piping exposed to weather shall be cleaned, primed, and provided with two coats of yellow oil based paint.

C. APPLICATION

(1) Install unions downstream of valves and at equipment or apparatus connections.

(2) Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.

D. DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

(1) Prior to starting work, verify system is complete, flushed and clean.

(2) Ensure pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

(3) Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

(4) Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

(5) Maintain disinfectant in system for 24 hours.

(6) If final disinfectant residual tests less than 25 mg/L, repeat treatment.

(7) Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
(8) Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C601.

(9) Submit statement of test results and procedures to Architect.

E. FLUSHING OF DOMESTIC WATER PIPING SYSTEM

(1) Prior to start of work, verify system has been disinfected per paragraph 3.04 of this section.

(2) All installed plumbing fixtures shall be rinsed (ran) daily for a minimum of 30 seconds each. This shall continue for a minimum period of two (2) weeks.

(3) At the conclusion of the flushing cycle, verification samples may be collected by a school representative for testing.

(4) If the testing proves that the lead content is in excess of allowable levels, an additional two (2) week flushing period may be required.

(5) Records of flushing must be maintained and available for inspection.

F. TESTING

(1) Test soil and vent systems by plugging lines and filling systems with water to a static head of ten (10) feet of water. Observe water level for two (2) hours. If level is lowered, indicating leakage, repair leaks and test again until no further leakage is detected.

(2) Test water piping at 100 psig for a continuous period of four (4) hours. During this time, carefully inspect the system for leaks. If necessary, repair leaks and test again until no further leakage is detected.

(3) Test gas piping at 50 psig for a continuous period of four (4) hours. During this time, carefully inspect the system for leaks. If necessary, repair leaks and test again until no further leakage is detected.

END OF SECTION
1. GENERAL

A. RELATED WORK

(1) General Conditions

(2) Special Conditions

(3) Supplementary General Conditions

(4) Architectural, Structural, Civil, Electrical and Mechanical Drawings & Specifications

B. SCOPE OF WORK

(1) The work covered by the Mechanical and Plumbing Sections of the Specifications shall include the furnishing of all materials, labor, transportation, tools, permits, fees, inspections, utilities and incidentals necessary for the complete installation of all mechanical and plumbing work required in the Contract Drawings.

(2) It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction is required for work indicated or specified in this Section or work specified in other sections, it shall be the responsibility of the Contractor to provide all material and equipment which is usually furnished with such systems in order to complete the installation, whether mentioned or not.

(3) The Contractor shall visit the premises and thoroughly familiarize himself with all the details of the work and working conditions and to verify all dimensions in the field. The Contractor shall advise the Architect of any discrepancy prior to bidding. The submission of bids shall be deemed evidence of the Contractor's site visit, the coordination of all existing conditions, and the inclusion of all considerations for existing conditions.

C. PLANS AND SPECIFICATIONS

(1) These Specifications are accompanied by drawings of the building and details of the installations indicating the locations of equipment, piping, ductwork, outlets, etc. The drawings and these specifications are complementary to each other, and what is required by one shall be as binding as if required by both.
(2) If departures from the drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Architect for review. No departures shall be made without prior written acceptance of the Architect.

(3) The interrelation of the specifications, the drawings, and the schedules is generally as follows: The specifications determine the nature and setting of the materials, the drawings establish the quantities, dimensions, and details, and the schedules give the performance characteristics.

(4) Should the drawings disagree in themselves or with the specifications, the contractor shall immediately notify the architect and shall perform and/or furnish the better quality or greater quantity of work or materials unless otherwise directed by the architect in writing. In case the specifications should not fully agree with the schedules, the latter shall govern. Figures indicated on drawings govern scale measurements and large scale details govern small scale drawings. In case of disagreement between specifications and drawings, see Division I of these specifications for clarifications.

(5) Items specifically mentioned in the specifications but not shown on the drawings and/or items shown on the drawings but not specifically mentioned in the specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

D. QUALITY ASSURANCE

(1) All work shall comply with the applicable rules of the following:
   a. 2018 International Building Code
   b. 2018 International Mechanical Code
   c. 2018 International Plumbing Code
   d. 2018 International Fire Code
   e. 2018 International Energy Conservation Code
   f. National Fire Protection Association Codes
   g. State Fire Marshall
h. Latest edition of Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA) Standards.

i. All applicable city, county, state, and federal rules, codes, and ordinances.

(2) In any instance where these specifications call for materials for construction of a better quality or larger size than required by the codes, the provisions of these specifications shall take precedence. None of the terms or provisions of this specification shall be construed as waiving any rules, regulations, or requirements of these authorities. The codes shall govern in case of direct conflict between the codes and the Drawings.

E. SUPERVISION

(1) A competent foreman or superintendent, initially approved by the Architect, shall be assigned to the project to receive instructions and to act for the Contractor. Once this superintendent has been approved, no change shall be made without approval of the Architect. Architect's authorized representative and/or owner's observer shall have the right to observe the work at any time. The Contractor shall have a representative present when his work is being observed, and he shall give assistance, as may be required, to the Architect's representative. Recommendations made by the observer shall be promptly carried out, and all unsatisfactory material and/or workmanship shall be replaced at once, to the satisfaction of the Architect.

F. GUARANTEE

(1) The Contractor shall guarantee all materials and workmanship for a period of two (2) years after the final acceptance of work.

G. BUILDING CONSTRUCTION AND LAYOUT OF WORK

(1) It shall be the responsibility of the Contractor to consult the architectural and engineering drawings and details so as to thoroughly familiarize himself with the type and quality of construction to be provided on this project.

(2) The Drawings are diagrammatic in character and cannot show every connection in detail or every pipe and duct in its exact location. These details are subject to the requirements of ordinances and also structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the
separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases or above suspended ceilings, etc., in finished portions of the building, unless specifically noted or indicated to be exposed. Work shall be installed to avoid crippling of structural members; therefore, inserts to accommodate hangers shall be set before concrete is poured, and proper openings through floor, walls, beams, etc., shall be provided as hereinafter specified or as otherwise indicated or required before concrete is poured. All work shall be run parallel or perpendicular to the lines of the building unless otherwise noted.

(3) The approximate location of each item is indicated on the drawings. These drawings are not intended to give complete and exact details in regard to location. Exact locations are to be determined by actual measurements at the building and will in all cases be subject to the approval of the Architect, and he reserves the right to make any reasonable changes in the locations indicated without additional cost.

H. SHOP DRAWINGS AND BROCHURES

(1) After the Contract is awarded, but prior to proceeding with the Work, the Contractor shall obtain, check, certify, and submit complete Shop Drawings and Brochures from Manufacturers, Suppliers, Vendors, etc., for all materials and equipment specified herein. Submit Shop Drawings and Brochures in sufficient time so as not to impede the progress of work. At least two weeks will be required for the processing of Shop Drawings and Brochures in the Engineer's office, exclusive of transmittal time. This time shall be considered by the Contractor when scheduling submittal data.

(2) The Engineer's review of Shop Drawings and Brochures shall not relieve the Contractor of the responsibility for dimensions, errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the Engineer's noting some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the submittal data review.

(3) Each Shop Drawing shall indicate in the lower right hand corner and each Brochure shall indicate on the front cover the following: the Title of the Sheet or Brochure; name and location of the building; names of the Architect, Engineer, Contractor, Manufacturer, Supplier, Vendor, etc., the date of submittal; and the date of each correction and
revision. So far as is practical, each Shop Drawing and/or Brochure shall bear a cross-reference note to the sheet number or numbers of the Contract Drawings and/or Specifications showing the same work. Shop Drawings and Brochures shall be prepared as follows:

a. Shop Drawings: Drawings shall be drawn to a scale that can be easily read and shall contain sufficient plans, elevations, sections, and isometrics to describe clearly the items in question. Drawings shall be prepared by skilled technicians experienced in this type of work. All piping, equipment layouts, ductwork and similar Shop Drawings shall be drawn to at least 1/4" = 1'0" scale.

b. Brochures: Brochures shall be published by the Manufacturers and shall contain complete and detailed engineering and dimensional information to show that the equipment will fit into the allotted space. Brochures not compiled in the manner described below shall be returned for resubmittal.

c. Brochures submitted shall contain only information which is relevant to the particular equipment or materials to be furnished. Do not submit catalogs that describe several different items other than those items to be used unless all irrelevant information is marked out or relevant information is clearly marked.

(4) The submittal format shall follow the Specifications format with a submittal required for each section of Division 23. Each major category of equipment such as fans or pumps or air devices being submitted under a separate cover letter. The first submittal shall be accompanied by a three-ring hard back binder for the A/E to use in retaining copies of the submittals. Copies of each submittal shall be three-hole punched and arranged (or folded if required) for the A/E's filing convenience. Provide one copy of updated TABLE OF CONTENTS and progressive-tabbed manila index sheets also for the A/E's filing convenience.

(5) Submit all Shop Drawings and Brochures for review and approval in accordance with Division 1 – General Requirements

(6) Minimum size of submittal data shall be 8-1/2" x 11".

(7) Any submittal that is disapproved must be resubmitted within two (2) weeks following notification of such disapproval. If no satisfactory material is submitted within the two-week period, the Architect
reserved the right to require the Contractor to furnish items exactly as described in the Contract Documents.

(8) No allowances will be made for submittals which are not made in a timely fashion or which are turned down because they are not equal. Should delivery problems arise due to the above, affecting the completion time of the project, the Contractor will furnish and install acceptable alternates until the proper materials arrive and then replace the alternate materials with the approved materials, all at no cost to the Owner. If the Contractor is not able to furnish an acceptable alternate until the proper materials arrive, he will assume all costs for furnishing and installing all alternates as directed by the Architect and/or will pay a suitable penalty for the inconvenience experienced by the Owner. This penalty will be set by the Architect based on the particular circumstances.

I. SUBSTITUTIONS

(1) The listing of product manufacturers, catalog numbers, etc., in the various sections of the specifications is intended to establish a standard of quality only, and is not intended to preclude open, competitive bidding. The Contractor may at his option submit substitute materials or methods which he feels are equal or superior to those specified. If the Contractor does submit alternate materials or methods, it shall be understood that the Contractor:

a. Has personally investigated the proposed substitute product and determined that it has all the same accessories and is equal or superior in all respects to the item specified.

b. Will provide the same guarantee for the substitution that he would for that specified.

c. Has coordinated the installation of the equipment which he proposes to substitute with all other trades especially in regard to electrical requirements and to operating weights trades and includes the costs for any changes required for the work to be complete in all respects. The Contractor will prepare shop drawings where required by the Architect or where dimensions vary.

d. Waives any and all claims for additional costs related to the substitution.

J. SPARE PARTS DATA
(1) As soon as practicable after approval of materials and equipment, and, if possible, not later that one months prior to the date of beneficial occupancy, the Contractor shall furnish spare parts data for each different item of equipment listed. The data shall include a complete list of parts and supplies, with current unit prices and sources of supply; a list of parts and supplies that are either normally furnished at no extra cost with the purchase of the equipment or specified hereinafter to be furnished as part of the contract. The foregoing shall not relieve the Contractor of any responsibilities under the guarantee specified.

K. RECORD DRAWINGS

(1) The Contractor shall keep a set of Drawings of the job, noting daily all changes made in the Drawings in connection with the final installation including exact dimensioned locations of all new and uncovered existing active and inactive utilities outside the building and shall turn over a clean, neatly marked set of sepias reproducible Drawings showing "as-built" work to the A/E for delivery to the Owner. All underground utilities and services and systems shall be accurately located by the Contractor and dimensioned on the "as-built" Drawings.

L. OPERATING AND MAINTENANCE MANUAL

(1) Prepare and submit to the Architect for delivery to the Owner an indexed manual with complete technical data for every piece of equipment and material installed under this contract.

   a. Complete mechanical submittals as approved by Architect.
   
   b. Manufacturer's installation instruction brochures.
   
   c. Manufacturer's local representative and/or Distributor's name, address and phone number.
   
   d. Manufacturer's operating and maintenance brochures.
   
   e. Manufacturer's internal wiring diagrams.

(2) This manual shall include all of the listed data bound into a permanent hard-back binder identified on the cover as "Operating and Maintenance Manual" with additional cover display of the names and location of the Building, the Owner, the Architect, the Engineers, the General Contractor, and the Sub-Contractors installing equipment represented in the brochure.
(3) Contents of the Manual shall be grouped in sections according to the various sections of the specifications and shall be listed in a Table of Contents.

2. PRODUCTS

A. STANDARDS FOR MATERIALS

(1) All materials, in general, shall conform to the requirements of all agencies of publications hereinbefore specified under the paragraph QUALITY ASSURANCE and shall be listed, inspected, and approved by the Underwriters Laboratories and shall bear the U.L. label where labeling service is available. The label or listing of the Underwriters Laboratories, Inc. will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this listing, the Contractor may submit a statement from a nationally recognized testing agency indicating that the items have been tested in accordance with required procedures, and that the materials and equipment comply with all contract requirements.

B. STANDARD PRODUCTS

(1) Materials and equipment to be provided shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications, and shall essentially duplicate materials and equipment that have been in satisfactory use at least two years.

C. MANUFACTURERS INSTRUCTIONS

(1) The responsibility for the furnishing of the proper equipment and/or material and the responsibility for seeing that it is installed as intended by the manufacturer, rests entirely upon the Contractor. If needed for proper installation, operation, or startup, the Contractor shall request advice and supervisory assistance from the representative of the specific manufacturer. The manufacturers' published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufactured materials or equipment, unless otherwise indicated. The Contractor shall promptly notify the Architect in writing of any conflict between the requirements of the contract documents and the manufacturers' directions and shall obtain the Architect's instructions before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturers' directions or such
instructions from the Architect, he shall bear all costs arising in connection with the deficiencies.

D. RUST PREVENTION

(1) All metallic materials shall be protected against corrosion. Exposed metallic parts of outdoor apparatus made of ferrous metals but not of corrosion-resistant steel, shall be zinc-coated in accordance with ASTM A123 or A153, except where other equivalent protective treatment is specifically approved in writing.

E. STORAGE ON SITE

(1) The Contractor shall not receive material or equipment at the job site until ready for installation or until there is a suitable space provided to properly protect equipment from rust, weather, humidity, dust, or physical damage.

F. CAPACITIES

(1) Capacities shall be not less than those indicated and shall be such that no component or system becomes inoperative or is damaged because of startup or other overload conditions.

G. NAMEPLATES

(1) Each major component of equipment shall have the manufacturer's name, address, and catalog number on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of final inspection.

H. CONDITION OF MATERIAL AND APPURTENANCES

(1) All pipe, fittings, appurtenances, and other material required for complete installation of these systems shall be new to conform to manufacturer's recommendations, unless otherwise specified. All equipment injured or damaged in transit from factory, during delivery to premises, while in storage on premises, while being erected and installed, and while being tested, until time of substantial completion, shall be replaced by the Contractor without extra cost to Owner.

3. EXECUTION

A. INSTALLATION OF SYSTEMS
(1) Provide and install unions at proper points to permit removal of pipe and various equipment and machinery items without injury to other parts of system. No union will be required in welded lines or lines assembled with solder joint fittings, except at equipment items, machinery items, and other special pieces or apparatus. Companion flanges on lines at various items of equipment, machines and pieces of apparatus, shall serve as unions to permit removal of the particular items. Unions connecting ferrous pipe to copper or brass pipe shall be dielectric type.

B. SPACE AND EQUIPMENT ARRANGEMENT

(1) All equipment shall be installed in a manner to permit access to parts requiring service without disassembly of other equipment.

(2) Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through stairways, doorways, or shafts shall be brought to the job and placed in the space before the enclosing structure is completed. Following placement in the space, such apparatus shall be thoroughly protected against damage.

C. PRECEDENCE OF WORK

(1) This contract includes many different systems furnished and installed by different trades. Each trade shall coordinate their work with that of all other trades so that it may be installed in the most direct and workmanlike manner without hindering or handicapping any other trades.

D. CUTTING AND PATCHING

(1) Where it becomes necessary to cut through any wall, floor, or ceiling to permit installation of any work under this section of the specifications or to repair any defects that may appear, up to the expiration of the guarantee period, such cutting shall be done under the observation of the Architect by the Contractor. The Contractor shall not be permitted to cut or modify any structural members without the written direction of the Architect.

(2) Patching of all openings cut by the Contractor, or repairing of any damage to the work of other trades occasioned by the cutting operations, or occasioned by the failure of any part of work installed under this contract, shall be performed by the trade whose work is involved, but shall be paid for by the Contractor.
(3) Any openings cut through exterior walls or roofs shall be provided with suitable covers, while they are left open, to protect the property or materials involved. Any openings cut through walls below grade shall be properly protected to prevent entrance of water or other damaging elements.

E. HOISTING, SCAFFOLDING, AND TRANSPORTATION

(1) The Contractor shall provide his own hoisting facilities to set his materials and equipment in place in the building, as indicated on drawings and for subsequent cleaning, testing, and adjusting.

(2) The Contractor shall provide necessary transportation to facilitate the delivery of all materials, equipment, tools, and labor to the job, in accordance with intent of these documents.

F. CLEANING

(1) The Contractor shall, at all times, keep the premises free from accumulations of waste material or rubbish caused by him, his employees, or his work. This debris shall be removed, not only from the building, but also from the project site.

(2) At completion of the job, the Contractor shall remove all of his tools, scaffolding, and surplus materials. He shall leave the area "broom clean."

G. ELECTRICAL WIRING OF MOTORS AND EQUIPMENT

(1) Unless specifically shown, indicated, or specified to the contrary, each item shown or required by the Mechanical Drawings or specified in the Mechanical Specifications shall be accompanied by all motors and starting and controlling equipment necessary for the items’ proper operations. These motors shall be integrally attached to and/or installed with their associated equipment item and electrically connected as specified in Electrical. Equipment controlled from motor control centers shall be supplied with motors only. Motor control centers are specified in the Electrical Specifications and shown on the Electrical Drawings.
230529 – HANGERS & SUPPORTS FOR HVAC EQUIPMENT

1. GENERAL

A. WORK INCLUDED

   (1) Duct Hangers and Supports
   (2) Sleeves for Mechanical Equipment

B. RELATED WORK

   (1) Section 230500 – Common Work Results for HVAC
   (2) Section 230529 - Supports, Anchors and Sleeves
   (3) Section 233113 – Ductwork

C. SUBMITTALS

   (1) Submit shop drawings in accordance with Section 230500.

D. REFERENCES

   (1) Duct Hangers: SMACNA Duct Manuals.

2. PRODUCTS

A. ACCEPTABLE MANUFACTURERS

   (1) Products shall be as manufactured by Grinnell, Elcen, Fee and Mason, Unistrut or approved equal.

B. HANGER RODS

   (1) Provide cadmium plated steel hanger rods, threaded both ends, threaded one end, or continuous threaded.

C. DUCT HANGERS AND SUPPORTS

   (1) Hangers: Galvanized steel band iron or rolled angle and 3/8 inch rods.

D. SLEEVES
(1) Round Ducts: Form with 18 gauge galvanized steel.

(2) Rectangular Ducts: Form with 18 gauge galvanized steel.

(3) Size large enough to allow for movement due to expansion and to provide for continuous installation.

3. EXECUTION

A. LOW VELOCITY DUCT HANGERS AND SUPPORTS

(1) Duct hangers and supports to be sized and spaced as per SMACNA requirements.

B. SLEEVES

(1) Where ductwork passes through ceiling or wall close off space between duct and construction with non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.

END OF SECTION
1. GENERAL

A. WORK INCLUDED

(1) Testing, adjusting and balancing of the following systems:

a. Air Distribution Systems
b. Duct Leakage
c. Exhaust Systems
d. HVAC Systems

B. RELATED WORK

(1) Section 230500 – Common Work Results for HVAC
(2) Section 233423 – HVAC Power Ventilators
(3) Section 233713 – Diffusers, Registers & Grilles
(4) Section 236200 – Packaged Heating/Cooling Units

C. REFERENCED STANDARDS

(1) Associated Air Balance Council, AABC National Standards.
(2) Applicable SMACNA Standards.
(3) AMCA publication 203-A Guide to the Measurement of Fan System Performance in the Field.

D. QUALITY ASSURANCE
(1) All work for the testing and balancing of the HVAC air distribution and hydronic systems shall be done by an independent Testing and Balancing firm that specializes in and whose business is limited to the testing and balancing of heating, ventilating and air conditioning systems.

(2) If requested, the test shall be conducted in the presence of the Architect and/or the Owner.

(3) The environmental systems including all equipment, apparatus and distribution systems shall be tested, adjusted and balanced in accordance with the latest edition of the AABC Procedural Standards for Testing, Adjusting and Balancing of Air Distribution and Hydronic Systems.

(4) Instruments used in all HVAC systems and equipment tests shall be as recommended by the AABC, ASHRAE, or as approved by the Architect. Test instruments used shall be initially and periodically checked thereafter to verify their calibration accuracy.

(5) All test equipment shall be furnished by the Contractor and shall remain in his property. Any adapters such as "Pete's Plugs", pitot tube traverse connections, etc. shall be left in place and marked for future use.

E. SUBMITTALS

(1) Submit test reports in accordance with Section 230500.

(2) Specific procedures used in all tests shall be included in the test report. Contractor shall identify all equipment by the identification code as shown on the drawings.

(3) Data shall be on printed forms published by AABC or the Contractor.

(4) The test report shall include as a minimum the following information and data:

   e. Motors:
      Equipment number
      Manufacturer
      Model or serial number
      Frame size
      Rated horsepower
      Rate rpm
      Corrected full load amperage
f. Fans:
   Equipment number
   Manufacturer
   Model or serial number
   Rated cfm
   Rated rpm
   Rated pressures
   Measured cfm
   Measured rpm
   Measured pressures
   Pulley size, type and manufacturer
   Belt size and quantity

g. HVAC Units
   Equipment number
   Manufacturer and type
   Total cfm (design and actual)
   Outdoor air cfm (design and actual)
   Return air cfm (design and actual)
   Total static pressure (design and actual)
   Measured discharge static pressure
   Measured suction static pressure
   Pressure drop across components, if possible

h. Diffuser, Registers and Grilles:
   System identification
   Grille number
   Grille or diffuser manufacturer
   Manufacturer's model number
   ADC flow factor
   Instrument to be used with ADC flow factor
   Grille size
   Design velocity
   Design cfm
   Final measured velocity
   Final measured cfm

(5) All reports shall be certified by the Testing and Balancing Contractor that the methods used and the results achieved are as specified. In addition, each individual reporting form submitted must bear the signature and the Technician.
F. GUARANTEE

(1) The test and balance firm shall include an extended warranty of 90 days, after the submittal of the test and balance report, during which time the Architect, at his discretion, may request a recheck or resetting of any outlet, supply air fan, exhaust fan, or any other item listed in the test report. The firm shall provide technicians to assist the Architect making any tests he may require during this period of time.

2. PRODUCTS

Not applicable for this section.

3. EXECUTION

A. INSPECTION

(1) The Testing and Balancing Contractor shall act as an authorized inspection firm responsible to the Architect. He shall review the HVAC design drawings and shop drawings prior to fabrication and installation of the HVAC systems to insure that all of the necessary balancing equipment required to balance these systems is shown.

B. PREPARATION

(1) Coordinate Schedules with the Test and Balancing Engineer and provide sufficient time before final completion of work so that testing and balancing can be accomplished. Provide all labor and tools to make corrections to the system when required to balance the system without undue delay to the Test and Balancing Contractor. Put all equipment into full operation and continue it in operation during each working day of testing and balancing. No test and balancing work shall start until all of the air handling equipment has new filters installed. The Test and Balancing Engineer shall be kept informed during the construction of the project of major changes made to the HVAC system. Provide the Test and Balancing Contractor with one (1) set of shop drawings on all equipment which he will be required to work on when balancing the HVAC system.

(2) Shop drawings shall be submitted to the Test and Balancing Contractor. The Test and Balancing Contractor will, during the construction of the HVAC system, make job site inspections to familiarize himself with the project and shall report to the Architect.
items installed incorrectly or not installed in accordance with the contract drawings and specifications.

(3) Work shall not begin until all systems which are to be tested have been completed and are in full working order. Put all systems and equipment into full operation and continue the operation of all equipment during each working day of the testing and balancing work.

C. AIR DISTRIBUTION SYSTEMS TESTING AND BALANCING

(1) Utilizing the latest issue of design documents, compare the installed equipment to the design and check for completeness of the installation.

(2) The system and air outlet air quantities shall be balanced to the values indicated on the drawings.

(3) The grille manufacturer’s outlet flow factors as determined by the ADC test code and recommended procedure for testing air outlets shall be used.

(4) Pre-balance equipment check:
   a. Check fan housing, ducts, duct elbows, coils, louvers, etc., to insure they are clean and free of foreign material.
   
   b. Check filters to insure that they are clean and in place.
   
   c. Examine drivers for proper belt tension and alignment.
   
   d. Check fan and motor lubrication.
   
   e. Coordinate with Electrical Contractor to verify correct motor overload protectors.
   
   f. Check fans for proper rotation.

(5) Pre-balance System Check:
   a. Verify installation of all required balancing dampers. Set all systems dampers in their open position.
   
   b. Check for air leaks at the fan and the system ductwork. Coordinate with the Contractor for repair of leaks.
c. Position all building doors and windows (if a part of system design) in their normal position.

d. Check air temperature to insure required air temperature delivery.

(6) Air Handling Equipment Balance:

a. Check motor amperage and voltage to insure motor is not being overloaded.

b. Measure and set minimum outdoor air quantity where applicable.

c. Determine the volume of air being delivered by the fan. Adjust the fan speed, if belt-driven, or the dampers in the system, if direct-driven, to increase or decrease the flow required. If the speed is increased, or the flow changes due to a damper adjustment, insure that the motor is not overloaded.

d. Check fan and motor speed, no-load amperage, operating amperage and voltage. Calculate brake horsepower.

e. Take fan static pressure readings.

f. Variation of air flow for all modes of operation from the design values shall be within +10 percent of design values.

D. OTHER EQUIPMENT TESTS

(1) All equipment installed shall be tested, adjusted, and reported upon unless stated otherwise. The equipment discussed herein is not necessarily all of the equipment requiring testing.

(2) Fans:

a. Record nameplate data.

b. Check belt alignment and belt tension.

c. Measure current, voltage, and speed (rpm).

END OF SECTION
233113 - DUCTWORK

1. GENERAL

A. WORK INCLUDED

(1) Ductwork and Plenums
(2) Fasteners
(3) Sealants
(4) Duct Cleaning
(5) Leakage Testing

B. RELATED WORK

(1) Section 230500 – Common Work Results for HVAC
(2) Section 230529 – Hangers & Supports for HVAC
(3) Section 230593 – Testing, Adjusting & Balancing For HVAC
(4) Section 232114 – Duct Lining
(5) Section 233300 – Air Duct Accessories
(6) Section 233423 – HVAC Power Ventilators
(7) Section 233713 – Diffusers, Registers & Grilles

C. REFERENCE STANDARDS

(1) Fabricate in accordance with the most recent edition of SMACNA HVAC Duct Construction Standards.

D. DEFINITIONS
(1) Duct Sizes: Dimensions shown on the Drawings are sheet metal sizes.

(2) Low Pressure or Velocity: All return, transfer, and exhaust ductwork and all supply ductwork from all constant volume air handlers and fan coils, and downstream of terminal units to air devices.

2. PART 2 PRODUCTS

A. ACCEPTABLE MANUFACTURERS

(1) Products manufactured by the following manufacturers meeting these specifications are acceptable.

(2) Flexible ducts manufactured by Thermaflex, Wire Mold, Certain Tweed and ATCO are acceptable.

(3) Round and oval ductwork manufactured by United Sheet Metal, Semco, General Metals, Spiro-Fab and Metal Manufacturing are acceptable.

B. 2.2 MATERIALS

(1) Galvanized Ductwork: Galvanized steel lock forming quality having zinc coating of 1.25 ounces per square foot for each side per ASTM A525 G90. All ductwork to be galvanized unless otherwise noted.

(2) Fasteners: Use rivets and bolts throughout; sheet metal screws accepted on low pressure ducts.

(3) Sealant: Water resistant, fire resistive, compatible with mating materials. All mastics shall be listed and labeled in accordance with U.L. 181.

(4) Flexible Ducts: UL 181 Class 1 airduct consisting of inner vapor barrier supported by a helically wound steel wire; wrapped with 1-1/2" thick flexible fibrous glass insulation, enclosed by a reinforced foil outer jacket. Ductwork shall be a factory fabricated assembly with hanger tab support system equal to CertainTeed Certaflex 25.

C. 2.3 FABRICATION

(1) The contractor shall visit the premises and thoroughly familiarize himself with all the details of the work and working conditions and to verify all dimensions in the field prior to fabricating ductwork. The
contractor shall advise the Architect of any discrepancy prior to fabrication.

(2) Lap metal ducts in direction of air flow. Hammer down edges and slips to leave smooth duct interior.

(3) Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on center line. Where not possible and where rectangular elbows used, provide single thickness type turning vanes.

(4) Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible.

(5) Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breathe, rattle, vibrate, or sag. Seal all duct joints and connections with "hard cast" tape sealant or equal as ducts are being assembled.

(6) Fabricate continuously welded medium pressure round duct fittings one gauge heavier than gauges indicated for duct size. Joints shall be 4 inch cemented slip joint, brazed, or electric welded. Prime coat welded joints. Fabricate elbows of five piece construction. Provide standard 45 degree takeoffs unless otherwise indicated where conical 90 degrees tee takeoff connections may be used.

D. DUCT GAUGES AND REINFORCEMENT

(1) Provide minimum duct wall thickness and reinforcement as required by the latest edition of the SMACNA HVAC Duct Construction Standards.

3. EXECUTION

A. INSTALLATION

(1) Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

(2) Clean duct system with forced air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning.
(3) Seal all transverse joints with Hard Cast or equivalent.

(4) Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

(5) At each point where ducts pass through partitions, seal joints around duct with non-combustible material. Provide sheet metal closure around opening when exposed.

(6) Paint all exposed ductwork as directed by architect.

END OF SECTION
233114 - DUCT LINING

1. GENERAL
   A. WORK INCLUDED
      (1) Duct Lining
   B. RELATED WORK
      (1) Section 230500 – Common Work Results for HVAC
      (2) Section 233113 – Ductwork
   C. QUALITY ASSURANCE
      (1) International Mechanical Code and Local Codes
   D. REFERENCE STANDARDS
      (1) SMACNA Duct Liner Application Standard
   E. SHOP DRAWINGS
      (1) Submit product data and installation instructions in accordance with Section 230500.

2. PRODUCTS
   A. ACCEPTABLE MANUFACTURERS
      (1) Products manufactured by Johns-Manville, Knauf, Owens-Corning or CertainTeed meeting these specifications are acceptable.
   B. MATERIALS
      (1) All low pressure rectangular supply ductwork between the terminal unit and air devices and all constant volume rectangular supply and return ductwork shall be provided with Type 1 flexible duct liner, 1" thick, 1-1/2 lbs. per cubic foot density "K" value at 75 degrees F mean temperature of 0.26 BTU/in/sq. ft./degrees F/hr., suitable for temperature range of 40 degrees F to 250 degrees F and maximum velocity of 4000 fpm.
(2) Weld pins or approved equal mechanical fasteners capable of withstanding 50 lb. tensile load test.

(3) Adhesives meeting FM, UL and NFPA requirements for fire and smoke ratings, maximum 25 flame spread and maximum 50 smoke developed. Adhesives shall conform to Adhesive and Sealant Council Standards for Adhesives for Duct Liner ASC-A-7001C-1972.

3. EXECUTION

A. INSTALLATION

(1) All duct designated to receive liner shall be completely covered with liner. Transverse joints shall be neatly butted and there shall be no interruptions or gaps. The black coated surface of the duct liner shall face the air stream. Provide 26 gauge galvanized steel “Z” strip at leading edge of duct liner.

(2) Duct liner shall be adhered to sheet metal with mechanical fasteners and 100% coverage of adhesive. Transverse edges of liner to be coated with adhesive. Duct liner shall be cut to assure overlapped and compressed longitudinal corner joints.

(3) For velocities up to 2,000 feet per minute, fasteners shall start within 3” of the upstream transverse edges of the Duct Liner and 3” from the longitudinal joints and shall be spaced at a maximum of 12’ o.c. around the perimeter of the duct, except that they may be a maximum of 12” from corner break. Elsewhere they shall be a maximum of 18” o.c. except that they shall be placed no more than 6” from a longitudinal joint of the liner nor 12” from a corner break.

END OF SECTION
233115 - DUCT INSULATION

1. GENERAL

A. WORK INCLUDED

(1) Duct Thermal Insulation

(2) B. Adhesives, Tie Wires, Tapes

B. RELATED WORK

(1) Section 230500 – Common Work Results for HVAC

(2) Section 233113 – Ductwork

C. QUALITY ASSURANCE

(1) All insulation materials required for ductwork shall be furnished and installed under the contract. The execution of the work shall be by approved insulation contractor in strict accordance with the best practice of the trade and the intent of the specification.

(2) It is mandatory that all insulation be applied in a neat and workmanlike manner. Contractor shall be required to remove and replace all insulation not applied in strict accordance with the manufacturer's specifications or not presenting a neat finished appearance.

(3) The Ductwork insulation shall meet NFPA Standards 902 and 906 for fire resistance.

D. SUBMITTALS

(1) Submit product data and installation instructions in accordance with Section 230500.

E. REFERENCE STANDARDS

(1) NFPA 90A and 90B.

(2) ASTM Standard E84-75.

F. JOB CONDITIONS
(1) Deliver material to job site in original non-broken factory packaging, labeled with manufacturer’s density and thickness.

2. PRODUCTS

A. ACCEPTABLE MANUFACTURERS

(1) Materials as manufactured by Certain-Teed, Johns-Manville, Knaul, Owens-Corning, Foster Products, Childers or approved equal meeting these specifications are acceptable.

B. TYPE AND PERFORMANCE

(1) Adhesives and Insulation Materials: Composite fire and smoke hazard ratings maximum 25 for Flame Spread and 50 for Smoke Developed. Adhesives to be waterproof.

(2) All Rectangular and Round Supply Ducts: Rigid or Flexible fibrous glass insulation, 1 1/2 inch thick "K" value at 75 degrees F maximum 0.26 btu/hr./sq.ft./Deg. F/hr. with factory applied reinforced aluminum foil vapor barrier for temperatures for +40 Deg. F to +250 Deg. F services.

3. EXECUTION

A. PREPARATION

(1) Do not install covering before ductwork has been tested and approved.

(2) Ensure surface is clean and dry prior to installation. Ensure insulation is dry before and during application.

B. INSTALLATION

(1) Ensure installation is continuous through inside walls. Pack around ducts with fireproof self-supporting insulation material, properly sealed.

(2) Finish insulation neatly at hangers, supports and other protrusions.

(3) Locate insulation or cover seams in least visible locations.

(4) Concealed Ducts: Adhere flexible insulation to ductwork with adhesive applied in 6 inch wide strips on 16 inch centers. Provide 16
gage annealed tie wire tied, spiral wound or half hitched at 16 inch centers for securing duct insulation until adhesive sets. Butt insulation and seal joints and breaks in ducts conveying air at less than room temperature with 2 inch of foil adhered over joint.

(5) Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship.

END OF SECTION
233300 – AIR DUCT ACCESSORIES

1. GENERAL

A. WORK INCLUDED

(1) Access Doors
(2) Balancing Dampers
(3) Backdraft Dampers
(4) Flexible Connections
(5) Turning Vanes

B. RELATED WORK

(1) Section 230500 – Common Work Results for HVAC
(2) Section 230593 – Testing, Adjusting & Balancing For HVAC
(3) Section 230700 – HVAC Insulation
(4) Section 233113 – Ductwork
(5) Section 232114 – Duct Lining
(6) Section 233423 – HVAC Power Ventilators
(7) Section 233713 – Diffusers, Registers & Grilles

C. QUALITY ASSURANCE

(1) Accessories shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems as applicable.

(2) Fabricate in accordance with ASHRAE handbooks and SMACNA duct manuals.

D. SUBMITTALS

(1) Submit product data in accordance with Section 230500.
2. PRODUCTS

A. ACCEPTABLE MANUFACTURERS

   (1) Products manufactured by Air Balance, Greenheck, DuroDyne, Penn, Krueger or Ruskin meeting these specifications are acceptable.

B. ACCESS DOORS

   (1) Fabricate rigid and close-fitting doors of galvanized steel with sealing gaskets and quick fastening locking devices. For internally lined or insulated ductwork, install minimum one inch thick insulation with sheet metal cover.

   (2) Provide two hinges and two sash locks for sizes up to 18 inch square, two hinges and two compression latches with outside and inside handles for sizes up to 24 inch x 48 inch. Provide an additional hinge for larger sizes.

C. DAMPERS

   (1) Fabricate balancing dampers of galvanized steel, minimum 16 gauge and provide with locking quadrants.

   (2) Fabricate multi-blade damper of opposed blade pattern with maximum size 16 sq. ft. Assemble center and edge crimped blade in prime coated or galvanized channel frame with suitable hardware and locking quadrant.

   (3) Fabricate multi-blade, counter balanced backdraft dampers with blades a maximum 8 inch width having felt or flexible vinyl sealing edges, linked together in rattle-free manner and width adjustment device to permit setting for varying differential static pressure.

D. FLEXIBLE CONNECTION

   (1) Fabricate of neoprene coated flameproof fabric approximately 4 inch wide tightly crimped into metal edging strip and attach to ducting and equipment by screws or bolts at 6 inch intervals.

E. TURNING VANES

   (1) Fabricate turning vanes and rails of 24 gauge galvanized steel and assemble rattle free.
(2) Turning vanes shall be single thickness prefabricated or assembled per manufacturer's instructions for optimum shape.

(3) Secure to duct with sheet metal screws, rivets or weld. Final assembly shall be rattle free.

F. APPLICATION

(1) Provide access doors for inspection and cleaning at filters, fans, terminal units, fire/smoke dampers, and as indicated on the drawings. Review locations prior to fabrication.

(2) Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing and where indicated on the drawings.

(3) Provide flexible connections immediately adjacent to equipment, in ducts associated with fans, equipment subject to forced vibration and as shown on the drawings.

3. EXECUTION

A. INSTALLATION

(1) Install items in accordance with manufacturer's printed instructions and SMACNA Standards.

(2) For connections to fans, install 1/2 inch thick neoprene pad over fabric and hold in place with additional metal strips.

END OF SECTION
233423 – HVAC POWER VENTILATORS

1. GENERAL
   A. WORK INCLUDED
      (1) Ceiling Exhaust Fans
   B. RELATED WORK
      (1) Section 230500 – Common Work Results for HVAC
      (2) Section 230593 – Testing, Adjusting & Balancing For HVAC
      (3) Section 233113 – Ductwork
      (4) Section 233300 – Air Duct Accessories
   C. QUALITY ASSURANCE
      (1) AMCA rated for both sound and air flow performance
      (2) AMCA rating seals
   D. SUBMITTALS
      (1) Submit product data including dimensional data, material specifications, capacity data, sound data and installation procedures in accordance with Section 230500.

2. PRODUCTS
   A. ACCEPTABLE MANUFACTURERS
      (1) Products manufactured by Greenheck, Cook, Penn, Jenn Fan or Twin City meeting these specifications are acceptable.
   B. CEILING EXHAUST FANS
      (1) Provide direct driven centrifugal fan. Performance shall meet or exceed that scheduled.
      (2) Fan wheels shall be forward curved type statically and dynamically balanced for vibration free operation. Motor shall have built in thermal overload protection and shall be mounted on vibration
isolators. Fan scroll shall be galvanized steel of lock seam construction.

(3) Housing shall be lined with acoustical fiberglass insulation. Construction shall be of corrosion resistant galvanized steel. Exhaust grille when required shall be aluminum with white baked enamel finish.

3. EXECUTION

A. INSTALLATION

(1) Connect to ductwork as specified in Section 233113.

(2) Balance in accordance with Section 230593.

(3) Install fans as shown on the drawings.

END OF SECTION
233713 – DIFFUSERS, REGISTERS & GRILLES

1. GENERAL

A. WORK INCLUDED

(1) Supply, Return, Transfer and Exhaust Air Devices and Accessories.

B. RELATED WORK

(1) Section 230500 – Common Work Results for HVAC
(2) Section 230593 – Testing, Adjusting & Balancing For HVAC
(3) Section 233113 – Ductwork
(4) Section 233300 – Air Duct Accessories

C. QUALITY ASSURANCE

(1) Make air flow tests and sound level measurement in accordance with applicable ADC equipment test codes and ASHRAE standards.

(2) Manufacturer shall certify cataloged performance and ensure correct application of air outlet types.

D. SUBMITTALS

(1) Submit in accordance with Section 230500.

(2) Submit product data and shop drawings covering each item together with schedule of outlets, listing cfm, neck velocity, NC level and Ak factor and air flow measurement procedures.

E. JOB CONDITIONS

(1) Review requirements (including architectural drawings) of outlets as to size, finish, and type of mounting prior to submitting shop drawings and schedules of outlets.

(2) Check location of outlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
2. PRODUCTS

A. ACCEPTABLE MANUFACTURERS

(1) Products manufactured by Krueger, Tuttle & Baily, Titus, J&J, Price or Nailor, meeting these specifications are acceptable.

B. GENERAL REQUIREMENTS

(1) Provide air devices equal in all respects to those scheduled on the drawings.

(2) Rate units in accordance with ADC standards.

(3) Base air outlet application on space noise level of NC 35 maximum in all areas unless indicated otherwise on drawings.

(4) Provide supply outlets with sponge rubber seal around edge.

(5) All devices shall be factory finished.

(6) When required provide air devices factory installed in metal panels painted to match air device finish. Panel shall be suitable for insertion into lay-in-tile ceilings.

3. EXECUTION

A. INSTALLATION

(1) Install items in accordance with manufacturer's printed instructions.

(2) Paint ductwork visible behind air outlets matt black.

(3) Seal square to round adaptors or lined plenum boxes air tight to diffusers or grilles.

(4) When required cut metal panels for insertion in ceiling at grid location where tiles may be less than nominal size. Center diffuser or grille within modified panel.

END OF SECTION
236200 - PACKAGED HEATING/COOLING UNITS

1. GENERAL

   A. WORK INCLUDED
      (1) Packaged heating/cooling unit
      (2) Controls

   B. RELATED WORK
      (1) Section 15010 - Basic Mechanical Requirements
      (2) Section 15090 - Support, Anchors & Sleeves
      (3) Section 15890 - Ductwork
      (4) Section 15990 - Testing, Adjusting & Balancing

   C. QUALITY ASSURANCE
      (1) Meet the requirements of UL and applicable codes.
      (2) Test and rate cooling systems to the appropriate ARI Standard.

   D. REFERENCE STANDARDS
      (1) ARI Standard 210/240 or 360 and 270.
      (2) National Electrical Code.
      (3) American Gas Association Certification.

   E. SUBMITTALS
      (1) Submit shop drawings and product data in accordance with Section 15010.
      (2) Submit manufacturer's installation instructions.
      (3) Submit manufacturer's descriptive literature including dimensions, capacity data, fan performance data, motor data and filter data.
      (4) Submit schedule of actual unit performance data versus design unit performance data.
F. WARRANTY

(1) Provide 5 year unconditional parts warranty on compressor.

2. PRODUCTS

A. ACCEPTABLE MANUFACTURER’S

(1) Units manufactured by Carrier or Trane meeting or exceeding these specifications are acceptable.

B. TYPE AND PERFORMANCE

(1) Units shall be self-contained, factory assembled and prewired with single point electrical connection. Unit shall consist of cabinet and frame, supply fan, heat exchanger and burner, economizer cycle dampers and controls when required, compressors, evaporator coil, condenser coil and fan(s) and all required and necessary safety and operating controls.

(2) Units shall be suitable for outdoor use.

(3) Unit shall meet or exceed the capacity scheduled.

C. CABINET AND FRAME

(1) Unit shall be fabricated of heavy gauge, galvanized steel with weather-resistant baked enamel finish.

(2) Insulate the cabinet interior with 1/2 inch thick minimum coated fiberglass insulation. Protect exposed edges from erosion.

(3) Cabinet panels shall be easily removable for serving.

(4) Unit shall have a factory installed, sloped condensate drain pan with drain connection.

D. FANS AND MOTORS

(1) Fans shall be forward curved centrifugal type. Fan and motor shall be internally isolated from the unit frame. Fans shall be belt or direct driven as scheduled. Belt drive units shall have an adjustable pitch motor pulley.
(2) Outdoor fans shall be of the propeller type, direct drive, statically and dynamically balanced. Fan motor shall have permanently lubricated bearings and have built-in thermal overload protection. Fan motor shall be totally enclosed.

E. COILS

(1) Evaporator and condenser coils shall be of non-ferrous construction with aluminum plate fins mechanically bonded to enhanced copper tubes with all joints brazed. Coils shall be factory leak tested and pressure tested. Condenser coil shall be provided with hail guard assembly to prevent damage from hail and debris.

F. COMPRESSORS

(1) Compressor(s) shall be fully hermetic or semi-hermetic with unloading and have spring vibration isolators and crankcase heaters. Compressors shall be capable of operation down to 25 degrees F outdoor air temperature.

G. COOLING SYSTEM SAFETY CONTROLS

(1) Compressors shall be provided with the following minimum protections:

   a. Overcurrent Protection.
   b. Over-Temperature Protection.
   c. Short Cycle (minimum 5 minutes before restart).
   d. Loss of Refrigerant (low pressure).
   e. Indoor Coil Freeze Protection Thermostat.
   f. High-Pressure Switch.

H. GAS HEAT EXCHANGERS

(1) Heating section shall have a heat exchanger constructed of corrosion resistant steel components.

(2) Gas burner shall be induced draft combustion type and shall be constructed of corrosion resistant steel.

(3) Heating controls shall consist of the following as a minimum:

   a. Redundant gas main valve.
   b. Electronic spark ignition system.
   c. High temperature limit switches for excessive bonnet temperature.
d. Flame rollout switch.
e. Flame proving controls.

I. REFRIGERANT COMPONENTS

(1) Refrigerant circuit components shall include:

a. Filter drier
b. Refrigerant strainer
c. Service gage connections on suction, discharge and liquid lines.

J. FILTER SECTION

(1) Filter section shall consist of two inch thick disposable pleated media filters, Aerostar Green Pleat MERV-13 or equivalent.

K. CONTROLS

(1) Unit shall be provided with a protected low-voltage control circuit.

(2) Unit shall be controlled by a Honeywell programmable thermostat as scheduled with locking cover. Install thermostat and wire to unit as per manufacturer's instructions.

L. OUTDOOR DAMPER

(1) Unit shall be provided with a motorized outdoor air damper and rainhood. Rainhood shall be provided with birdscreen covering outdoor air opening.

M. ELECTRICAL

(1) Unit shall be provided with a single point electrical connection.

(2) Unit shall be provided with a unit-mounted, non-fused disconnect switch.

3. EXECUTION

A. INSTALLATION

(1) Install units in strict accordance with manufacturer's installation instructions.
(2) Unit shall be installed on a factory roof curb. Roof curb shall allow the installation and securing of ductwork prior to maintaining unit on curb.

(3) Provide flexible connection at all duct connections. Provide sheet metal weather guard over flex connections on side discharge units.

END OF SECTION
DIVISION 26 - ELECTRICAL

260500 - ELECTRICAL

1. GENERAL

A. GENERAL

(1) Drawings, Section I - Legal Documents and Division 1 Specification Sections, apply to this Section.

(2) This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

B. SCOPE

(1) Includes all labor, material and equipment required to furnish and install a complete electrical system as shown on the drawings and as specified herein.

(2) Work includes but is not necessarily limited to the following:

a. Electrical secondary feeders and distribution equipment and grounding.
b. Wiring for light and power to all outlets, devices, controls and equipment.
c. Lighting fixtures as specified, complete with lamps and necessary hardware.
d. Lighting controls, complete with necessary incidentals, wiring and programming for a complete and operating system.
e. Final electrical connections of equipment specified or furnished under other divisions of this specification.
f. Special systems (fire alarm, etc.) as specified by other sections of this specification or as indicated on the drawings.
g. Cutting and patching as necessary to install electrical work.

(3) Omission of express reference to any material or labor necessary for or incidental to a complete installation shall not be construed as releasing Contractor from furnishing such material and labor. The electrical system as installed shall be complete and functional with all electrical items in operable condition.
(4) Carefully examine the building site and compare the drawings with existing conditions. Further, verify utility requirements with the proper utility companies involved. By the act of submitting a bid, the contractor shall be deemed to have made such examination and to have accepted such conditions, and to have made allowance therefore in preparing this bid.

(5) Construction Power Electrical Service:

a. Make all necessary arrangements, apply for all permits, and provide all temporary electrical service and lighting required for construction purposes during the entire period of construction.
b. Coordinate with all trades and provide temporary lighting and power adequate for construction.
c. Comply with all applicable OSHA and NFPA-70, National Electrical Code requirements for temporary wiring at construction sites.
d. Existing building electrical system may be used as the power supply for the construction power electrical system. Verify point of connection with Architect/Engineer.

(6) Permanent Utility Services:

a. Existing to remain.

C. DRAWINGS

(1) The architectural drawings take precedence over the electrical drawings in the representation of the general construction work and the drawings of the various trades take precedence in the representation of the work of those trades.

(2) For the purpose of clearness and legibility, the electrical drawings are essentially diagrammatic. The size and location of equipment is shown to scale whenever possible, but the contractor shall make use of all the data in the contract documents to properly locate all electrical equipment.

a. Refer to Architectural Reflected Ceiling Plan for exact location of ceiling mounted lighting fixtures, heat and smoke detectors, loud speakers and similar equipment which are mounted on ceiling.
b. When Architectural Interior or Millwork Elevations show electrical outlets, the locations on such elevations shall define the exact location of the outlet.
c. Maintain Code clearances about electric equipment.
d. Although the drawings are diagrammatic and the exact location and routing of raceways is not indicated, it is intended that the point-to-point connections of the raceways as shown on the circuited plans be adhered to.

e. When raceways are indicated to be installed above the floor (by being drawn with solid lines), they shall not be changed to be run under floor inside the building. When specifically indicated (by dashed lines) raceways shall run under floor inside the building.

f. In the event that Contractor proposes to deviate from layouts as indicated, submit for prior approval before making any changes. Shop drawings showing the proposed changes may be required. All such changes shall be approved and be recorded in the record drawings.

D. CODES AND STANDARDS

(1) All electrical equipment, materials and method furnished and installed by this contractor shall comply with the 2017 edition of NFPA-70 National Electrical Code as adopted by the legally constituted authorities having jurisdiction; including all local ordinances, safety orders of the State Division of Industrial Safety, and state and local fire marshals. All code references in the Contract Documents (Drawings, Specifications, Addenda, Change Orders, etc.) are to the current adopted edition of the Code.

(2) Materials shall be listed by a nationally recognized testing laboratory which is accepted by the authority having jurisdiction, such as Underwriter's Laboratories, Inc. (UL), where such a listing exists for that style or general arrangement of equipment. Equipment shall be installed and connected in compliance with all the listing instructions.

(3) It is recognized that Codes specify minimum standards, and whenever the Contract Documents call for materials, workmanship, arrangement or construction of quality or standard higher than Code, the Contract Documents shall take precedence. In the event that the contract documents call for a quality or standard lower than Code, then Code requirements shall govern.

E. PERMITS AND INSPECTIONS

(1) Refer to Division 1 for Permits.

(2) All work shall be subject to the inspection of any authorized agency and the Owner or Owner's Agent. No work shall be covered or concealed in any way prior to inspection and approval by the proper authorities. Should uninspected work be covered, the contractor
shall, at no cost to Owner, uncover all such work and, after it has been inspected and approved, repair all damage done in a manner satisfactory to the Architect.

F. APPROVAL OF MATERIALS

(1) For convenience in designation, certain materials are specified by manufacturer's name and catalog number. Alternative equipment which is of equal capacity, style, size and quality as the equipment specified may be used subject to the approval of the Architect. The burden of proof as to the comparative suitability of the alternate equipment shall be upon the Contractor. Provide all information, demonstrations, and samples necessary or related hereto as required by the Architect. The Architect shall be the sole judge in such matters and his decision shall be final.

(2) Requests for approval of alternate material or method shall be submitted to the Architect at least seven (7) days prior to bid date and in addition shall conform with all provisions of the General Provisions of these Specifications.

(3) Where the use of alternate materials results in a change of arrangement, location or size from that indicated on the drawings, the Contractor shall submit for approval shop drawings showing the proposed changes.

(4) Verify availability of all equipment and materials proposed for use in execution of Contract prior to submitting same for approval. Discontinuance of production of any equipment or materials shall not relieve the Contractor from furnishing and installing approved alternate equipment and/or materials of equal quality and style without additional cost to Owner.

G. SUBMITTALS

(1) Before starting work, submit shop drawings and/or product literature for at least the materials listed below:

Switchboard modifications -- product literature for switch added.
Panelboards -- shop drawings
Motor Controls -- product literature
Safety Switches and Disconnects -- product literature
Switches, Receptacles and Device Cover Plates -- product literature
Floor Boxes and Covers -- product literature
Wall Box Dimmers -- product literature
Lighting Fixtures -- shop drawings

260500 ELECTRICAL
Nameplates and Engraved Cover Plates -- schedule describing all types
Special Systems (i.e. fire alarm, etc.) -- shop drawings
Control Systems -- shop drawings

(2) Submittals shall be in accordance with Division 1 requirements. If paper submittals are provided, they shall be in four (4) copies, one (1) of which will be returned to the contractor. The contractor shall make reproductions of the returned copy in quantities as required for his own use and in addition shall give one (1) copy to the equipment supplier, keep one (1) copy at his office and include four (4) copies in the Maintenance and Operating Instructions.

(3) Do not include operating, maintenance or repair manuals in the product submittals unless specifically requested.

(4) All electrical submittals shall be made at one time. Incomplete or partial submittals will not be accepted.

(5) Re-submittals shall not include material which was previously reviewed and approved.

(6) Shop drawings larger than 11" x 17" paper size shall be prepared using the same size drawing sheet as the bid/construction documents. Such shop drawings shall be included as part of the Record Drawings.

H. MAINTENANCE AND OPERATING INSTRUCTIONS

(1) Prepare four (4) complete sets of Maintenance and Operating Instructions which cover electrical systems and equipment furnished and installed for this project.

(2) Include all published literature which is provided by the equipment manufacturer. As a minimum, the following shall be provided:

a. Instruction sheets or manuals
b. Repair manuals
c. Spare parts lists
d. Wiring Diagrams
e. Manufacturer's warrantee information
f. written material or drawings furnished with or packed with Other the products or available on-line from the equipment manufacturer.
g. Manufacturer and Catalog Number of all ballasts and lamps.
(3) Do not include copies of the electrical product submittals in the O & M material. Only submit material described in 1.8 B. 1 thru 8 above.

(4) Assemble each set of Maintenance and Operating Instructions into 3-ring binder.

(5) Provide table of contents and tab separators to organize the manual by specification section and product type.

(6) Provide a copy of the product submittals in a separate binder labeled: "Electrical Products Submittals."

I. RECORD DRAWINGS

(1) Provide and keep up-to-date one (1) separate complete and legible "as-built" set of drawing prints, corrected daily and showing every change from the original drawings and specifications, exact "as-built" location, size and kind of fixture, runs of wire and conduit, location of pull and junction boxes, and other equipment as actually installed. In addition, items changed or deleted by addendum or change orders shall be indicated. This drawing shall be kept on-site and used only as a record set. This set shall not be used for construction purposes.

(2) In each section of the record drawings and specifications the manufacturer's name, product name, and catalog number for each product used shall be indicated. When the bid documents indicate more than one name or catalog number for a product, the products not used shall be deleted from the record drawings so that only the exact products used are the only types described on the record drawings.

(3) Addenda, Change Order and Clarification drawings issued for construction during the course of the work shall be drawn on to the record drawings at the correct location and on the correct drawings.

(4) Changes as shown on corrected drawing prints shall be professionally drawn in accordance with Division 1 requirements. Such drawings shall be accurate and will provide a record for future maintenance and service.

J. MASTER KEYING

(1) For equipment such as panelboards and equipment cabinets which are supplied with integral locks, all such locks shall be keyed alike. Furnish three (3) sets of keys for each lock.
(2) For equipment such as outdoor switchboards and safety switches provide provisions for padlocking for all such equipment with direct access by the public. Provide Master Model 3 padlocks for all such equipment. In addition on safety switches and similar equipment provide one padlock for unit cover and one padlock to lock switch handle on. All padlocks keyed alike, unless specifically indicated otherwise.

(3) All keys shall be identified as to the locks which they operate.

K. IDENTIFICATION

(1) For switchboards and panels, provide nameplates for each section or panel stating the section name and voltage. Each circuit breaker and fused switch in distribution panels or switchboards shall have a nameplate indicating the load served.

(2) Individual safety switches, disconnect switches, starters, contactors, time-switches, etc. shall have nameplates describing the load served.

(3) Switches for lights installed remote from the switch location shall have engraved cover plates provided.

(4) Control switches for mechanical and other equipment shall be identified by engraved cover plates or nameplates attached to the switch.

   a. Describe the load controlled.
   b. Describe the power source feeding the equipment.
   c. Engraved cover plates shall be factory machine engraved and shall have black enamel filled lettering.
   d. Nameplates shall be engraved bakelite type.
   e. Applies to all switches except light switches.

(5) Nameplates as specified above shall be constructed of laminated bakelite.

   a. Use white-black-white color laminated bakelite.
   b. Lettering shall be 3/16" high (or larger when called for on drawings) cut through white layer of bakelite to reveal black layer.
   c. All nameplates shall be screwed or riveted to the equipment. Adhesive attachment is not acceptable.

(6) Home run junction boxes and pull boxes located above accessible ceilings and exposed in unfinished spaces shall have panel name
and circuit numbers written on the box cover. Use waterproof marking pen, 1" high lettering.

(7) Pull and junction boxes for special systems (i.e. fire alarm, etc.) shall be identified. Use waterproof marker on cover for boxes above accessible ceilings and exposed in unfinished spaces, write identification on inside of box when in exposed location.

(8) Pull, outlet and junction boxes for special systems shall be color coded by painting the inside and outside of box (and cover when in unfinished space or in equipment room) prior to installation. Boxes painted after installation are not acceptable. Also write type of system on cover.

   a. Fire Alarm: Red

(9) Panelboards shall be field marked to warn qualified persons of potential electric arc flash hazards in accordance with NFPA-70, Article 110.16. Warning label shall comply with ANSI Z535.4-2011 requirements.

L. COOPERATION WITH OTHERS

(1) Work shall proceed so that it will harmonize with that of other trades. All work shall coordinate with other trades and contractor is responsible for correct placing of work in proper location to avoid conflict.

M. PRELIMINARY OPERATION

(1) Owner may require operation of any portion of systems or equipment prior to final completion and acceptance of work. Such preliminary operation shall not be construed as an acceptance of any work.

(2) Contractor shall become familiar with the requirements and schedule for construction phasing and shall comply as required to have Electrical systems operational at the appropriate time. It may be necessary for electrical work to be completed ahead of other trades or ahead of the scheduled completion of a given area of the building in order to make the work functional in a preceding phase of work.

N. CHANGES AND ADDITIONAL WORK

(1) Changes shall not be made from the work as indicated except on written order of Architect, stating change to be made for the work.
O. PROTECTION

(1) Materials, equipment, etc., including those furnished by others that are to be installed by this contractor shall be received and properly protected from damage.

P. WARRANTY

(1) Refer to Division 1 for basic warranty requirements.

(2) LED Drivers and lighting controls shall be warranted for at least two years, including material and labor to replace defective equipment.

(3) When manufacturer’s standard warranty exceeds the warranty as described in Division 1 the full manufacturer's warranty shall apply to this work.

2. PRODUCTS

A. GENERAL

(1) Except as specifically noted, materials shall be new, full weight or size, standard in every way, the best quality of their respective kinds, and satisfactory to the Architect.

(2) Equipment and Materials shall be suitable for use intended (i.e. weatherproof enclosures for exterior or wet locations, proper voltage ratings for fuses and safety switches, etc.).

(3) All metallic conduit shall be hot dipped galvanized, sherardized or electro-galvanized.

B. RACEWAYS

(1) Rigid Metallic Conduit:

   a. Full weight, minimum size is 3/4 inch trade size.

   b. Fittings installed underground, in wet locations or exposed outdoors shall be threaded type -- no set screw or compression types.

   c. Fittings installed indoors where otherwise impracticable to install threaded type fittings shall be permitted to be steel compression type. Other indoor locations shall use threaded type fittings.

   d. Rigid Metallic Conduit installed underground or concealed in slabs on grade shall be protected from corrosion by Scotch No. 50 tape, half overlap wrapped. Such tape wrapping
shall cover the entire conduit system below grade or in concrete slabs on grade.

e. Rigid Metallic Conduit shall be permitted to be used as raceway for all wiring systems at any location concealed or exposed (exposed wiring only when specifically permitted). Hazardous (classified) locations shall be required to use Rigid Metallic Conduit with threaded fittings.

(2) Intermediate Metal Conduit (IMC):

a. Minimum size is 3/4 inch trade size.
b. Fittings installed underground, in wet locations or exposed outdoors shall be threaded type -- no set screw or compression types.
c. Fittings installed indoors where otherwise impracticable to install threaded type fittings shall be permitted to be steel compression type. Other indoor locations shall use threaded type fittings.
d. IMC installed underground or in concrete slabs on grade shall be protected from corrosion as specified above for Rigid Metallic Conduit.
e. IMC shall be permitted to be used for raceways for all wiring systems at any location concealed or exposed (exposed wiring only when specifically permitted) except IMC shall not be used in hazardous locations or when drawings indicate use of a different type of raceway for the specific run.

(3) Electrical Metallic Tubing (EMT):

a. Minimum size is 1/2 inch trade size.
b. EMT may be used concealed in attic, furred spaces and stud walls.
c. EMT may be used concealed in masonry and brick above grade. EMT may be embedded in poured concrete above grade.
d. EMT may be used exposed, but only when exposed raceway is permitted, EMT shall not be used for exposed raceways subject to physical damage.

1. Do not use exposed EMT above roofs.
2. Do not use exposed EMT in any location subject to severe physical damage such as loading docks or locations exposed to vehicular traffic.
3. In such locations exposed raceways shall be rigid steel or IMC raceways with threaded fittings.

(4) EMT Fittings and Connectors:
a. Appleton, Crouse-Hinds or Thomas & Betts.
b. In concealed work use steel set screw or compression type fittings. Do not use die cast or pot metal type.
c. In exposed work use only steel compression type fittings for sizes 2 inch and smaller (steel set screw fittings are acceptable only for exposed runs of 2 1/2 inch and larger EMT).
d. Use insulated throat connectors except when insulated bushings are used.

(5) Rigid Non-Metallic Conduit (PVC):

a. Heavy wall schedule 40 or of type as noted on drawings. Minimum size is 3/4" trade size.
b. Fittings used with PVC shall be cement-on style, rated for same operating temperature as the conduit.
c. PVC may be used for underground conduit runs both outside and under floor inside building. PVC shall not be used anywhere above grade or exposed. Use Rigid Metallic Conduit for penetrations through concrete slabs from PVC below. For pulls over 25' long, bends and elbows in PVC system shall be rigid steel, with appropriate coupling to PVC or they shall be concrete encased PVC.
d. Provide concrete encasement for PVC only when indicated. Concrete encasement shall cover conduits minimum of 3" on all sides. Provide plastic conduit supports as necessary for duct alignment in concrete encased duct banks.

(6) Flexible Metallic Conduit (Greenfield):

a. Greenfield connectors shall be screw clamp type -- no twist-in connectors allowed. Do not use 90 degree flex connectors without prior approval.
b. Use only steel flex conduit, not aluminum. Minimum size shall be 1/2" except 3/8" may be used for light fixture whips.
c. Greenfield shall be used in lengths not to exceed 3'-0". Use only indoors in dry locations.
d. Fixture whips up to 6'-0" long may be used to connect lay-in type lighting fixtures. Connectors on flex whips shall be screw clamp type. (In general, light fixture manufacturer's standard flex connectors are not acceptable.)

(7) Liquid-Tight Flexible Non-Metallic Conduit (Liquid-Tight Flex):

a. Connectors shall be weatherproof compression type.
b. Minimum size 1/2" trade size.
c. Liquid-tight flex shall be used in lengths not to exceed 3'-0".
d. Do not use Liquid-Tight Flexible Metallic Conduit in locations outdoors where exposed to sunlight.

(8) Special Raceways: As indicated.

C. OUTLET BOXES AND JUNCTION BOXES

(1) Galvanized code gauge steel construction for concealed work.

(2) Size in accordance with Articles 312 and 314 of NFPA-70 National Electrical Code.

(3) Provide plaster rings or tile covers of proper gang as required.

(4) Minimum size for any outlet is 4" sq. x 1-1/2" deep or larger when required with appropriate plaster ring.

(5) Use cast aluminum type boxes and matching cover plates for surface outlets, switches, etc. in exposed work and for surface or flush weather-proof locations. Use Pass & Seymour WPB series in 1-gang, 2-gang and 3-gang configurations or equivalent by other manufacturers. (Above 8'-0" A.F.F. stamped steel boxes may be used in interior locations when exposed except when surface metal raceways are used.)

(6) Floor boxes shall be Legrand Evolution Series with grey finished metallic covers. Unless otherwise indicated provide dual service boxes flush in floor with (2) duplex power receptacle devices and provision for telephone-data outlet devices. Actual telephone-data devices provided by Division 27. Coordinate exact mounting plate required for telephone-data devices. When used for feed to systems furniture provide systems furniture activation cover and liquid tight flexible conduit whips to connect to furniture. Covers and flanges shall match floor finishes at each location. Provide carpet flanges in carpeted locations. Minimum size conduit supplying telephone-data compartment is 1". Provide larger conduit when indicated.

D. CONDUCTORS

(1) Unless indicated otherwise, all conductors shall be insulated, 98% minimum conductivity copper.

a. Minimum size for lighting and power circuits is No. 12 AWG, provide larger size when indicated or required.

b. Fixture whips and internal wiring in light fixtures shall be No. 18 AWG minimum, unless larger size indicated.
c. Minimum size for fire alarm circuits is No. 14 AWG, solid copper conductor.

d. Minimum size for line voltage controls is No. 14 AWG, stranded or solid copper conductor when overcurrent protection on control circuit does not exceed 15 amperes.

e. Minimum size for low voltage controls is No. 18 AWG, copper. Low voltage control wiring shall be type and ratings as recommended by the control system manufacturer.

f. Provide Aluminum Alloy type conductors for specific, indicated feeders and service lateral conductors only.

(2) Conductors construction:

a. No. 10 AWG and smaller solid conductor.

b. No. 8 AWG and larger for general wiring stranded conductor.

c. No. 8 - 2 AWG exposed grounding conductors solid conductor.

(3) Conductor insulation:

a. No. 12 - 8 AWG in wet or dry locations: "THHN or THWN" or "THWN-2".

b. No. 6 AWG and larger in wet or dry locations: "THHN or THWN", "THWN-2", "XHHW" or "XHHW-2".


d. Fire alarm conductors installed underground (individual conductors): "XHHW" or "XHHW-2". Alternatively, West Penn AquaSeal type cable can be used.

e. Special conductor insulation as noted.

(4) Color code all conductors. Use colored insulation (not colored tape) for sizes No. 6 AWG and smaller. Use colored tape at all terminations, junction and pull boxes, etc., for sizes No. 4 AWG and larger.

a. 208Y/120V three phase system -- Neutral White, Phase A Black, Phase B Red, Phase C Blue, Ground Green.

(5) Copper conductor, #12 AWG minimum, THHN insulated in types AC and MC cables are approved for 15A and 20A branch circuits installed above grade in frame wall and above ceiling spaces. Provide AC and MC cables with proper color coded conductors for each circuit application.

E. WIRING DEVICES
(1) Catalog numbers listed below are for Pass & Seymour wiring devices. Equal products as manufactured by Arrow Hart, Hubbell and Leviton are acceptable.

(2) Color of all devices shall be brown unless otherwise indicated.

(3) Toggle Switches:
   a. Single pole, double pole, 3-way, 4-way Hard Use Specification Grade 20A 120/277V # CSB20AC1, CSB20AC2, CSB20AC3, CSB20AC4 respectively.
   b. Toggle switch type equipment disconnect switches shall be heavy duty industrial grade type of ampere rating, voltage and number of poles indicated.

(4) Manual Motor Starter Switches:
   a. Square D class 2510, with overload protection, 1-Pole or 2-pole as required. With overload heaters selected per manufacturer's recommendation for actual motor nameplate amperes. Use for all locations unless switch without overload protection is specifically indicated.
   b. When non-overload protected manual motor starter switches are indicated use Square D class 2510 switches of the proper style for the application.

(5) Duplex Receptacles:
   a. Tamper Resistant 20A, 125V #TR5362.
   b. Duplex receptacle devices shall have Auto-ground clip on one device mounting screw.
   c. On 15A circuits use 15A rated versions of devices indicated above.

(6) Ground Fault Circuit Interrupter Receptacles:
   Indoor Tamper Resistant 20A, 125V #2095TR.
   Outdoor or Weather Proof locations 20A, 125V #2095TRWR. These are also tamper resistant.
   On 15A circuits use 15A rated versions of devices indicated above.

(7) Special Receptacles: Ampere rating, voltage, number of poles and NEMA type as indicated. All such devices shall be specification grade. 20A and smaller devices shall be same color as listed above for switches and duplex receptacle type devices. 30A and larger single receptacles shall be permitted to be brown or black color if devices are not available in color to match the lower rated devices.
(8) Time Switches:
   a. As indicated. Refer to drawing notes.

(9) Photo Controls: Tork #2101/2104 or equal Paragon or Intermatic.
   Verify voltage with circuit to which unit is wired. Provide weatherproof junction box for mounting.

(10) Furnish all devices of similar type as products of a single manufacturer.

F. COVER PLATES

(1) For flush outlets in interior, non-weatherproof locations use Pass & Seymour standard size satin finish stainless steel #302. All plates shall be of same type and style. Do not use oversize cover plates to cover up oversized wall openings.

(2) For surface outlets in interior, non-weatherproof locations with exposed raceways and cast aluminum type boxes use stainless steel type flush device plates as above, sized to fit the cast box face.

(3) For weatherproof toggle switches use Pass & Seymour type CA1-GL, or approved equal.

(4) For weatherproof 15A or 20A, 125V duplex receptacles located in damp locations as defined in Article 406.8 (A) of NFPA-70 use Pass & Seymour type 4512 (for GFCI type duplex receptacle), or approved equal.

(5) For weatherproof 15A or 20A, 125V duplex receptacles located in wet locations as defined in Article 406.8 (B) of NFPA-70 use Pass & Seymour type WIUC10-G, or approved equal.

G. POWER DISTRIBUTION AND CONTROL EQUIPMENT

(1) General:
   a. For the following classes of equipment, the catalog numbers listed are for products as manufactured by Eaton Corporation. Equal products as manufactured by GE Industrial Solutions, Schneider Electric and Siemens are approved. Power distribution and control equipment shall be products of the same manufacturer.
   b. Terminal lugs for circuits rated 15A and larger shall be rated for use with 75° C rated conductors. Terminal lugs on
equipment shall be sized for the conductors sizes as indicated. If necessary provide larger circuit breaker frame sizes in order to accommodate the required lugs.

c. Additions to existing switchboard or panelboards shall be same manufacturer, type and ratings as the existing equipment and shall maintain the UL listing of the existing equipment. Provide all necessary connecting bus work, mounting hardware and dead-front fillers for a factory-like installation.

(2) Branch Circuit and Distribution Panelboards:

a. Type: Eaton PRL1a (250V or less), as scheduled.

1. Arrangement and Ratings: Circuit breakers and spaces shall be arranged and numbered exactly as shown on panel schedules. Where spaces are indicated, they shall be fully prepared to accept an overcurrent device of the maximum rating for the frame size used in the panelboard. Circuit breakers shall be quick-make, quick-break, trip free thermal magnetic type unless otherwise indicated. Minimum interrupting capacity 10,000 AIC unless indicated higher. Two and three pole breakers shall be common trip, do not use single pole breakers with handle ties for this function. Use bolt-on style circuit breakers. Circuits shall be numbered adjacent to each breaker with an engraved plastic number strip running vertical between the breakers or other approved permanent circuit number tags – paper or tape labels which can be peeled off breaker are not acceptable. Provide a "Caution--Series Rated System" nameplate on interior of panel dead front when series tested short circuit rating of the panelboard is used.

2. Bus Bars: All phase, neutral and ground busses shall be 98% conductivity copper or tin plated aluminum. Provide an equipment ground bus, bolted or welded to the panel cabinet in all panelboards. When so indicated, provide an insulated, isolated ground bus. When so indicated, provide double capacity neutral bus (200% neutral).

3. Cabinets and Fronts: Cabinets shall be made from unpainted galvanized code gauge steel. Cabinets shall be of sufficient size to provide a minimum gutter space on all sides not less than as required by Underwriter's Laboratories Standard (UL) 67 and in no case less than 4". Minimum size of cabinets is 20" wide x 5-3/4" deep. End walls shall be blank. Fronts
shall be fabricated from code gauge sheet steel. All exterior and interior steel surfaces of the front shall be properly cleaned and finished with gray ANSI-61 paint over a rust inhibiting phosphatized coating. Fronts for flush panels shall overlap the cabinet by at least 3/4" all around. Surface fronts shall have the same height and width as the cabinet. Provide a door over the overcurrent devices on all panelboards except for fusible switch panelboards. Doors shall have concealed hinges. Doors shall have a lock (all locks keyed alike). **Panelboard fronts shall be hinged trim type with hinges to box on one side of the trim. (Door over dead front circuit breaker compartment; entire front opens by removing screws.)**

4. Panels 60 circuits and larger shall be provided with oversized boxes, at least 26" wide x 6" deep to provide sufficient room for wiring leaving top and bottom of box.

5. **Directories:** Provide a metal directory frame welded to inside of panel front door with 1/16" thick plastic cover or plastic pocket type directory card holder. Provide typewritten list of all circuits. Circuits shall be described using the final room name or number and any other pertinent data to accurately and succinctly describe the destination of all circuits.

(3) **Safety Switches and Disconnects:**

a. Non-fused single pole toggle switch for 115 volt, single phase motors 3/4 horsepower and smaller shall be Square "D" Class 2510 motor starting switch.

b. 60A and smaller 240V class disconnect switches shall be General Duty type.

c. Provide "Heavy-Duty" type safety switches for all locations except as indicated above.

d. Enclosures shall be suitable for location where used, i.e., use NEMA 3R enclosures at locations exposed to weather.

e. Disconnects for motors and A/C equipment shall be horsepower rated.

f. Disconnects shall be capable of being padlocked in the open or closed position.

H. **FUSES**

(1) Provide Limitron, Low-Peak, Fusetron and Hi-Cap types as manufactured by Bussmann Division of Eaton Corporation. Fuses shall be of the voltage class, ampere rating and type as noted on the drawings. Fuse clips shall match the fuse type and class.
(2) When class RK-1 fuses are specified provide a permanent nameplate on each switch enclosure which states: "CAUTION -- REPLACE FUSES ONLY WITH CURRENT LIMITING TYPE OF SAME RATING."

(3) Littelfuse and Mersen are approved equal to Bussmann.

I. LIGHTING FIXTURES

(1) Lighting fixture schedule: The manufacturer, type, style, size, color, general arrangement, mounting, etc., of all lighting fixtures shall be as indicated on the lighting fixture schedule and as described elsewhere in the drawings.

(2) General: All lighting fixtures shall be furnished complete with all brackets, lenses, lamps, etc., for a complete and finished installation.
   a. Coordinate fixture mounting configuration to make fixtures compatible with ceilings used on this project at each location. The contractor shall be responsible for making fixtures compatible and fixtures which do not fit ceiling system must be corrected at Contractor’s expense.
   b. Voltage for LED drivers shall correspond to voltage of circuit wired on -- in general, LED fixtures are 120V. Multi-voltage drivers may be used when suitable for the purpose.

J. LAMPS:

(1) LED lamps as indicated on light fixture schedule.

3. EXECUTION

A. GENERAL

(1) Work to be accomplished under this specification shall be performed by experienced, competent personnel.

(2) Except where otherwise specifically permitted by these specifications or drawings, raceways and wiring of every system shall be installed concealed.

(3) Except where otherwise specifically permitted by these specifications or drawings, all wiring of every system shall be installed in approved raceways. The "PRODUCTS" part of this
specification describes the approved locations for each type of raceway system and the requirements set forth in that section shall be adhered to for all raceway systems including systems for power, lighting, telephone, sound, fire alarm, television, data, and any other special system. The use of types NM, SE and UF cable type wiring methods are **not approved**. Types AC and MC cables are approved for 20A and smaller branch circuits installed above grade concealed in walls or in above ceiling locations. MC cables may also be installed exposed in open ceiling locations, but shall be adequately supported and installed and routed parallel or perpendicular to the building structure and supported tight to the structure or ceiling deck above.

(4) Any installation of underground conduit stub-ups to switchboards, transformers and similar equipment will not be accepted until such time that reviewed shop drawings are on site to compare rough-ins with conduit space in the equipment.

(5) Chases and Openings:

a. Any chases and openings other than those described on drawings that are found necessary to accommodate electrical work shall be provided at proper time to prevent unnecessary cutting. Provide approved access panels or doors if necessary.

b. Fire stop all chases and openings as required by Fire Stopping section.

(6) Penetrations through Roof:

a. Penetration through finished roof caused by work of this division shall be properly flashed or otherwise waterproofed as required by the roofer and Architect.

b. No penetration shall occur closer than 12" from any other penetration.

c. No electrical work shall run above roof except for vertical penetration for roof mounted HVAC equipment.

d. When roof mounted HVAC units are provided with integral disconnecting means supplied by the HVAC unit manufacturer, the electrical supply wiring to the unit shall be routed through the unit curb without roof penetration. Thermostat, control and interlock wiring shall also be routed in the same manner.

B. **EXCAVATION**
(1) Do all excavating required to install the work. Except under concrete floors laid on the ground, the underground conduit shall be buried to a depth of not less than 24" below the finished grade.

(2) The depth of conduits run under concrete floors and slabs on grade (concrete minimum 4" thickness) may be reduced to 8" below the slab. Do not allow conduits to be embedded in the concrete floor, except at floor boxes and where conduits turn out of floor.

(3) Backfill, puddle and tamp all excavations and remove all surplus materials from the site. All backfill and compaction shall be in accordance with the Architect's instructions. Provide plastic marker tape 12" below grade over all underground conduit runs outside of building.

C. INSTALLATION OF RACEWAYS

(1) Unless otherwise noted, all wiring of every description shall be run in conduit. Conduit, except as otherwise specifically noted, shall be run concealed. Exposed conduit shall be run parallel with supporting wall, beam or ceiling and with each other, with right angle turns consisting of cast metal fittings (LB condulets shall not be used for conduit larger than 1-1/4" in diameter) or symmetrical bends, and with supports spaced per NEC requirements. All runs of conduit shall be installed in such manner as to avoid trapped condensation. No junctions or splices in wire shall be made in condulets.

(2) Minimum size conduit is 1/2". Where five or more No. 12 AWG wires are in one conduit minimum size shall be 3/4". Where No. 10 AWG or larger wire is used minimum size shall be 3/4". Larger sizes as noted. Minimum size underground conduit is 3/4".

(3) Conduit shall be installed as a complete system, continuous from outlet to outlet, cabinet, box for fitting and be so mechanically and electrically connected that adequate electrical continuity from one conduit to another is secured.

(4) Conduit to be installed in concrete work shall be carefully laid and rigidly supported in the forms, as directed, and in such manner as to provide proper clearances and so that all boxes and outlets will be in exact locations after concrete has set and forms are removed. Conduit run in concrete walls or floors shall be embedded deep enough so that no portions of the conduit or fittings will show through the concrete and so there will be no cracking of the concrete finished surfaces. Obtain approval of the Structural Engineer prior to installing conduits in concrete work. Use only rigid steel conduit embedded in concrete.
(5) Conduit shall not run through any structural member of the building, except as specifically directed by the Architect. This shall not prohibit conduit run through open web trusses or through factory made openings in structural members.

(6) On exposed runs of conduit where junctions, bends or offsets are required, provide condulets whether such condulets are indicated on drawings or not. Bends will not be permitted around corners or beams, or equipment. Condulet covers shall be accessible. Condulet fittings shall not be used on conduit larger than 1-1/4" trade size. Use junction boxes on larger conduit. Use two hole straps on all exposed runs of conduit.

(7) Separate conduit shall be used for each home run indicated on drawings. Do not combine conduit runs. Run exactly as shown on the plan. Do not run branch circuits under floor unless so indicated (by dashed lines) on the plans.

(8) Conduits shall be securely supported to the building structure. Support or fasten conduits within 18" of all outlet, junction or pull boxes. Support or fasten conduit runs at intervals not to exceed NEC requirements. Exposed conduits 1" size or smaller and located below 8' AFF shall be supported at least every 5'. Single runs of conduit may be supported with 12 gauge galvanized tie wire. For multiple runs, use conduit trapezes made of suitable Unistrut or Kindorf channel with threaded rod (not less than 1/4" outside diameter) and suitable conduit straps. For multiple exposed conduit runs, use Unistrut or Kindorf channel with suitable conduit straps. Channels embedded in concrete shall not be deeper than 7/8". Nails, perforated strap and plumber's tape are not acceptable means of support.

(9) Anchors which fasten devices, raceways, etc. to brick or masonry shall be metal expansion type with screws or bolts. Plastic or shot-in anchors are not acceptable.

(10) Anchors which fasten devices, raceways, etc. to hollow, dry, or plaster walls shall be a type which expands after it has penetrated the material such as toggle, molly, etc. Wood screws into 2x4 or larger wood framing is acceptable.

(11) Conduit shall not run closer than 6" to any hot water pipe, steam pipe, heater flue or vent.

(12) Projections through roofing shall be made watertight by proper flashing and/or pitch pockets satisfactory to Roofing Contractor, Architect and roof bonding company. Verify method prior to rough-
in and comply as required. Contractor shall supply all required roof jacks.

(13) Conduit connections to tops of enclosures located outdoors or other location subject to water shall be made with Myers hubs or weatherproof hubs that are supplied with the equipment. Gasketed locknuts as only weatherproof fitting are not approved for conduits entering the tops of enclosures.

(14) The use of pliers for tightening of conduit connections or making up runs of conduit is prohibited. All conduit joints and connections shall be wrench tight.

(15) Upon completing the installation of any run of conduit, test the runs and see that they are free from all obstructions and have a smooth interior. Plug each end with conduit pennies and bushings and leave plugged until ready to pull wire. Wood or fiber plugs or concrete nails are not acceptable.

(16) The ends of conduit shall be cut square and carefully reamed out to full size with a tapered burring reamer and shouldered in the fitting.

(17) No running threads will be permitted, special union fittings shall be used in lieu thereof. The open ends of conduit shall be kept closed with approved conduit seals during the construction of the building. Rigid conduit couplings shall be of the threaded type.

(18) Except as otherwise indicated on drawings, bends in conduits 1" and larger shall be made with standard conduit ells. Wire or cable bends in junction boxes or pull boxes shall be made on long radius of not less than five (5) times diameter of the cable. Nesting of conduits shall be made when more than one conduit is used in parallel without the use of standard ells.

(19) Where ungrounded conductors of No. 4 or larger enter a raceway in a gutter, pull box, junction box, or auxiliary gutter, the conductors shall be protected by a substantial bushing or liner sleeve providing a smoothly rounded insulating surface, unless the conductors are separated from the raceway fitting by a substantial insulating material securely fastened in place.

(20) A nylon pull string shall be installed in all raceways which do not have conductors pulled by this contractor.

(21) Flexible "Greenfield" shall be used only where necessary, approved, or directed for connections to equipment which is removable (as for belt replacement and adjustment), or is mounted on isolation units for nontransmittal of vibration or sounds of
operation. Regulation fittings shall be used for all connections to terminal, junction and switch boxes. Use liquid-tight flex where exposed to weather. Maximum length shall be 3'-0". Run conduit to within 3'-0" of outlet before using flex.

D. INSTALLATION OF OUTLETS, WIRING DEVICES AND JUNCTION BOXES

(1) Lighting outlets, convenience outlets and wall switches shall be installed as shown on the drawings, with switch control as indicated. All outlets and switches shall be accurately located and shall be installed plumb with building walls. The final position of such outlets must be verified with the Architect. Wall switches shall typically be within 4" of the door frame on the lock side according to the Architectural plans.

(2) Outlets in unplastered masonry walls shall be 4" square (or larger when required) boxes with deep plaster rings or box extensions already attached to the box when the outlet box is installed in the masonry. Help the Mason set each box (and every box) in place, so that the face of the ring or extension is vertical and approximately 1/16" in from the finished surface. The Mason and Electrician shall be mutually responsible for the proper execution of the work.

(3) Light outlet boxes shall be sized to comply with Code, but not less than 4" square.

(4) Ceiling outlet boxes shall be equipped with plaster rings and extension rings as required.

(5) Convenience outlets, switch, telephone, television and intercom outlets, shall be 4" square (or larger when required) pressed steel boxes with plaster rings.

(6) Flush outlet boxes shall be installed with the box edge flush to not more than 1/16" recessed into the wall. Provide box extensions as necessary for proper installation.

(7) Outlet boxes in concrete shall be of a type which will allow the placing of conduit without displacing of reinforcement bars.

(8) Boxes shall be set so that when covers are in place they will be flush with finished building surface, and so that fixtures will stand at right angles. Where exposed to weather, use conduit cast body type or cast aluminum type.
(9) All boxes shall be securely supported to the building structure. In metal stud work, provide bracing between studs for all boxes. Attachment to a single vertical metal stud without additional bracing is not acceptable.

(10) Safety switches and disconnects for HVAC and similar equipment shall be supported independently from unit. Provide Unistrut or Kindorf brackets from structure as required. Do not attach switches to equipment or duct work.

(11) Approved bar hangers, fitted with fixture studs, shall be used to support outlet boxes in stud partitions and furred or drywall ceilings.

(12) The Owner shall reserve the right, without additional cost, to relocate any outlet up to 6'-0" from the location shown on the drawings provided that such instruction is given to the contractor prior to rough-in.

(13) Mounting Heights:

a. Light Switches +3'-10" unless otherwise directed
b. Control Switches for HVAC +3'-10" unless otherwise directed
c. Receptacles +1'-6" unless otherwise directed
d. Telephone, Data, etc. +1'-6" unless otherwise directed
e. Wall bracket lights As directed
f. Fire Alarm Manual Station +3'-10" unless otherwise directed
g. Fire Alarm Strobe Light +6'-8" to bottom of strobe
h. Heights given are from box center to finish floor. Consult Architect for any heights not listed above.

(14) All receptacle devices shall be installed vertical unless otherwise directed. Install with grounding pole at top. When receptacle devices are horizontally mounted, grounding pole shall be at left side.

(15) All control apparatus, outlet boxes, junction and pull boxes, and other similar equipment shall be installed and maintained in accessible positions and locations. Refer to the complete set of drawings covering the mechanical and architectural plans for locations of HVAC equipment (dampers, motors, etc.) and access panels. At areas adjacent to these openings, provide accessible locations for junction and pull boxes.

(16) Provide a junction box accessible and close to all recessed can and similar type lighting fixtures. This box shall be furnished as part of the lighting fixture. Wiring from lamp socket to junction box shall be approved for temperature involved. This box shall be sized to allow a minimum of eight No. 12 AWG conductors in the box. When
more than eight No. 12 AWG conductors are in box provide oversize boxes.

(17) Receptacle outlet supplying wall mounted electric drinking fountains shall be concealed within the drinking fountain so that unit cord and plug is not visible after installation.

(18) Surface mounted boxes installed below 8'-0" A.F.F. shall be cast aluminum type or when larger than three gang shall be standard sheet metal type with screw on cover and no knockouts.

(19) Every box shall have a cover, either blank or the appropriate system outlet cover. Telephone, data and similar outlets which are not activated with an outlet shall have a blank stainless steel cover installed.

(20) Outlets for telephone, data, television, computer and similar systems shall have a raceway stubbed from the outlet box to accessible ceiling space unless specifically indicated otherwise. When no accessible ceilings exist the raceway shall run to the nearest telephone (or applicable other system) terminal board or terminating point on the same floor level as the outlet. Floor outlets may stub into ceiling space of floor below unless specifically indicated otherwise. Minimum size raceway is 1-inch. Use larger raceways when specifically indicated. When a specific raceway layout is shown on drawings it shall take precedence over the general requirements stated in this paragraph. When no specific raceway layout is shown on drawings then the general requirements stated herein shall apply. Coordinate with ‘T’ series drawings and associated Division 17 specification sections.

(21) Switch and receptacle devices shall be wired using the back wiring terminals on the device which are tightened by a screw. Do not thru-wire receptacles. Instead, provide wire nut splice in box to tap circuit to feed the receptacle device. All screw terminals on wiring devices shall be made tight.

(22) Three-way and four-way switches shall be installed such that when all switches on the same switch leg are operated with the toggle handle down the load will be off.

(23) 15A and 20A, 125V receptacle devices shall be GFCI type or GFCI protected when installed in locations per NFPA-70, National Electrical Code Section 210.8 (B). Do not use feed-thru type devices unless indicated. GFCI protection shall be provided for higher rated receptacle devices as described in NEC 210.8 (B).
(24) 15A and 20A, 125V receptacle devices in Pre-School, Child Care Spaces, Auditorium, Gymnasium, and all outside shall be Tamper Resistant type.

E. INSTALLATION OF CONDUCTORS

(1) All circuits and feeder wires shall be continuous from switch to terminal or most distant outlet. No splices shall be made except in pull, junction or outlet boxes, or in switchboards or panels.

(2) Thoroughly clean out all conduits and wireways and see that all parts are perfectly dry before pulling any wires. Do not install any permanent wiring until all drywall taping is done and dirt removed. Any run of conduit which does not allow conductors to be fished in readily will be condemned and the run must be replaced by other conduit satisfactory to the Architect.

(3) Splices and taps for conductors No. 10 AWG and smaller shall be made with approved solderless mechanical connectors, size of the connector to be selected in accordance with the listing of the connector. All splices and taps which are not self-insulating shall be covered with thermoplastic insulating tape (Scotch No. 33) layered to a thickness equal to or greater than the conductor insulation.

(4) At all outlet and switch boxes, leave not less than 6" free conductor outside of the box for connection of devices and fixtures.

(5) Provide pull boxes wherever indicated or as necessary to facilitate the pulling in of wires or cables. Run shall not exceed 200' for straight pulls without any bends. Reduce pull box spacing to 150' if one 90 degree bend or equivalent in the run; 100' if two 90 degree bends or equivalent in the run; and 90' if more than two 90 degree bends or equivalent in the run. Pull boxes shall be sized in accordance with Article 314 of the National Electrical Code.

(6) Vertical runs shall be supported in accordance with Section 300-19 of NFPA-70 National Electrical Code. Use wedge-in conduit cable supports or cleats in J-box as required.

(7) Underground splices in pull boxes or direct buried shall be insulated with listed splicing and insulating materials for submersible, waterproof splices.

(8) Minimum size conductors for power and lighting circuits is #12AWG, copper. Provide larger conductors when indicated.
(9) Do not combine neutrals to make multi-wire branch circuits unless circuits are specifically indicated that way and multi-pole overcurrent devices with simultaneous switching of all line-voltage conductors are provided.

F. TAGGING

(1) All branch circuits shall be left tagged in panelboards, gutters, etc., for the purpose of distinguishing the various circuits. Phase, neutral, equipment grounding and isolated grounding conductors shall be tagged with circuit numbers. In addition, where more than one circuit occurs in junction boxes, provide tags indicating circuit numbers. All feeders and main lines shall be tagged in all junction boxes, gutters, switchboards, etc. Use Ideal or Brady wire marker numbers for circuit numbers, etc. Do not use metal numbering tags.

(2) In panel gutters, junction and pull boxes containing multiple neutrals, neutral conductors shall be tagged with circuit numbers to ensure that multi-wire branch circuits are not inadvertently made by sharing neutrals between two or three phase legs.

G. INSTALLATION OF PANELS, SWITCHBOARDS, ETC.

(1) Panels and equipment enclosures shall be securely supported to wall to which they are mounted in accordance with the equipment manufacturer's installation instructions.

(2) In general, branch circuit panels shall be installed with top at 6'-3" above finished floor. For wall mounted panels over 5'-6" high consult Architect for mounting height.

(3) When more than one branch circuit panel is installed in the same location or room, the panels shall be mounted with tops at all same height.

(4) Provide at least one 1-1/4 inch conduit nipple between all adjacent panel back boxes that are flush mounted at a common location. This conduit shall be empty for future use.

(5) Where branch circuit panels are installed flush with the walls, empty conduits shall be extended from the panel to an accessible space above or as indicated on the plans. Furnish a minimum of one 3/4" conduit for every three single pole circuit breakers or spaces or fraction thereof, but never less than three conduits. Provide one additional 1-1/4" conduit stub on all 200A and larger panels.
(6) When conduits leave top of weatherproof switchboards or panelboards, conduit connections to the equipment shall be made with Myers hubs or weatherproof hub type fittings by the switchboard or panelboard manufacturer. Generally, conduits shall not leave the tops of switchboards and panelboards installed outside unless specifically indicated; or with special permission.

(7) Panelboards and switchboards shall be installed with all operating handles not over 6'-7" above finished floor.

(8) Pads for switchboards, transformers, etc., shall have steel rebar reinforcing rods (#4) installed 12" on center. Concrete pads on grade over earth shall have conduit openings boxed out such that entering conduits are not encased by the concrete. The boxed out openings shall be able to accommodate future conduits additions. Concrete pads shall be sized approximately 2" larger than the switchboard plan dimension on all sides and shall be finished in accordance with the Concrete Section. Pad corners and edges shall be chamfered or rounded.

(9) Switchboards shall be bolted to the pads with approved seismic restraints and where mounted against a wall shall also be attached to the wall near the top of the enclosure.

(10) Install enclosed dry type transformers a minimum of 3" away from walls along sides with ventilation openings. Use flexible conduit to connect transformers if conduits connect to transformer above the floor. When conduits enter bottom of transformer from under floor flexible conduit connection is not required. Provide concrete housekeeping pad (4" high) for floor mounted transformers when indicated.

(11) Conductors in panelboard and switchboard interiors shall be neatly trained but shall not be bundled or tied together.

H. MOUNTING AND INSTALLATION OF LIGHT FIXTURES

(1) Lighting fixtures shall be adequately supported to building structure in accordance with applicable building codes.

(2) For lay-in grid type ceilings, provide a minimum of two (2) No. 12 gauge galvanized seismic wires from fixture to structure. Seismic wires shall be slack enough to permit the fixture to set level in the ceiling grid. Points of attachment of seismic wires to structure shall be located on opposite corners of the fixture so that the fixture will not drop more than 6" if the surrounding ceiling should fail to support the fixture. Provide at least three (3) full twists of seismic wires at attachment points.
Exception to this requirement: When ceiling system is designed and installed per manufacturer’s instructions and is rated to carry the weight of the installed light fixtures the seismic wires may be omitted. Ceiling system may require additional support wires installed within 3” of corners of the light fixture. Coordinate installation with ceiling installer.

(3) Provide approved seismic clips or screws to attach fixtures to the ceiling grid on all fixtures installed in grid ceilings. Such clips shall be constructed to be able to support the entire weight of the fixture in any direction.

(4) When for any reason light fixtures have an asymmetrical lighting pattern or appearance, all similar fixtures shall be installed with the with the asymmetry or pattern aligned or oriented in the same direction to provide a uniform appearance, unless other specific instruction is given regarding the placement or orientation of the light fixtures.

(5) In hard (non-accessible) ceilings, the fixture wiring and maintenance (such as LED Driver replacement) shall be accessible through the light fixture trim opening. Do not use flex conduit whips with remote inaccessible junction boxes to supply such fixtures. Instead, the branch circuit wiring shall be run to the permanent outlet box mounted to the fixture, accessible through the fixture trim opening.

(6) Any fixture with field replaceable lamps (screw shell or b-pin) installed and operated (other than testing) more than 3 months ahead of substantial completion (or preliminary use by the Owner) shall have new lamps installed at the time of substantial completion.

I. OVERCURRENT PROTECTION

(1) All equipment shall have proper overcurrent protection.

(2) The fuse sizes indicated on the drawings for motors and equipment are based on equipment sizes as specified. Substitutions of equipment as well as change in manufacturer may make overcurrent devices of a different rating necessary.

(3) The contractor shall verify the actual nameplate ampere rating of all equipment and shall select fuses and overload heaters based on the following criteria.

   a. For motors:
1. When fuses are the only overcurrent protective device for the motor they shall be rated not over 125% of the motor full load running current. If possible, select fuses rated between 105% and 115% of the motor full load running current.

2. When manual or magnetic starters are provided for motors, size overload heaters based on motor nameplate amperes according to the starter manufacturer's instructions. Fuses used in conjunction with motor starter shall be sized as indicated.

b. For heating units and appliances: Fuses shall be rated at least 125% but not over 150% of the unit full load running current, but in no case shall exceed the "Maximum Fuse Size" listed on the unit nameplate.

c. For packaged A/C units: The fuse size shall not exceed the "Maximum Fuse Size" listed on the unit nameplate.

J. GROUNDING

(1) All electrical apparatus, either stationary or portable, shall be adequately grounded, either by direct connection from frame of the apparatus or an approved ground wire connected securely to conduit, or by an approved grounded flexible cord through an approved cap and receptacle.

(2) All raceways and junction boxes shall be installed in a manner such that all joints are electrically conductive to function as an equipment grounding conductor.

(3) Concentric knockouts are not considered an adequate grounding means. Provide grounding bushings on all conduits connected to concentric knockouts for all system voltages.

(4) For branch circuits and feeders, provide a green insulated equipment grounding conductor sized in accordance with Table 250.122 of NFPA-70, National Electrical Code, or as indicated whichever is larger. Such conductor shall be installed in the raceway along with the circuit conductors whether or not shown on the drawings.
(5) Service main bonding and grounding shall be in accordance with the Service Grounding detail on the drawings. Always use the UFER ground if available.

(6) Neutrals throughout the system shall not be grounded except at service entrance equipment and at the first overcurrent devices served by the secondaries of dry type transformers.

K. EQUIPMENT CONNECTIONS

(1) All outlets, devices, equipment, etc., shall be connected to circuits and made operational as required.

(2) The Electrical Section shall connect electrically all heating, cooling, ventilating and plumbing equipment. For HVAC equipment as specified in the Mechanical Section, the Electrical Section shall run all conduits to electrically operated thermostats and controls (line voltage and 24 volt) and do all line voltage control wiring. 24 volt control wiring will be provided by the Mechanical Section. The Electrical Section shall provide magnetic starters unless otherwise indicated. A disconnecting means shall be provided at all equipment by the Electrical Section unless equipment is furnished with integral disconnecting means which meets the requirements of NFPA-70.

(3) The Electrical and Mechanical sub-contractors shall coordinate their work along with the Architect to attain proper installation.

L. TESTS AND COMMISSIONING

(1) Contractor shall test the work in sections. All defects shall be made good immediately at Contractor's expense, including all repairs to walls, ceilings, floors, or other portions of building damaged in making repairs. Furnish all instruments necessary for testing and pay observers necessary. Owner's representative will check observations only.

(2) Contractor shall perform megger test on all feeders. Minimum resistance shall be 500,000 ohms to ground using 500V megger. All branch circuits shall be free from grounds and shorts. Contractor shall perform, as directed, megger test on any branch circuit or feeder as required by Engineer. All megger tests shall be made with representative from Engineer's office present.

(3) Test and verify A-B-C phase rotation on main service entrance and at all motors.
(4) Electrical equipment with adjustments or settings shall be adjusted as recommended by the equipment manufacturer, engineer or Owner as required or directed, for proper operation.

(5) Controls systems such as lighting controls and time switches shall be adjusted to Owner's schedule, or as directed. The Contract shall include the initial adjustment or settings as well as two follow-up sessions to change or modify settings upon the request of the Owner which may occur any time during the warranty period. At the time such settings are made, the Contractor shall instruct the Owner on the methods of making the adjustments.

M. PAINTING

(1) Exposed electrical conduits, boxes, equipment, enclosures, etc. shall be finish painted to match adjacent building finishes, except in equipment rooms or unfinished space, work may be left unpainted.

(2) Do not paint panelboard fronts unless specifically directed.

END OF SECTION
DIVISION 27 - COMMUNICATIONS

270500 – BASIC COMMUNICATIONS SYSTEMS REQUIREMENTS

1. GENERAL

A. SECTION INCLUDES

(1) Basic Communications Systems Requirements specifically applicable to Division 27 sections, in addition to Division 1 - General Requirements.

B. RELATED WORK:

(1) Related work described elsewhere Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

C. SCOPE OF WORK

(1) This Specification and the accompanying drawings govern the work involved in furnishing, installing, testing and placing into satisfactory operation the Communications Systems as shown on the drawings and specified herein.

(2) Each Contractor shall provide all new materials as indicated in the schedules on the drawings, and/or in these specifications, and all items required to make their portion of the Communications Systems a finished and working system.

(3) Description of Systems include but are not limited to the following:

a. Complete Structured Cabling System including, but not limited to:

i. Voice and data backbone cabling and terminations.
ii. Voice and data horizontal cabling and terminations.
iii. Information outlets (IO’s) including faceplates, jacks and labeling.
iv. Equipment racks, cabinets, cable management and equipment.
v. Telecommunication Room equipment including patch panels, optical distribution cabinets, and termination blocks.

vi. Cabling pathways.

vii. Grounding and Bonding

viii. Testing


d. Complete Classroom Sound Reinforcement Systems

e. Low Voltage Communications Wiring (less than +120VAC) as specified and required for proper system control and communications.

f. All associated backboxes, conduit, miscellaneous cabling, and power supplies required for proper system installation & support systems.

g. Firestopping of penetrations as described in Division 7 Section 27 05 03.

D. QUALITY ASSURANCE

(1) Codes

a. National Fire Protection Association (NFPA)

b. NFPA 70, National Electrical Code® (NEC®)

c. NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces,

d. NFPA 72, National Fire Alarm Code®

 e. NFPA 75, Standard for the Protection of Electronic Computer/Data Processing Equipment

f. NFPA 76, Recommended Practice for the Fire Protection of Telecommunications Facilities

g. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems


i. NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials

j. NFPA 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces

k. NFPA 780, Standard for the Installation of Lightning Protection Systems
I. NFPA 5000™, Building Construction and Safety Code

(2) Reference Standards

a. Telecommunications Structured Cabling System Standards:

b. All work and equipment shall conform to the most current ratified version of the following published standards unless otherwise indicated that draft standards are to be followed:

i. ANSI/NECA/BICSI 568 - Standard for Installing Commercial Building Telecommunications Cabling

ii. ANSI/TIA-568-C.0 - Generic Telecommunications Cabling for Customer Premises

1.) C.1 - Commercial Building Telecommunications Standard

2.) C.2-Balanced Twisted-Pair Telecommunications Cabling and Components Standard

3.) C.3 - Optical Fiber Cabling Components Standard

4.) C.4 - Broadband Coaxial Cabling and Components Standard

iii. ANSI/TIA-569-C - Telecommunications Pathways and Spaces

iv. ANSI/TIA-606-B - Administration Standard for Commercial Telecommunications Infrastructure

v. ANSI/TIA-607-B - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

vi. ANSI/TIA-758-B - Customer-Owned Outside Plant Telecommunications Standard


viii. ANSI/TIA-942-A - Telecommunications Infrastructure Standard for Data Centers

ix. ANSI/TIA-1152 - Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling

x. ANSI/TIA-1179 - Healthcare Facility
Telecommunications Standard

xi. ANSI/TIA/EIA-598-C - Optical Fiber Cable Color Coding

xii. NFPA 70 (NEC) - National Electrical Code (Current Edition)

xiii. UL 444 - Standard for Safety for Communications Cable

(3) BICSI- Telecommunication Distribution Methods, Customer Owned Outside Plant

E. Refer to individual sections for additional Quality Assurance requirements.

F. Qualifications:

a. Only products of reputable manufacturers as determined by the Architect/Engineer will be acceptable.

b. The installing Contractor shall be certified by the manufacturer of the structured cabling system to offer Commscope/Uniprise 25 component warranty; Corning NPI 25 year warranty. Shop drawings will not be approved until proof of certification is submitted. Refer to the end of this specification section for certification documentation requirements.

c. Each Contractor and their subcontractors shall employ only workers who are skilled in their respective trades and fully trained. All workers involved in the termination of cabling shall be individually certified by the manufacturer.

d. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size.

e. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and copper structured cabling systems and have personnel adequately trained in the use of such tools and equipment.

f. The Contractor must have a RCDD (Registered Communications Distribution Designer) on-staff serving as
a project manager. Project shop drawings and test reports shall be stamped by the RCDD.

G. COMPLIANCE WITH CODES, LAWS, ORDINANCES:

(1) This Contractor shall conform to all requirements of the City of Tucson, Laws, Ordinances and other regulations having jurisdiction over this installation.

(2) This Contractor shall also conform to all published standards of the Vail Unified School District as related to this installation.

(3) In the event there are no local codes having jurisdiction over this job, the current issue of the National Electrical Code shall be followed.

(4) If there is a discrepancy between the codes and regulations having jurisdiction over this installation, and these specifications, the codes and regulations shall determine the method or equipment used.

(5) If the Contractor notes, at the time of bidding, any parts of the drawings and specifications which are not in accordance with the applicable codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time to follow this procedure, he shall submit with the proposal, a separate price required to make the system shown on the drawings comply with the codes and regulations.

(6) All changes to the system made after the letting of the contract, in order to comply with the applicable codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.

H. EXAMINATION OF DRAWINGS:

(1) The drawings for the Communications Systems work are diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment etc., and the approximate sizes of equipment.

(2) Contractor shall determine the exact locations of equipment and the exact routing of cabling so as to best fit the layout of the job. Scaling of the drawings will not be sufficient or accurate for determining this layout. Where a specific route is required, such route will be indicated on the drawings.

(3) Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
(4) If an item is either shown on the drawings, called for in the specifications or required for proper operation of the system, it shall be considered sufficient for including same in this contract.

(5) The determination of quantities of material and equipment required shall be made by the Contractor from the drawings. Schedules on the drawings and in the specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.

(6) Where words "provide", "install", or "furnish" are used on the drawings or in the specifications, it shall be taken to mean, to furnish, install and terminate completely ready for operation, the items mentioned.

I. Electronic Media/Files:

(1) Construction drawings for this project have been prepared utilizing AutoCAD/AutoCAD Revit.

(2) If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.

(3) The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.

(4) The drawings prepared for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.

(5) The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.

(6) The information is provided to expedite the project and assist the Contractor with no guarantee by Dplace as to the accuracy or correctness of the information provided. Dplace accepts no responsibility or liability for the Contractor’s use of these documents.

J. FIELD MEASUREMENTS:

(1) Before ordering any materials, this Contractor shall verify all pertinent dimensions at the job site and be responsible for their
270500 BASIC COMMUNICATIONS REQUIREMENTS

2. PRODUCTS

A. REFER TO INDIVIDUAL SECTIONS

B. General Product Requirements” Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.

C. Materials and equipment shall be the standard products of the manufacturer regularly engaged in the manufacture of the products and shall be the manufacturer’s latest standard design that has been in satisfactory use for at least 2 years prior to bid opening, and as approved by submittal.

3. EXECUTION

A. FIELD QUALITY CONTROL

(1) General:

   a. Refer to specific Division 27 sections for further requirements.
   
   b. The Contractor shall conduct all tests required and applicable to the work both during and after construction of the work.
   
   c. The necessary instruments and materials required to conduct or make the tests shall be supplied by the Contractor who shall also supply competent personnel for accuracy.

(2) Field conditions that will result in telecommunications drops that exceed the length limitations identified in the contract documents shall be brought to the attention of the Architect/Engineer prior to installation. The cost of reworking cabling that is too long, that was not brought to the written attention of the Architect/Engineer will be borne entirely by the Contractor.

(3) This Contractor shall provide the Architect/Engineer with written documentation of any cabling drops that will not be able to use the cable tray (where cable tray is available) due to the resulting cabling lengths. This documentation shall be submitted prior to installation and installation shall not commence until approved by the Architect/Engineer.
making the tests who has been schooled in the proper testing techniques.

d. In the event the results obtained in the tests are not satisfactory, This Contractor shall make such adjustments, replacements and changes as are necessary and shall then repeat the test or tests which disclose faulty or defective work or equipment, and shall make such additional tests as the Architect/Engineer or code enforcing agency deems necessary.

e. All telecommunications tests that fail, including those due to excessive cabling lengths, shall be remedied by the Contractor without cost to the project.

(2) Protection of Cable From Foreign Materials:

a. It is the Contractor’s responsibility to provide adequate physical protection to prevent foreign material application or contact with any cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer’s performance warranty. This includes, but is not limited, to overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.

b. Application of foreign materials of any kind on any cable, cable jacket or cable termination component will not be accepted. It shall be the Contractor’s responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable
c. Comply with manufacturer’s instruction for installation of products, Anchor each product securely in place, accurately located and aligned with other Work. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

B. INSTRUCTING THE OWNER’S REPRESENTATIVE

(1) Adequately instruct the Owner’s designated representative or representatives in the maintenance, care, and operation of the complete systems installed under this contract.

(2) Provide verbal and written instructions to the Owner’s representative or representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

(3) The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.

(4) The Architect/Engineer shall be notified of the time and place for the verbal instructions to be given to the Owner’s representative so that their representative can be present if desirable.

(5) Refer to the individual specification sections for minimum hours of instruction time for each system.

(6) Operating Instructions:

a. The Contractor is responsible for all instructions to the Owner and/or Owner’s operating staff on the Communications Systems.

b. If the Contractor does not have Engineers and/or Technicians on staff who can adequately provide the required instructions on system operation, performance, troubleshooting, care and maintenance, they shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

C. SYSTEM COMMISSIONING

(1) The Communications Systems included in the construction documents are to be complete and operating systems. The
Architect/Engineer will make periodic job site observations during the construction period. The system start-up, testing, configuration, and satisfactory system performance is the responsibility of the Contractor. This shall include all calibration and adjustments of electrical equipment controls, equipment settings, software configuration, troubleshooting and verification of software, and final adjustments that may be required.

(2) All operating conditions and control sequences shall be simulated and tested during the start-up period.

(3) The Contractor, subcontractors, and equipment suppliers are expected to have skilled technicians to insure that the system performs as designed. If the Architect/Engineer is requested to visit the job site for the purpose of trouble shooting, assisting in the satisfactory start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period through no fault of the design; the Contractor shall reimburse the Owner on a time and material basis for services rendered at the Architect/Engineer's standard hourly rates in effect at the time the services are requested. The Contractor shall be responsible for making payment to the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

D. ADJUST AND CLEAN

(1) Contractor shall thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.

(2) Contractor shall clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from equipment.

(3) Contractor shall remove all rubbish, debris, etc., accumulated during the Contractor's operations from the premises.

END OF SECTION
270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

1. GENERAL
   A. SECTION INCLUDES
      (1) Bonding Conductors
      (2) Bonding Connectors
      (3) Grounding Busbar (TMGB and TGB)
      (4) Rack-mount Telecommunications Grounding Busbar

   B. RELATED WORK
      (1) Section 260513 – Wire and Cable
      (2) Section 260526 – Grounding and Bonding
      (3) Section 260533 – Conduit
      (4) Section 260536 – Cable Trays
      (5) Section 264100 – Lightning Protection Systems
      (6) Section 270500 – Basic Communications Systems Requirements
      (7) Section 270532 – Firestopping
      (8) Section 270553 – Identification and Administration
      (9) Section 271116 – Communications Cabinets, Racks, Frames and Enclosures

   C. QUALITY ASSURANCE
      (1) Refer to Section 27 05 00 for relevant standards

      (2) Material and work specified herein shall comply with the applicable requirements of the current revision of the following:

         a. ANSI/TIA-568 Commercial Building Telecommunications Cabling Standard
         b. ANSI/TIA-569 Telecommunications Pathways and Spaces
         c. ANSI/TIA-606 Administration Standard for the Telecommunications Infrastructure
         d. BICSI – Telecommunications Distribution Methods Manual
         e. J-STD-607-A Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
         f. NFPA 70 – National Electric Code
(3) Communications bonding system component, device, equipment, and material manufacturer(s) shall have a minimum of five (5) years documented experience in the manufacture of communications bonding products.

(4) The entire installation shall comply with all applicable electrical codes, safety codes, and standards. All applicable components, devices, equipment, and material shall be listed by Underwriters' Laboratories, Inc.

D. REFERENCES

(1) ANSI/IEEE 1100 – Recommended Practice for Power and Grounding Sensitive Electronic Equipment in Industrial and Commercial Power Systems

(2) ANSI/TIA/EIA 568-C – Commercial Building Telecommunications Cabling Standard

(3) ANSI/TIA/EIA 569-A – Commercial Building Standard for Telecommunications Pathways and Spaces

(4) ANSI/TIA/EIA 606 – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

(5) ANSI/TIA/EIA 758 – Customer Owned Outside Plant

(6) ANSI-J-STD-607-A – Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications


(8) IEEE 837 – IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding

(9) NFPA 70 – National Electrical Code

(10) NFPA 780 – Standard for the Installation of Lightning Protection Systems

(11) UL 96 – Lightning Protection Components

(12) UL 96A – Installation Requirements for Lightning Protection Systems
E. SUBMITTALS

(1) Submit product data and shop drawings under provisions of Section 27 05 00 and Division 1.

(2) Provide manufacturer’s technical product specification sheet for each individual component type. Submitted data shall show the following:

(3) Compliance with each requirement of these documents. The submittal shall acknowledge each requirement of this section, item-by-item, including construction, materials, ratings, and all other parameters identified in Part 2 - Products.

(4) Manufacturer’s installation instructions indicating application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F. DELIVERY, STORAGE, AND HANDLING

(1) Deliver products to the site under the provisions of Section 27 05 00.

(2) Store and protect products under the provisions of Section 27 05 00.

(3) Contractor shall exercise care to prevent corrosion of any products prior to installation. Corroded products shall not be acceptable for use on this project.

G. SYSTEM DESCRIPTION

(1) This section describes the requirements for the furnishing, installation, adjusting, and testing of a complete turnkey communications bonding system, including connection to the electrical ground grid.

(2) Performance Statement: This specification section and the accompanying drawings are performance based, describing the minimum material quality, required features, operational requirements, and performance of the system. These documents do not convey every wire that must be installed, every equipment connection that must be made, or every feature and function that must be configured. Based on the equipment constraints described and the performance required of the system as
presented in these documents, the Contractor is solely responsible for determining all components, devices, equipment, wiring, connections, and terminations required for a complete and operational system that provides the required performance.

(3) This document describes the major components of the system. All additional hardware, subassemblies, supporting equipment, and other miscellaneous equipment required for complete, proper system installation and operation shall be provided by the Contractor.

(4) Basic System Requirements:

a. A complete communications bonding infrastructure is required for this project. Refer to the drawings and the requirements of ANSI-J-STD-607-A and NFPA 70 for complete information.

b. The bonding system shall include, but not be limited to, the following major components:

i. Bonding Conductor for Telecommunications (BCT)
ii. Telecommunications Main Grounding Busbar (TMGB)
iii. Telecommunications Bonding Backbone (TBB)
iv. Telecommunications Grounding Busbar(s) (TGB)
v. Rack mount Telecommunications Grounding Busbar(s)
vi. Bonding Conductor(s) (BC)
    viii. Bonding Connectors
    viii. Bonding system labeling and administration as defined in Section 27 05 53

2. PRODUCTS

A. MANUFACTURERS

(1) Panduit: www.panduit.com
(2) Chatsworths Products Inc.: www.chatsworth.com

B. GROUND BARS

(1) Telecommunications Main Grounding Busbar (TMGB): TMGB shall be Panduit GB2B0612TP1-1 busbar kit.
(2) Telecommunications Grounding Busbar: (TGB) shall be Panduit GB2B0304TP1-1 busbar kit.
(3) Rack Grounding Strip: (RGB) shall be Panduit RGS134-1 with paint piercing grounding washers installed.

C. GROUND WIRE: Unless otherwise noted, all conductors green insulated stranded copper
(1) Telecommunications Bonding Backbone: (TBB) 2/0
(2) Common Bonding Network: (CBN) #6 AWG
(3) Equipment Jumper Kits: #6 AWG 24" length with 90 degree bent lug to straight lug

D. CONNECTORS AND ACCESSORIES
(1) Grounding Clamp: U-bolt bronze for attachment to rods, pipes (non-water) and tubes
(2) Ground Lugs:
   a. TMGB: Code conductor, two-hole, long barrel irreversible compression with window lug
   b. TGB: Code conductor, one-hole, long barrel irreversible compression with window lug
(3) Paint Piercing Grounding Washers: 3/8" stud size .875 O.D. with antioxidant
(4) HTAP: Single or multitap to meet conductor size with clear cover
(5) Electro Discharge (ESD) Port: Panduit RGESD-1 with wrist strap
(6) Exothermic Connections:
(7) Substitutions: See Section 01 6000 - Product Requirements.

3. EXECUTION
A. INSTALLATION
(1) General Bonding Requirements:
   a. The communications bonding system shall be a complete system. Contractor shall furnish and install all necessary miscellaneous components, devices, equipment, material, and hardware, including, but not limited to, lock washers, paint-piercing washers, hex nuts, compression lugs, insulators, mounting screws, lugs, etc., to provide a complete system.
   b. A licensed electrician shall perform all bonding to electrical systems.
c. Bonding conductors shall be green or marked with a distinctive green color.

d. Interior water piping is not acceptable for use as a communications bonding system bonding conductor.

e. Metallic cable shields are not acceptable for use as communications bonding system bonding conductors.

2. Comply with the manufacturer’s instructions and recommendations for installation of all products.

3. Provide or coordinate installation of TBB from the main electrical service entrance ground bus.
   a. Do Not route TBB on Cable Ladderway
   b. TBB must be insulated if exposed more than 24” within the CER.

4. Ensure TMGB is connectorized within 24” of TBB entrance has vertical access to Cable Ladderway and is no more than 18” above finished floor

5. Provide bonding to meet requirements described in Quality Assurance.

6. Provide (1) RGB at of each rack

7. Provide (1) TGB at each Voice Board

8. Provide & install ground buses as shown on plans.

9. Provide & install CBN from TMGB to each RGB & TGB in home run fashion. Do not daisy chain grounds.

10. Provide & install CBN from TMGB to all ladderway. Provide CBN grounding across all joints in ladderway.

11. Provide (2) spare Equipment Jumper Kits for each rack installed

12. Provide ESD port for each rack installed

B. FIELD QUALITY CONTROL

   1. Owner will provide field inspection in accordance with Section 01 40 00.

C. TESTING

   1. Test installed system under provisions of Section 27 17 10.

   2. Measure and document resistance to ground at TMGB, each TGB, each RTGB, and each electrical distribution panel bonded to the TMGB or a TGB.
(3) Measurements shall be made not less than two full days after the last trace of precipitation, and without the 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. Perform tests by the fall-of- potential method according to IEEE 81.

(4) Measured resistance to ground at TMGB, each TGB, and each RTGB must not exceed 1 ohm. Under no circumstances shall any point in the communications bonding system have a lower resistance to ground than that of nearby electrical distribution system components that it is bonded to.

(5) Measure and document voltage between screen of installed and terminated ScTP, FTP, and/or SSTP horizontal cables and electrical ground of electrical outlet(s) serving the information outlet location area.

a. The voltage between the screen and the ground wire shall not exceed 1.0 V rms, and 1.0 V dc for any installed and terminated ScTP, FTP, and/or SSTP horizontal cables.

(6) Include measurement documentation in test data submitted at completion of project.

END OF SECTION
270529 – HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

1. GENERAL
   A. SECTION INCLUDES
      (1) Hangers equipment supports.
      (2) Anchors and fasteners.
      (3) Backboards
   B. REFERENCES
      (1) Section 27 05 00 - Basic Communications Requirements
   C. SUBMITTALS
      (1) See Section 01 30 00 - Administrative Requirements, for submittal procedures.
   D. QUALITY ASSURANCE
      (1) Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.
      (2) Non-continuous cable supports and cable support assemblies shall be listed by Underwriters Laboratories for both Canadian and US standards (cULus).
      (3) Non-continuous cable supports shall have the manufacturers name and part number stamped on the part for identification.
      (4) Manufacturer: Company specializing in manufacturing products specified in this section with a minimum of five years documented experience in the industry, and certified ISO 9000.
   E. Coordination
      (1) Coordinate installation of hangers supports and cables with other trades.

2. PRODUCTS
   A. MANUFACTURERS
      (2) Substitutions: See Section 01 60 00 - Product Requirements.
   B. MATERIALS
      (1) Non-continuous Cable Support Systems
a. Non-continuous cable supports
b. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; cULus Listed
c. Non-continuous cable supports shall have flared edges to prevent damage while installing cables
d. Non-continuous cable supports sized 1-5/16” and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces
e. Non-continuous cable supports shall have an electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments
f. Stainless Steel non-continuous cable supports are intended for indoor and outdoor use in non-corrosive environments or where only mildly corrosive conditions apply

(2) Multi-tiered non-continuous cable support assemblies
a. Multi-tiered non-continuous cable support assemblies shall be used where separate cabling compartments are required. Assemblies may be factory assembled or assembled from pre-packaged kits. Assemblies shall consist of a steel angled hanger bracket holding up to six non-continuous cable supports, rated for indoor use in non-corrosive environments; UL Listed.
b. If required, the multi-tier support bracket may be assembled to manufacturer recommended specialty fasteners including beam clamps, flange clips, C and Z purlin clips.

(3) Non-continuous cable support assemblies from tee bar
a. Tee bar support bracket with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; UL Listed.

(4) Non-continuous cable support assemblies from drop wire/ceiling
a. Fastener to wire/rod with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.

(5) Installation accessories for non-continuous cable supports
a. Cable Pulley
i. Non-continuous cable supports may be used as an installation tool when a removable pulley assembly is included. The pulley shall be made of plastic and be without sharp edges. The pin and bail assembly must be able to be secured to the J-Hook during cable installation. The pulley must remain secured while cables are being pulled.

ii. The pin and roller assembly must be removed after cables are installed.

b. Cable Protector

   i. The protective steel tube shall fit over threaded rod and be at least 4" in length.

   ii. The tube shall prevent damage to cables placed in or pulled through CAT-CMTM U-hooks. The tube shall not inhibit the pulling of cables.

(6) Backboards

   a. 3/4" AC fire treated plywood

3. EXECUTION

   A. INSTALLATION

      (1) Install hangers and supports as required to adequately and securely support cable system components, in a neat and workmanlike manner, as specified in NECA 1 and minimally 4' O.C.

      a. Installation and configuration shall conform to the requirements of the current revision levels of TIA Standards 568 and 569, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer’s installation instructions.

      b. Do not exceed load ratings specified by manufacturer.

      c. Adjustable non-continuous support sling shall have a static load limit of 100 lbs.

      d. Follow manufacturer’s recommendations for allowable fill capacity for each size non-continuous cable support.

      e. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

      f. Do not drill or cut structural members.

END OF SECTION
**270532 – FIRESTOPPING FOR TELECOMMUNICATIONS SYSTEMS**

1. GENERAL

   A. SECTION INCLUDES

      (1) Firestopping of Through Penetrations in Fire Rated Assemblies.
      (2) Smoke Seals.
      (3) Construction enclosing compartmentalized areas.

   B. SCOPE

      (1) This SECTION describes the requirements for furnishing and installing firestopping for fire-rated construction. This includes all openings in fire-rated floors, walls and other rated elements of construction, both blank (empty) and those accommodating items such as cables, conduits, pipes, ducts, etc.
      (2) Fireblocking for Concrete Floor or Wall Sleeved Cables.
      (3) Fireblocking for Gypsum Wall Sleeved Cables.
      (4) Fireblocking for Concrete Block Wall Sleeved Cables.

   C. RELATED SECTIONS

      (1) Division 3 – Section 033000 – Cast-In-Place Concrete
      (2) Division 4 – Section 042200 – Concrete Unit Masonry
      (3) Division 9 – Section 092000 – Plaster and Gypsum Board
      (4) Division 7 – Section 078413 – Penetration Firestopping
      (5) Division 26 – Section 260000 – Electrical
      (6) Division 27 – Section 270000 – Communications

   D. REFERENCES

      (1) ASTM E 84, “Surface Burning Characteristics of Building Materials”.
      (2) ASTM E 119, “Fire Tests of Building Construction and Materials”.
      (3) ASTM E 814, “Fire Tests of Through Penetration Firestops”.

270532 Firestopping for Communications
(5) ANSI/UL723, “Surface Burning Characteristics of Building Materials”.

(6) ANSI/UL1479, “Fire Tests of Through Penetration Firestops”.

(7) Underwriters Laboratories Inc. (UL) – Fire Resistance Directory


E. PERFORMANCE REQUIREMENTS

(1) Fire rated pathway devices shall be the preferred product and shall be installed in all locations where frequent cable moves, add-ons and changes will occur.

(2) Where non-mechanical products are utilized, provide products that upon curing do no re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during or after construction.

(3) Where it is not practical to use a mechanical device, openings within floors and walls designed to accommodate telecommunications and data cabling shall be provided with re-enterable products that do not cure or dry.

(4) Openings for cable trays shall be sealed using re-enterable firestopping pillows.

F. SUBMITTALS

(1) Submit under provisions of Section 01 30 00.

(2) Product Data: Provide manufacturer’s standard catalog data for specified products demonstrating compliance with referenced standards and listing numbers of systems in which each product is to be used.

(3) Shop Drawings: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance ratings.

(4) Certificates: Product certificates signed by firestop system manufacturer certifying material compliance with applicable code and specified performance characteristics.
(5) Installation Instructions: Submit manufacturer’s printed installation instructions.

G. QUALITY ASSURANCE

(1) Products/Systems: Provide firestopping systems that comply with the following requirements:

a. Firestopping tests are performed by a qualified, testing and inspection agency. A qualified testing and inspection agency is UL, or another agency performing testing and follow-up inspection services for firestop system acceptable to authorities having jurisdiction.

b. Firestopping products bear the classification marking of qualified testing and inspection agency.

c. Installer Qualifications: Experience in performing work of this section who is qualified by the firestopping manufacturer as having been provided the necessary training to install firestop products in accordance with specified requirements.

H. COORDINATION

(1) Coordinate layout and installation of Firestopping System with other trades.

(2) Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Architect.

(3) Storage and Handling: Avoid breakage, denting and scoring finishes. Damaged products will not be installed. Store devices and accessories in original cartons and in clean dry space; protect from weather and construction traffic. Wet materials will be unpacked and dried before storage.

I. PROJECT CONDITIONS

(1) Do not install firestopping products when ambient or substrate temperatures are outside limitations recommended by manufacturer.

(2) Do not install firestopping products when substrates are wet due to rain, frost, condensation, or other causes.
(3) Maintain minimum temperature before, during, and for a minimum 3 days after installation of materials.

(4) Do not use materials that contain flammable solvents.

(5) Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

(6) Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

(7) Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

2. PRODUCTS

A. MANUFACTURERS

(1) Acceptable Manufacturer: Specified Technologies Inc., 200 Evans Way, Somerville, NJ 08876. Tel: (800) 992-1180, Fax: (908) 526-9623, Email: specseal@stifirestop.com, Website: www.stifirestop.com.

(2) Substitutions: Pre-Approval.

(3) Single Source: Obtain firestop systems for each type of penetration and construction condition indicated only from a single manufacturer.

B. MATERIALS

(1) General: Use only firestopping products that have been tested for specific fire resistance rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.

(2) Firestop Sealants: STI SpecSeal® Brand single component latex formulations that upon cure do not re-emulsify during exposure to moisture, the following products are acceptable:

   a. Specified Technologies Inc. (STI) SpecSeal® Series SSS Sealant
   b. Specified Technologies Inc. (STI) SpecSeal® Series LCI Sealant
(3) Firestop Putty: STI SpecSeal® Brand intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds, the following products are acceptable:

(4) Specified Technologies Inc. (STI) SpecSeal® Series SSP Putty

(5) Firestop Pillows: STI SpecSeal® Brand re-enterable, non-curing, mineral fiber core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag, the following products are acceptable:

(6) Specified Technologies Inc. (STI) SpecSeal® Series SSB Pillows

(7) Fire Rated Cable Pathways: STI EZ-PATH™ Brand device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:

(8) Specified Technologies Inc. (STI) EZ-PATH™ Fire Rated Pathway

3. EXECUTION

A. EXAMINATION

(1) Before beginning installation, verify that substrate conditions previously installed under other sections are acceptable for installation of firestopping in accordance with manufacturer’s installation instructions and technical information.

(2) Surfaces shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellants, and any other substances that may inhibit optimum adhesion.

(3) Provide masking and temporary covering to protect adjacent surfaces.

(4) Do not proceed until unsatisfactory conditions have been corrected.

B. INSTALLATION

(1) General: Install through-penetration firestop systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified in the published design.
(2) Manufacturer’s Instructions: Comply with manufacturer’s instructions for installation of firestopping products.

C. FIELD QUALITY CONTROL

(1) Inspections: Owner shall engage qualified independent inspection agency to inspect through-penetration firestop systems.

(2) Keep areas of work accessible until inspection by authorities having jurisdiction.

(3) Where deficiencies are found, repair firestopping products so they comply with requirements.

D. ADJUSTING AND CLEANING

(1) Remove equipment, materials, and debris, leaving area in undamaged, clean condition.

(2) Clean all surfaces adjacent to sealed openings to be free of excess firestopping materials and soiling as work progresses.

E. SCHEDULES:

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<th>Concrete Wall</th>
<th>Gypsum Board Wall</th>
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<td>C-AJ-0100, C-AJ-101</td>
<td></td>
</tr>
</tbody>
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END OF SECTION
270553 – IDENTIFICATION FOR COMMUNICATION SYSTEMS

1. GENERAL

A. SUMMARY

(1) Administration of the telecommunications infrastructure includes documentation of cables, termination hardware, patching and cross-connection facilities, conduits, other cable pathways, Telecommunications Rooms, and other telecommunications spaces. All facilities shall apply and maintain a system for documenting and administering the telecommunications infrastructure.

(2) The owner maintains a campus wide labeling scheme for voice and data outlets and patch panels.

(3) Industry Labeling Standards and Conventions shall be used unless otherwise stated in the bid documents or by the Owner’s Representative.

(4) Telecommunications Infrastructure Records must be maintained in a computer spreadsheet, or in a computer database. Paper records are encouraged, but are optional. A cable record is prepared for each backbone cable. The record will show the cable name, and must describe the origin point and destination point of the cable. The cable record will record what services and/or connections are assigned to each cable pair or strand. An equipment record is prepared for services distributed from a certain piece of equipment, such as a router, or a system such as the telephone system PBX.

(5) Installer shall maintain accurate, up-to-date Installation or Construction Drawings. At a minimum, the Installation Drawings shall show pathway locations and routing, configuration of telecommunications spaces including backboard and equipment rack configurations, and wiring details including identifier assignments.

(6) Installer shall provide a complete and accurate set of as-built drawings. The as-built drawings shall record the identifiers for major infrastructure components including; the pathways, spaces, and wiring portions of the infrastructure which may each may have
separate drawings if warranted by the complexity of the installation, or the scale of the drawings.

B. RELATED DRAWINGS

a. T-Series drawings follow the specifications in this Section.

b. Electrical drawings specify the electrical requirements.

c. Interior Design drawings specify interior finishes, spatial relationships between items, and specific mounting height.

C. REFERENCES

(1) Requirements, Codes, and Standards

a. Design, manufacture, test, and install telecommunications cabling networks per manufacturer’s requirements and in accordance with latest revision of the NFPA-70 (National Electrical Code®), state codes, local codes, requirements of Authorities Having Jurisdiction (AHJ), and the following standards, including the most current revisions, addendums, and any Technical Service Bulletins (TSBs) that may have been released at the time of bid, including:

b. TIA/EIA-606 – Administration Standard for Commercial Telecommunications Infrastructure

D. SYSTEM DESCRIPTION

E. The Contractor will provide and install identification labeling for the project’s voice and data communications systems, including all components from the TO to the TR and between telecommunications spaces.

2. PRODUCTS

A. GENERAL NOTES

(1) In this section, certain products are specified by manufacturer and part number to establish a level of quality, performance, and consistency. To substitute other products would defeat this effort to the Owner’s detriment. If no manufacturer or part number is specified for a part, then that part is generic, and the Contractor
shall submit for approval a part that provides the performance specified herein.

B. IDENTIFICATION

(1) Labels

a. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969

b. Shall be preprinted or computer printed type. Hand written labels are not acceptable

c. Where insert type labels are used provide clear plastic cover over label

d. Outside plant labels shall be totally waterproof even when submerged

e. Equipment Room Copper, Fiber, and Coax Backbone Cable Labels

f. Equipment Room Copper, Fiber, and Coax Horizontal Cable Labels

g. Work Area Copper, Fiber, and Coax Riser Cable Labels

h. Patch Panel Labels

(2) Label Construction

a. Labels shall be white, manufactured of resilient and flexible vinyl or polyester, die-cut, and have adhesive backing for permanent attachment.

b. Labels for Data Cables

c. Labels for data cables shall be:

i. Self-laminating

ii. Rotatable/repositionable

iii. Of appropriate size to completely encircle the cable and completely overlay the identification tag area

d. Placement of Data Cable Labels
e. Labels shall be placed within view at the termination points, within 3 inches (75 mm) of each end of each:
   
i. Backbone cable
   
ii. Horizontal cable
   
iii. Bonding conductor

f. Labels for Data Cable Bundles
   
i. Cable bundles shall be identified with non-adhesive thermal-transfer-printable marker plates.
   
ii. Marker plates shall be attached to cable bundles with nylon cable ties or hook and loop ties.
   

g. Labels for Cabinets and Equipment
   
i. Cabinets and equipment shall be identified with thermal-transfer-printed, die-cut, microcellular foam labels with a polyester printable surface and high-tack adhesive.
   
ii. Each outlet, patch panel, and wiring block shall be identified by a label installed on or in the space provided on the device.

h. Label Sizes for Outlets and Termination Hardware
   
i. Labels for outlets and termination hardware shall be at least 1-1/4 inches wide and 3/8 inch high.

j. Label Sizes for Other Equipment

k. Labels for the following shall be at least 4 inches wide and 1 inch high:
   
i. Riser cables
   
ii. Network equipment
iii. Equipment cabinets and racks
iv. Bonding busbars
v. Consolidation point enclosures
vi. Active hardware and equipment

(3) Warning Tags

a. At each location where the fiber cable is exposed to human intrusion, it shall be marked with warning tags. These tags shall:
   i. Be yellow or orange
   ii. Bear the warning, “CAUTION FIBER OPTIC CABLE”
   iii. Have this text in permanent, black, block characters at least 5 mm high

b. A warning tag shall be permanently affixed to each exposed cable or bundle of cables at intervals of not less than 1.5 m.

c. Any section of exposed cable less than 1.5 m long shall have at least one warning tag affixed to it.

(4) Printing of Labels

a. Printing shall be machine-generated in permanent ink that contrasts the background color.

b. All characters shall be block style.

c. The text shall fill the area of the printable field.

3. EXECUTION

A. IDENTIFICATION

(1) Prior to the installation or termination of cabling, confirm all specific labeling requirements with the Owner or the Owner’s Engineer.

(2) Cables
Old Vail Middle School
New Library

October 11, 2019

a. Mark backbone cables at each endpoint and at all intermediate pull points, access points, and junction boxes. Labels shall indicate the origination and destination identifier, the sheath identifier, and the strand or pair range.

b. Horizontal cables shall be marked at each end, on the sheath indicating the TR, patch panel and panel port to which the cable is wired. Block terminated cable shall be identified with a V in place of the panel ID.

(3) Faceplates, Patch Panels, and Wiring Blocks

a. Mark Fiber Distribution Enclosures (FDEs) with adhesive labels that indicate the range of circuits installed within. Label each port with the origination and destination grid identifier and the individual strand ID.

b. Label patch panels alphabetically, beginning at the top. Individual ports shall come from the factory labeled with a number designation.

c. Label each faceplate to indicate, for each cable that it houses, the TR, patch panel, and panel port to which the cable is wired. Label block-terminated cables with the Telecommunication Room and “V” cable number.

d. Label each wiring block numerically, beginning at the top left of the termination field. Within each block, identify the individual rows alphabetically, beginning at the top left and proceeding sequentially down and to the right. Label each row with the corresponding cable identifier, and label each pair or circuit on each cable.

e. Fit each cable with a self-laminating label, bearing the appropriate cable identifier, that surrounds the outermost jacket. Place the label at each end of the cable, within 3 inches (75 mm) of the end of the sheath.

f. Fit each equipment enclosure with a self-adhesive label bearing its respective identifier, affixed to the top center of the front and rear doors.
g. Fit each FDE with a self-adhesive label, bear its respective identifier in block characters, affixed at the top center of the front and rear faces.

h. Fit each adapter inside enclosures with a label bearing its identifier, affixed directly adjacent to its shortest side. Rotate characters so that their orientation is kept left to right, top to bottom.

i. Label conduits and pathways within 0.5 m (18 inches) of each end, where exposed and accessible. It is recommended that additional labeling be provided every 3 m (10 feet) of exposed length.

j. Fit network equipment with a label, placed in an accessible area on the front and rear, bearing the appropriate identifier, MAC address, and date of installation. The label shall not interfere with the operation of or interface to the unit, nor shall it obscure manufacturer's labels.

END OF SECTION
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27116 – COMMUNICATIONS CABINETS, RACKS, FRAMES AND ENCLOSURES

1. GENERAL

A. SECTION INCLUDES

(1) Communication Equipment room termination support hardware, backboards
   a. Racks
   b. Equipment Enclosures

B. RELATED SECTIONS

(1) Section 27 05 26 Ground & Bonding for Communications Systems
(2) Section 27 11 23 Communications Cable Management & Ladder Rack

C. SUBMITTALS

(1) See Section 01 30 00 - Administrative Requirements, for submittal procedures.
(2) Product Data: Provide manufacturers catalog data for hardware
(3) Project Record Documents: Prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).

D. QUALITY ASSURANCE

(1) All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner or Owner Representative. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

(2) Strictly adhere to all Building Industry Consulting Service International (BICSI) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling
Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:

- **ANSI/TIA-568 Series Commercial Building Telecommunications Cabling Standard**,
- **ANSI/TIA-569 Telecommunications Pathways and Spaces**,
- **ANSI/TIA-606 Administration Standard for the Telecommunications Infrastructure**
- **ANSI-J-STD-607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications**
- **EIA-310-E, Cabinets, Racks, Panels, and Associated Equipment (most recent version) NFPA 70 National Electric Code**
- **BICSI Telecommunications Distribution Methods Manual**

**E. WARRANTY**

1. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

**2. PRODUCTS**

**A. EQUIPMENT ENCLOSURES**

   a. **Model**: BGR- 41SA-27LRD .
   b. **Type**: 19-inch gangable equipment rack.
   c. **Compliance**:
      i. **EIA/TIA 310D**.
d. UL Listed: US and Canada.
e. Construction: Fully welded.
f. Weight Capacity: 3,000 pounds UL Listed, 12,000 pounds static.
g. Finish of Structural Elements: Black textured powder coat.
h. Rackrail:
   i. Two pairs of fully adjustable, 11-gauge steel rackrail with tapped 10-32 mounting holes in universal EIA spacing.
   ii. Finish: Black e-coat.
   iii. Rackspace: Numbered.
i. Rear Door: Solid, keylocked, selectively vented with mounting provisions for 4-1/2” fans.
j. Removable Rear Knockout Panel:
   i. 1/2-inch, 5/8-inch, 1-inch, and 1-1/4-inch electrical knockouts and ½” “D” UHF/VHF knockouts on 1-5/16-inch x 7-1/2-inch laser knockout plate installed in top and bottom.
k. Grounding and Bonding Stud: 1/4-20 by 1-inch threaded, installed in top and base, allows installation to conform to NEC.

(2) OPTIONS

a. Front Doors: perforated vented
c. Top Panels: steel, accepts 10-inch fan]
d. Integrated Fan Tops:
   i. Proportional speed, thermostatic fan control.
   1.) Fans: 276 CFM
e. Leveling Feet:
   i. 3/8-inch threaded steel, Heavy Duty adjustable from top or bottom.
f. Removable side panels.
g. Door latch.
h. Rackmount Power Strip
   i. 9 outlet 15A Basic surge

B. RACKS

a. Racks shall be manufactured from aluminum and/or steel extrusion.
b. Each rack will have two L-shaped top angles, two L-shaped base angles and two C-shaped equipment-mounting channels. The rack will assemble with nut and bolt hardware.
The base angles will be pre-punched for attachment to the floor.

c. Equipment mounting channels will be punched on the front and rear flange with the EIA-310 Universal Mounting hole pattern.

d. Aluminum Racks will be threaded with 12-24 roll-formed threads and will include 40 each combination pan head, pilot point mounting screws.

e. Steel Racks will have 3/8” square holes and will include 40 each #12-24 x ½” mounting screws and 40 each #12-24 cage nuts.

f. The rack will include assembly and equipment-mounting hardware.

g. The rack will be rated:

h. Two Post Racks: 1,000 lb. (453.6 kg) of equipment

i. Four Post Racks: 2,000 lb. (907.2 kg) of equipment

j. The rack will be UL Listed

k. When assembled with top and bottom angles, equipment-mounting channels will be spaced to allow attachment of 19” EIA rack-mount equipment.

(2) RACK CABLE MANAGEMENT

a. Vertical cable management shall have doors that are lightweight, sturdy, and be available in different sizes to allow flexibility in design.

b. The cable management system shall have a C-Channel bracket that allows for easy access to the cable trough.

c. The vertical cable management system shall allow tool-less installation of Cable Spool.

d. Doors shall come standard with on all cable management and be available in both single and double sided configurations.
e. The door shall have dual hinge design that can be opened to the right or left.

f. The door latching mechanism shall have an easy closing feature.

g. The door shall have one point removal and installation process for door.

h. Horizontal wire managers: The door shall have horizontal cover hinges up or down and be lockable into position with cylindrical finger ends for easy snap on installation

i. The door shall have a recessed handle to eliminate snag potential for clothes and arms.

j. The Horizontal cable management system shall have an open back on 2U and 3U horizontal troughs for easy pass-through of cables

C. FREE STANDING TWO POST ALUMINUM RACKS

(1) 45U - 7ft (2134 mm) H x 3in (76 mm) Channel x 19in (482.6 mm) Equipment Rack

(2) Rack is to provide 45 rack-mount spaces in a "7-foot rack" for equipment. Each mounting space will be marked and numbered on the mounting channel.

(3) For the "7-foot rack" the assembled rack will measure 84" (2133.6 mm) high, 20.4" (518 mm) wide and 15" (381 mm) deep. The sides (webs) of the equipment-mounting channels will be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.

(4) Finish shall epoxy-polyester hybrid powder coat in the color as specified below.

(5) Approved Manufacturer: Chatsworth

D. FREE STANDING FOUR POST ALUMINUM RACKS

(1) 45U - 7ft (2134 mm) H x 3in (76 mm) Channel x 19in (482.6 mm) Equipment Rack
(2) Rack is to provide 45 rack-mount spaces in a “7-foot rack” for equipment. Each mounting space will be marked and numbered on the mounting channel.

(3) For the "7-foot rack" the assembled rack will measure 84" (2133.6 mm) high, 20.4" (518 mm) wide and 29" (736.6 mm) deep. The sides (webs) of the equipment-mounting channels will be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.

(4) Finish shall be epoxy-polyester hybrid powder coat in the color as specified below.

(5) APPROVED Manufacturer: Chatsworth

E. VERTICAL CABLE MANAGEMENT FOR RACKS

(1) The vertical cable management kits are installed on the side of a 19-inch or 23-inch (483 or 584 mm) wide industry standard rack.

(2) The door(s) shall be designed to provide a concealed vertical space for organizing patch cables.

(3) Cable spools shall be used to organize longer patch cable lengths.

(4) Cable managers are to be matched to the cable rack. Cable managers are available in 6 inch (152 mm), 8 inch (203 mm), 10 inch (254 mm), and 12 inch (305 mm) widths and in 7 foot (2.1 m), 8 foot (2.4 m), and 9 foot (2.7 m) heights.

(5) Approved Manufacturer: Chatsworth

(6) 12” Double Side, Vertical Cable Management, Black Door

(7) 6” Double Side, Vertical Cable Management, Black Door

F. HORIZONTAL CABLE MANAGEMENT FOR RACKS

(1) The horizontal cable management kits are installed on a 19-inch (483 mm) wide industry standard rack above or below panels to organize patch cables.

(2) The kits shall be available in a single-sided and double-sided configuration, and in a 1U-, 2U-, and 3U-height.
(3) The units shall include covers that can be opened from the top, the bottom, or removed altogether.

(4) The cover hinges shall be designed to hold the cover open from the top or bottom to facilitate faster cabling.

(5) The 2U and 3U cable managers shall have a pass-through feature allowing access to and from the rear for additional cable routing.

(6) The depth of the units shall be

(7) Single-sided: 5-1/2 inches (140 mm) deep from front to back with the cover closed

(8) Double-sided: 11 inches (280 mm) deep from front to back with the covers closed.

(1) Approved Manufacturer: Chatsworth

3. EXECUTION

A. RACKS AND CABLE MANAGEMENT

(1) Assemble racks and cable management per manufacturer's instructions. Verify that equipment mounting rails are sized properly for rack-mount equipment before attaching the rack to the floor.

(2) All racks must be attached to the floor in four places using appropriate floor mounting anchors. When placed over a raised floor, threaded rods should pass through the raised floor tile and be secured in the structural floor below.

(3) Racks shall be grounded to the TGB using appropriate hardware provided by the contractor. The ground will meet local code requirements and will be approved by the Authority Having Jurisdiction (AHJ).

(4) In seismic areas, the rack should have additional bracing as required by building codes and the recommendations of a licensed structural engineer.

(5) Ladder rack may be attached to the top of the rack to deliver cables to the rack. The rack should not be drilled to attach ladder rack. Use appropriate hardware from the ladder rack manufacturer.
(6) The equipment load should be evenly distributed and uniform on the rack. Place large and heavy equipment towards the bottom of the rack. Secure all equipment to the rack with equipment mounting screws.

B. CLEANING

(1) Remove all unsightly marks and repair any damaged scratched or disfigured work
271119 – COMMUNICATIONS TERMINATION BLOCKS & PATCH PANELS

1. GENERAL

A. SECTION INCLUDES

(1) Copper, fiber termination blocks & panels

B. RELATED SECTIONS

(1) Section 270510 Basic Communication Requirements
(2) Section 270526 Ground & Bonding for Communications Systems
(3) Section 271123 Communications Cable Management & Ladder Rack
(4) Section 271116 Communications Cabinets, Racks, Frames & Enclosures
(5) Section 271543 Communications Faceplates & Connectors

C. SUBMITTALS

(1) See Section 013000 - Administrative Requirements, for submittal procedures.
(2) Product Data: Provide manufacturers catalog data for hardware
(3) Project Record Documents: Prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).

D. QUALITY ASSURANCE

(1) Approval by Contracting Officer is required of products of proposed manufacturer, or supplier, and will be based upon submission by Contractor certification.
(2) Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
(3) Certify materials and equipment shall be the standard products of the manufacturer regularly engaged in the manufacture of the products and shall be the manufacturer’s latest standard design that has been in satisfactory use for at least 2 years prior to bid opening
(4) Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of experience.

E. DELIVERY, STORAGE, AND PROTECTION
(1) Deliver components to the site in original manufacturers packaging.
(2) Store all materials in a secure place that is weather tight dry, and not exposed to UV radiation.
(3) Protect all components from damages by handling, weather and construction operations before, during and after installation.

F. WARRANTY

G. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

2. PRODUCTS

A. MANUFACTURERS

(1) Commscope, Uniprise; www.commscope.com
(2) Corning Cable Systems; www.corning.com

B. PATCH PANELS

(1) Category 6A/Class EA Patch Panels
   a. General specifications: Patch panel shall be constructed of high strength steel with satin chrome finish and designed for wall or 19-inch rack mounting.
   b. Panels shall be available in 24-port and 48-port configurations, with height of 1 Rack Unit (RU) of 44.5 millimeters (1.75 inches) for each group of 24 ports.
   c. Removable rear mounted cable management bar and front and rear identification labels.
   d. Patch panels must be capable of connection to the CommScope Intelligent Patching solution or upgradable to connection to the CommScope Intelligent Patching Solution.
   e. Patch panels shall support 5 meter cables in 3 and 4 connector channels, 3 meter cables in 2 connector channels and cross connect cords down to 1 meter.
   f. Comply with the standards for Category 6A/Class EA patch panels listed in the TIA-568 Series Standards and ISO/IEC 11801.
   g. Approved Manufacturer:
      i. CommScope Uniprise Patch Panels
         1.) CPP-UDDM-SL-1U-24 Uniprise Universal
Cat6A Panel 1U 24 Port

2.) CPP-UDDM-SL-2U-48  Uniprise  Universal
    Cat6A Panel 2U 48 Port

C. FIBER HOUSING
   (1) Corning CCH

D. FIBER CONNECTORS
   (1) Fiber Connectors shall be of the same manufacturer as Optical Fiber Cable
   (2) Type: Factory Terminated LC Pigtail
   (3) Insertion Loss: 0.3 dB average, FOTP-171
   (4) Durability: <= 0.2 dB change, 500 rematings, FOTP-21
   (5) Materials
   (6) Ferrule: Composite or Ceramic
   (7) Housing Composite

E. FIBER COUPLERS-SPLICE HOUSING
   (1) OM-4 Duplex LC
   (2) CCH-CP12-E4-P03SH - CCH Pigtailed Splice Cassette 12 F, LC UPC duplex shuttered,

F. ACCESSORIES
   (1) Fiber: Use all Manufacturer recommended accessories
       a. Breakout Kits
       b. Cable Clamps
       c. Ground Kits
       d. Wrap

3. EXECUTION

A. INSTALLATION
   (1) Install in accordance with plans and manufacturer's instructions.
   (2) Leave no gaps or spaces between consecutively mounted panels

B. TERMINATIONS
   (1) Fiber Optic
       a. Terminate all fiber with appropriate single or multi-mode connector.
b. Provide 50’ minimum slack fiber at all fiber terminations and splices.

c. Ground system as required

END OF SECTION
271123 – COMMUNICATIONS CABLE MANAGEMENT & LADDER RACK

1. GENERAL

A. SECTION INCLUDES
   (1) Horizontal & Vertical management & support
   (2) Ladder Rack/Tray

B. RELATED SECTIONS
   (1) Section 27 05 26 Ground & Bonding for Communications Systems
   (2) Section 27 11 16 Communications Cabinets, Racks, Frames & Enclosures

C. SUBMITTALS
   (1) See Section 01 30 00 - Administrative Requirements, for submittal procedures.
   (2) Product Data: Provide manufacturers catalog data for hardware
   (3) Project Record Documents: Prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).

D. QUALITY ASSURANCE
   (1) Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:
      a. ANSI/TIA-568 Series
      b. ANSI/TIA-569 Telecommunications Pathways and Spaces
      c. ANSI/TIA-606 Administration Standard for the Telecommunications Infrastructure
      d. BICSI Telecommunications Distribution Methods Manual
      e. J-STD-607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
      f. NFPA 70 National Electric Code
         i. NEMA – VE-1 Metal Cable Tray Systems
   (2) NEMA – VE-2 Metal Cable Tray Installation Guidelines
   (3) Approval by Contracting Officer is required of products of proposed manufacturer, or supplier, and will be based upon submission by Contractor certification.
(4) **Manufacturer Qualifications**: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

(5) **Certify materials and equipment** shall be the standard products of the manufacturer regularly engaged in the manufacture of the products and shall be the manufacturer’s latest standard design that has been in satisfactory use for at least 2 years prior to bid opening.

(6) **Installer Qualifications**: Company specializing in performing the work of this section with minimum 3 years of experience.

**E. DELIVERY, STORAGE, AND PROTECTION**

(1) Deliver components to the site in original manufacturers packaging.

(2) Store all materials in a secure place that is weather tight dry, and not exposed to UV radiation.

(3) Protect all components from damages by handling, weather and construction operations before, during and after installation.

**F. WARRANTY**

(1) See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

2. **PRODUCTS**

**A. MANUFACTURERS**

(1) Chatsworth Products, Inc.; [www.chatsworth.com](http://www.chatsworth.com)

(2) Leviton; [www.leviton.com](http://www.leviton.com)

(3) **Substitutions**: See Section 01 60 00 - Product Requirements.

**B. CABLE MANAGEMENT**

(1) **Horizontal**

a. **WMPSE- Dual Sided Horizontal Patch Cord Organizers**, 1RU, 2" D-Rings

b. **WMP1E- Dual Sided Horizontal Patch Cord Organizers**, 2RU, 2" D-Rings

(2) **Vertical**

a. 35521-703 Vertical Front and Rear Cable Management, 6" Channel x 80" Long. Black Hinge Cover

b. 35524-703 Vertical Front and Rear Cable Management, 12" Channel x 80" Long. Black Hinge Cover
(3) Fiber Cable
   a. S4DCT-DHC 4x4 Solid Duct w/Hinged Cover Yellow with accessories

(4) Velcro
   a. For management only. Not for supporting cables

C. LADDER RACK / TRAY

(1) Ladder rack/tray shall be manufactured from tubular steel. Stringers (sides) will be made from 3/8” wide by 1-1/2” high tubular steel with .065” wall thickness. Cross members (rungs) will be made from 1” wide by ½” high tubular steel with .065” wall thickness.

(2) Ladder rack/tray cross members will be welded in between stringers on 9” centers. There will be 8” of open space in between each cross member.

(3) Design Make:
   a. CPI Universal UL Cable Runway, UL Cable runway Radius Drops - Black
      i. Width 12", 18” as shown
      ii. 11275-712
      iii. 11275-718

(4) Horizontal 90° Turns (Cable Runway E-Bend)

(5) Horizontal 90° turns shall be manufactured from 3/8” wide by 1-1/2” high tubular steel with .065” wall thickness.

(6) Stringers (sides) will be formed in a 90° arc. Cross members will be welded in between stringers on approximate 23° increments so that there are 5 cross members per turn. The welded assembly will have an inside radius that will create a smooth horizontal 90° turn.

(7) Design Make:
   a. CPI 10822-712

(8) Ladder Rack/Tray Splices

(9) Splice kits will provide a method of mechanically connecting ladder rack/tray sections and turns together end-to-end or side-to-end to form a continuous pathway for cables.

(10) Design Make:
   a. CPI
      i. Butt Splice - 16301-701
      ii. Junction Splice – 10302-701
(11) Ladder Rack/Tray Accessories

(12) Cable straps used for attaching cable bundles to the ladder rack/tray cross members must be reusable with a hook and loop-style closure, at least ¾” wide, and sized for cable bundles that are 2”, 3” or 4” in diameter.

(13) Cable retaining posts used to keep cable from falling from the side of the ladder rack/tray shall be manufactured from 1” by ½” tubular steel with .065” wall thickness. Cable retaining posts will be 8” high and will attach to the side stringer of the ladder rack/tray with included hardware. The top of the cable retaining posts will be fitted with a rubberized end cap to protect cables.

(14) End caps used to cover the ends of ladder rack/tray will be manufactured from a black fire-retardant rubberized material. End caps will be sized for 3/8” wide by 1-1/2” high side stingers and will be sold in pairs.

(15) Radius drops or “waterfalls” used to maintain the bend Radius of the cables as they exit or enter the ladder rack/tray will be manufactured from aluminum extrusion. The extrusion will be formed in a 90° arc with a minimum bend radius of 3”. Radius drops will attach to either the side stringer or the cross member of the ladder rack/tray using a clevis pin. Radius drops will include 1-1/2” high cable spools that attach to the top of the radius drop to guide cables.

(16) Auxiliary support brackets used to support cables that should be physically separated from the cables in the ladder rack/tray will be made from 1/8” x 1” steel bar. The bracket will be L-shaped and will attach to the side stringer of the ladder rack/tray. The bracket will hang below the ladder rack/tray a minimum of 4”. The bracket support surface will be 4” long. The bracket will be zinc plated with a gold chem. finish.

(17) Design Make:
   a. CPI
      i. Ladder rack end caps -
      ii. Radius Drops - 12100-712
      iii. Channel Rack-To-Runway Mounting Plate With Bracket - 12731-712

D. ACCESSORIES

(1) Velcro
   a. For management only. Not for supporting cables
3. EXECUTION

A. INSTALLATION

(1) Provide all components of the ladder rack/tray system (ladder rack/tray, turns, splices, supports, and accessories) from a single manufacturer.

(2) Provide all components of the Optical Fiber Protective system, (duct, dropouts, bends, sweeps, cover and accessories) to protect exposed fiber in Comm Rooms.

(3) Install in accordance with plans and manufacturer’s instructions.

(4) Ladder rack/tray shall be supported every 5’ or less in accordance with TIA-569. Ladder rack/tray shall be supported within 2’ of every splice and within 2’ on both/all sides of every intersection. Support ladder rack/tray within 2’ on both sides of every change in elevation. Support ladder rack/tray every 2’ when attached vertically to a wall.

(5) Use a radius drop to guide cables wherever cable exits overhead ladder rack/tray to access a rack, cabinet or wall-mounted rack, and cabinet or termination field. Provide a support other conductors that should be physically separated from cables within the ladder rack/tray as defined by local code or the authority having jurisdiction (AHJ).

(6) The installer will provide touch-up paint color-matched to the finish on the ladder rack/tray and will correct any minor cosmetic damage (chips, small scratches, etc.) resulting from normal handling during the installation process prior to delivery to the owner. If a component is cosmetically damaged to the extent that correction in the field is obvious against the factory finish, the component will be replaced with a new component finished from the factory. If a component is physically damaged due to mishandling or modification during the installation process, it shall not be used as part of the ladder rack/tray system.

(7) CABLE LADDER
   a. Install all work plumb and true in alignment and in relation to lines, and grades shown.
   b. Attach ladderway to walls with appropriate ‘L’ bracket
   c. Attach ladderway to racks with appropriate rack to runway
mounting plate
d. Install runway radius drops as needed.
e. Install ground braids to create a continuous system; ground to MGBB

END OF SECTION
271323 – COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

1. GENERAL

A. SECTION INCLUDES
   (1) Inside & Outside Optical Fiber cable plant

B. RELATED SECTIONS
   (1) Section 27 05 26 Ground & Bonding for Communications Systems
   (2) Section 27 11 16 Communications Cabinets, Racks, Frames, and Enclosures
   (3) Section 27 16 19 Communications Termination Blocks & Patch Panels

C. SUBMITTALS
   (1) See Section 01 30 00 - Administrative Requirements, for submittal procedures.
   (2) Product Data: Provide manufacturers catalog data for hardware

D. QUALITY ASSURANCE
   (1) Approval by Contracting Officer is required of products of proposed manufacturer, or supplier, and will be based upon submission by Contractor certification.
   (2) Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
   (3) Certify materials and equipment shall be the standard products of the manufacturer regularly engaged in the manufacture of the products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 2 years prior to bid opening
   (4) Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.

E. DELIVERY, STORAGE, AND PROTECTION
   (1) Deliver components to the site in original manufacturers packaging.
   (2) Store all materials in a secure place that is weather tight dry, and not exposed to UV radiation.
   (3) Protect all components from damages by handling, weather and construction operations before, during and after installation.
F. WARRANTY
   (1) See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
      a. Must be able to provide a 25-year Corning manufacturer’s warranty

2. PRODUCTS
   A. GENERAL
      (1) All Outside Plant, (OSP,) cables shall be filled or water blocked unless pre-approved by Communication Maintenance

   B. MANUFACTURERS
      (1) Corning Cable Systems; www.corning.com

   C. OPTICAL CABLE
      (1) Fiber Parameters
          a. OM-4 - Bend-insensitive Laser Optimized 50/125 micron fiber
             i. Graded-index optical fiber wave-guide with nominal 50/125micron -core/cladding diameter.
             ii. The fiber shall comply with the latest revision of ANSI/EIA/TIA-492AAAD.
             iii. Attenuation shall be measured in accordance with ANSI/EIA/TIA-455-78.
             iv. Information transmission capacity shall be measured in accordance with the latest revision of ANSI/EIA/TIA-455-204.
             v. Maximum attenuation dB/km @ 850/1300 nm: 3.0/1.0
             vi. EMB Bandwidth 4700 MHz-km @ 850nm.
             vii. OFL Bandwidth 500 MHz-km @ 1300nm.
             viii. Optical Fiber shall be Bend-insensitive Laser Optimized and guarantee 1Gigabit Ethernet distances of 1040m/600m for 850nm and 1300nm, respectively.
             ix. Optical fiber shall guarantee a 10 Gigabit Ethernet distance of 550m at 850

      (2) Corning FREEDM LST

   D. RISER CABLE
      (1) Corning: MIC

   E. CABLE PULLING LUBRICANTS
3. EXECUTION

A. PRE-INSTALLTION

(1) WRITTEN CERTIFICATION: Provide written certification
   a. Factory Certification showing compliance with all optical,
      attenuation and bandwidth specifications.

(2) Ensure all cable placing personnel understand the handling
    requirements, minimum bend diameters, and maximum pull
    tensions

(3) Swab and clean conduits

B. INSTALLATION OF CABLE

(1) Place fiber optic cables to maintain minimum cable bend radius
    limits specified by manufacturer or 15 times cable diameter,
    whichever is larger.

(2) Use care when handling fiber optic cables.

(3) Carefully monitor pulling tension so as not to exceed limits specified
    by manufacturer.

(4) Do not splice horizontal fiber optic cables.

(5) Where cables are to be routed in pathway, conductor shall supply
    and install any additional pathway necessary to complete any cable
    route. Use of existing pathway must comply with EIA/TIA
    standards and recommendations. Contractor shall ensure fire
    rating of all Contractors used pathway.

(6) Cables not routed in conduit or tray must be supported each 3' O.C.
    with an appropriate support.

(7) Seal all openings in conduits, sleeves, and pass thru’s with the
    required fire stopping material or duct plug as appropriate.

(8) Provide minimum 50’ slack cable coiled neatly in each pullbox.

(9) Provide minimum 150’ slack cable coiled neatly in each manhole.

END OF SECTION
1. GENERAL

A. SECTION INCLUDES

(1) Provision all labor, materials, and equipment for the complete installation of all Copper Horizontal Cabling applications called for in the Bid Documents.

B. RELATED SECTIONS

(1) Section 27 0510 Basic Communication Requirements
(2) Section 27 0526 Ground & Bonding for Communications Systems
(3) Section 27 1123 Communications Cable Management & Ladder Rack
(4) Section 27 1116 Communications Cabinets, Racks, Frames, and Enclosures
(5) Section 27 1619 Communications Termination Blocks & Patch Panels

C. SYSTEM DESCRIPTION

(1) This section includes the minimum requirements for Copper Horizontal Cables.

D. SUBMITTALS

(1) See Section 01 3000 - Administrative Requirements, for submittal procedures.
(2) Product Data: Provide manufacturers catalog data for hardware
   a. Manufacturers cut sheets, specifications and installation instructions for all products
(3) Project Record Documents: Record actual locations of All outlets, cable pathway, sleeves.
(4) Warranty: Submit manufacturer warranty and ensure that forms have been completed in Vail Unified School District’s name and registered with manufacturer.

E. QUALITY ASSURANCE
(1) All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner or Owner Representative. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

(2) Strictly adhere to all Building Industry Consulting Service International (BICSI) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

F. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:

a. ANSI/TIA-568 Series Commercial Building Telecommunications Cabling Standard

b. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard

c. ANSI/TIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and

d. ANSI/TIA-569 Telecommunications Pathways and Spaces

e. ANSI/TIA-606 Administration Standard for the Telecommunications Infrastructure


g. and Bonding Requirements for Telecommunications

h. BICSI – Telecommunications Distribution Methods Manual

i. Components Standards

j. NFPA 70 – National Electric Code

k. ISO/IEC 11801 - Generic Cabling for Customer Premises

l. CENELEC EN-50173 - Generic Cabling Systems
G. DELIVERY, STORAGE, AND PROTECTION
(1) Deliver components to the site in original manufacturers packaging.
(2) Store all materials in a secure place that is weather tight dry, and not exposed to UV radiation.
(3) Protect all components from damages by handling, weather and construction operations before, during and after installation.

H. WARRANTY
(1) The horizontal communications cabling system installed shall be eligible for coverage by a 25 Year Extended Product and Application Warranty to the end user.
(2) Installer Integrator shall provide labor, materials, and documentation in accordance with Commscope Solutions requirements necessary to ensure that the Owner will be furnished with a Commscope Lifetime Warranty.
(3) The installed structured cabling system shall provide a warranty guaranteeing installed channel performance above the ANSI/TIA 568-C requirements for Cat 6, and/or Cat 6A cabling systems or ISO 11801 requirements for Cass D, Class E, and/or Class Ea.
   a. Standards-compliant channel or permanent link performance tests shall be performed in the field with a Commscope approved certification tester in the appropriate channel or permanent link test configuration.
(4) Necessary documentation for warranty registration shall be provided to the manufacturer by the installer (within 10 days) following 100 percent testing of cables.
   a. Submit test results to Commscope Network Solutions, in the certification tester's original software files.
   b. Installer shall ensure that the warranty registration is properly submitted, with all required documentation within 10 days of project completion.
   c. Contractor Integrator must adhere to the terms and conditions of the respective manufacturer's warranty programs.
(5) Installer shall ensure that the Owner receives the manufacturer issued project warranty certificate within 60 calendar days of warranty registration.

I. Cable Construction (by Type):
(1) Listed CMR cable: Solid copper conductors with high-density polyolefin insulation and an overall low smoke polyvinyl chloride (PVC) jacket to achieve a riser (i.e., non-plenum) rating by applicable NEC requirements.

(2) Listed CMP cable: Solid copper conductors with fluorinated ethylene propylene (FEP) insulation and an overall low smoke PVC jacket to achieve plenum rating by applicable NEC requirements.

(3) LSZH cable: Solid copper conductors with non-halogen high-density polyethylene (HDPE) insulation and a low smoke, zero halogen, compound jacket to achieve a LSZH rating by applicable IEC standards.

(4) LC cable: Solid copper conductors with FEP fluoropolymer insulation and overall FEP fluoropolymer jacket to achieve CMP 50 rating by UL standards.

(5) OSP outdoor cable rated for wet locations: Solid copper conductors with polyethylene insulation, polyolefin fluted center member with flooding compound, and black polyethylene jacket.

(6) Comply with following general physical specifications:
   a. Maximum pulling tension: 110 Newton’s (25 pound-force)
   b. Operating temperature: –20 to 60 degrees C [–4 to 140 degrees F]

2. PRODUCTS

A. Category 6 Augmented (6A)/Class EA Unshielded Twisted-Pair (UTP) Cable
   (1) All Cables shall be of round construction
   (2) Each cable shall contain 4 color coded pairs
   (3) Cable shall be listed for the environment where it will be installed (Plenum, Riser, LSZH, etc.)
   (4) Approved Manufacturer:
   (5) CommScope Uniprise
(6) Category 6A horizontal cabling shall provide the following Margin to the specification when installed in a 4 connector Channel.

<table>
<thead>
<tr>
<th>Electrical Parameter (1-250MHZ)</th>
<th>Guaranteed Channel Margins to Amendment 1 to ISO/IEC 11801:2002 &quot;Class EA&quot;</th>
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<tr>
<td>Insertion loss</td>
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<tr>
<td>NEXT</td>
<td>3 dB</td>
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<td>5 dB</td>
</tr>
<tr>
<td>ACR-N</td>
<td>5 dB</td>
</tr>
<tr>
<td>PSACR-N</td>
<td>6.5 dB</td>
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<tr>
<td>ACR-F</td>
<td>6 dB</td>
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<td>PSACR-F</td>
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<td>1 dB</td>
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<td>Return Loss, PSANEXT, PSACR-F, Avg. PSANEXT, Avg. PSAACR-F</td>
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(7) Category 6A horizontal cabling shall meet or exceed the performance specifications listed in the following table when installed in a 4 connector Channel.

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<tr>
<th>Freq. (MHz)</th>
<th>Insertion Loss (dB)</th>
<th>PS NEXT (dB)</th>
<th>AVG. PS NEXT (dB)</th>
<th>PS ACR (dB)</th>
<th>AVG. PS ACR (dB)</th>
<th>NEXT (dB)</th>
<th>ACR-N (dB)</th>
<th>PS NEXT (dB)</th>
<th>ACR-F (dB)</th>
<th>PS ACR-F (dB)</th>
<th>Return Loss (dB)</th>
<th>Delay (ns)</th>
<th>Delay Skew (ns)</th>
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<td>546</td>
</tr>
</tbody>
</table>

3. EXECUTION
   A. PRE-INSTALLATION
(1) Prior to placing any cable pathways or cable, the Contractor shall survey the site to determine job conditions will not impose any obstructions that would interfere with the safe and satisfactory placement of the cables. The arrangements to remove any obstructions with the Project Manager need to be determined at that time.

(2) Ensure all cable placing personnel understand the handling requirements, minimum bend diameters, and maximum pull tensions.

(3) Swab and clean conduits.

B. INSTALLATION

(1) Install communications horizontal cabling in accordance with manufacturer’s instructions, ANSI/TIA-568-C.0, ANSI/TIA-568-C.1, ANSI/TIA-569-C, BICSI TDMM, and NFPA 70.

(2) To each Information Outlet, supply and install Data Cables, as indicated, from the CER.
   a. To each Information Outlet, supply and install (1), four pair Category 6A-Blue,
   b. To each Wall Phone Outlet, supply and install (1) four pair Category 6A-Blue,
   c. To each Duplex Data, supply and install (2) four pair Category 6A-Blue,
   d. To each Apple TV, supply and install (1) four pair Category 6A-White,
   e. To each CCTV outlet, supply and install (1) four pair Category 6A-Red
   f. To each WiFi outlet supply and install (1), four pair Category 6A-Yellow.
   g. To each Bell/PA outlet, supply and install (1) four pair Category 6A-Grey

(3) Where information Outlets are surface mountable, supply, install the proper raceway, and surface mounted box.

(4) Horizontal cabling shall be installed in raceways, cable trays, or other approved support systems and terminated at station locations indicated.

(5) All cable shall be routed parallel and perpendicular to the building.
supporting steel structure

(6) Cabling shall take the form of a “Universal Cabling Plan” where station cables are wired directly, home run fashion, from a distribution point to the appropriate Information Outlet supporting the specified Data capabilities.

(7) Horizontal cables not installed in conduit or wireways shall be properly secured and neat in appearance.

(8) All cabling shall be supported at least 15cm above the drop ceiling.

(9) All cabling shall be supported a minimum of 1.5m O.C. via the means of ‘J’ hooks or other approved method.

(10) All cabling shall be neatly organized using Velcro. NO cinch-type cable ties.

(11) Label each cable ends with computer generated permanent ink permanent label per TIA-606-B.

C. CLEANING

(1) Remove all unsightly marks and repair any damaged scratched or disfigured work
271543 – COMMUNICATIONS FACEPLATES & CONNECTORS

1. GENERAL

A. RELATED SECTIONS

(1) Section 27 05 00 Basic Communication Requirements
(2) Section 27 05 26 Ground & Bonding for Communications Systems
(3) Section 27 11 23 Communications Cable Management & Ladder Rack
(4) Section 27 11 16 Communications Cabinets, Racks, Frames, and Enclosures
(5) Section 27 11 19 Communications Termination Blocks & Patch Panels

B. SYSTEM DESCRIPTION

(1) This section includes the minimum requirements for Fiber Connectors, Adapters and Adapter Panels.
(2) The performance for the installation shall meet or exceed the requirements of ANSI/TIA-568 and ISO/IEC 11801 and other requirements as noted in this specification for the specified Fiber Type.
(3) The connectors and adapters shall match the fiber type of the cabling
(4) All connectors and adapters shall meet UL 94 V-O

C. SUBMITTALS

(1) See Section 01 30 00 - Administrative Requirements, for submittal procedures.
(2) Product Data: Provide manufacturers catalog data for hardware
(3) Project Record Documents: Record actual locations of All outlets, cable pathway, sleeves.
(4) Warranty: Submit manufacturer warranty and ensure that forms have been completed in City of Tucson’s name and registered with manufacturer.

D. QUALITY ASSURANCE

(1) Approval by Contracting Officer is required of products of proposed manufacturer, or supplier, and will be based upon submission by Contractor certification.
(2) Manufacturer Qualifications: Company specializing in
manufacturing products specified in this section, with not less than three years of documented experience.

(3) Certify materials and equipment shall be the standard products of the manufacturer regularly engaged in the manufacture of the products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 2 years prior to bid opening.

(4) Installer Qualifications: Company manufacturer certifies specializing in performing the work of this section with minimum 5 years of experience.

E. DELIVERY, STORAGE, AND PROTECTION

(1) Deliver components to the site in original manufacturers packaging.

(2) Store all materials in a secure place that is weather tight dry, and not exposed to UV radiation.

(3) Protect all components from damages by handling, weather and construction operations before, during and after installation.

F. COORDINATION

(1) Coordinate installation of Jack/Information outlets and connectors with other trades.

2. PRODUCTS

A. INFORMATION OUTLETS

(1) USL10G Cat 6A Information Outlet;
   a. Data: Blue
   b. Voice: White
   c. Security: Red
   d. PA: Yellow

(2) USL10G-SHLD, GY Shielded Cat 6 Connector
   a. AV: Grey

B. FACEPLATES

(1) Stainless Steel with ID window
   a. Port count as required

3. EXECUTION

A. PRE-INSTALLTION
B. INSTALLATION

(1) Clean cable to remove construction materials

(2) Contractor shall comply applicable codes, standards and with all local codes and requirements. It is the responsibility of the contractor to identify and adhere to any unique codes or requirements governed by the region where the work is to be performed.

(3) Jack/Information outlets and Connectors shall be installed following industry standard practices.

(4) Horizontal cabling shall be terminated on a Jack/Information outlet which is the same category rating as the Cable.

(5) Contractor shall not exceed the maximum pulling tension or the minimum bending radius for twisted pair cables per manufacturer’s specifications.

(5) Contractor shall test all horizontal links per the ANSI/TIA-568 Requirements.

C. WORKSTATION TERMINATIONS

(1) Use manufacturers recommend termination tool. Stuffer cap impact not acceptable

(2) Terminate fiber connectors where appropriate

(3) Label each cable ends with computer generated permanent ink permanent label per diSTRICT standard labeling scheme.

(4) Install appropriate faceplate.

(5) Label outlet per specification

D. RACK TERMINATIONS

(1) Terminate differing systems on their own patch panel

(2) Termination shall occur from the lowest information Outlet number to the highest Information Outlet number.

(3) Contractor shall take great care to route cabling and ensure clearance for maintenance.

E. CLEANING

(1) Remove all unsightly marks and repair any damaged scratched or disfigured work

END OF SECTION
274116 – PA SYSTEMS AND EQUIPMENT

1. GENERAL

A. Scope

(1) The work described by this section includes the furnishing of all components, materials, equipment, installation and technical labor and the performance of all operations necessary for the complete installation of a Bell & PA System in operating condition as indicated on the drawings and/or specified herein.

(2) Included in the Scope of this Section:

a. Licenses, permits as may be applicable
b. Provision of submittal information
c. Installation in accordance with contract documents, manufacturers’ recommendations and applicable codes
d. Configuration of control and signal processing software
e. Testing and adjustments, including documentation thereof
f. Provision of manuals
g. Maintenance and warranty services

(3) Applicable References:

a. National Electric Code (NEC)
b. Underwriters Laboratories (UL)
c. Sound System Engineering (Davis & Patronis) — 3rd Edition 2006
d. Audio Systems Design and Installation (Giddings) 1990
e. InfoComm International A/V Installation Handbook — 2nd Edition
f. Telecommunications Distribution Methods Manual (TDMM)

(4) In general, the conduit and/or cable tray, junction boxes, electrical power circuits and outlets and terminal cabinets, as required for a
complete operating system, shall be furnished and installed by the Electrical Contractor under a separate contract. The entire responsibility for the system, its installation, operation and function shall be that of the Systems Contractor.

B. Quality Assurance

(1) Installation shall be in compliance with the National Electric Code and all other applicable codes.

(2) All equipment described herein or otherwise required to perform the specified system functions shall be a regular product line, produced by the system manufacturer.

(3) All materials furnished under this contract shall be new, of highest quality and shall be of a regularly manufactured line, currently in production at the time of installation.

2. PRODUCT

A. General Equipment And Material Requirements

(1) Compatibility of Components: Coordinate component features to form an integrated system. Match components and interconnections for optimum performance of specified functions.

(2) Equipment: Comply with UL 813. Equipment shall be modular, using solid-state components, and fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.

(3) Equipment Mounting: Where rack, cabinet, or console mounting is indicated, equipment shall be designed to mount in a 19-inch housing complying with TIA/EIA-310-D.

(4) Weather-Resistant Equipment: Listed and labeled by a qualified testing agency for duty outdoors or in damp locations.

B. Common Areas Audio (Hallways)

(1) Provide 70-volt speakers, which will interface to the 70-volt amplifier listed under audio rack location. Audio zones shall be established based on the needs of the school. Each zone shall consist of 70-volt speakers and be tapped at the wattage desired to
provide the best sound for each speaker location without overloading the speaker or amplifier.

a. Acceptable: 2’ x 2’ 70 volt lay-in tile speaker JBL LCT 81C/T or equivalent

(2) Common Areas Audio (Offices)

a. Allow for offices requiring 1-way communication, reception of bells and PA announcements by connecting to the closest 70-volt zone.

   i. Acceptable: 2’ x 2’ 70 volt lay-in tile speaker JBL LCT 81C/T or equivalent

   ii. Acceptable: 70-volt wall volume attenuator as needed

(3) Common Areas Audio (Outside)

a. Provide 70-volt weatherized speakers to cover the desired area outside of the building(s) of the campus.

   i. Acceptable: 70-volt horn speaker JBL CSS-H15 or equivalent

   ii. Acceptable: 70-volt weatherized speaker JBL Control 25AV or equivalent

3. EXECUTION

A. General Installation

(1) Equipment shall be furnished and installed in accordance with manufacturer’s recommendations in compliance with all local, city, state and national codes.

(2) Provide all hardware, framing members, etc. as required for mounting supports.

(3) All penetrations in smoke or firewalls shall be sealed with fire stop rated for this purpose.

(4) The installation of all work shall be neat and of professional quality. Cooperate with other trades in order to achieve well-coordinated progress and satisfactory final results. Execute without claim for extra payment minor moves or changes in equipment locations to
accommodate equipment of other trades or the architectural symmetry of the facility.

(5) Conductors And Cables
a. Jacketed, twisted pair and twisted multipair, untinned solid copper.
b. Insulation for Wire in Conduit: Thermoplastic, not less than 1/32 inch thick.

(6) Raceways
a. Conduit and Boxes: Comply with Section Raceway and Boxes for Electrical Systems
b. Outlet boxes shall be not less than 2 inches wide, 3 inches high and 2-1/2 inches deep.

(7) Wiring Methods
a. Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters, and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
b. Comply with requirements for raceways and boxes
c. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
d. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

(8) Installation of Cables
a. Comply with NECA 1.
b. General Cable Installation Requirements:
i. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.

   ii. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet
boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.

iii. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

iv. Bundle, lace, and train conductors to terminal points without exceeding manufacturer’s limitations on bending radii. Install lacing bars and distribution spools.

v. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

vi. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.

vii. Open-Cable Installation:

1.) Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

2.) Suspend speaker cable not in a wireway or pathway a minimum of 8 inches above ceiling by cable supports not more than 60 inches apart.

3.) Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.

(9) Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other
intercommunication equipment conductors as recommended by equipment manufacturer.

B. Programming / Configuration
(1) It is the Contractor's responsibility to configure the system in this section according to the Owner's wishes.

C. Tests
(1) Upon completion of installation and satisfactory testing of system by Contractor, the Contractor shall test the system in the presence of the Owner and the Engineer to demonstrate satisfactory performance.

(2) System shall be tested by and a certificate of inspection shall be furnished by a qualified manufacturer's representative or equipment vendor; Submit report indicating result to the Engineer.

D. Identification/Labeling
(1) Contractor shall identify all major items of equipment and tag all cables with permanent type markers to denote equipment served. Cables shall be tagged at both end and at each point where the cable is administered.

(2) The contractor shall be responsible for applying a permanent label to each cable to indicate source and destination.

(3) All labeling and recording shall be approved by the Owner and the Engineer prior to application.

E. Training
(1) Provide step-by-step user instructions identifying operator controls for normal use operations. This shall be included with the O&M manuals.

F. Operation and Maintenance Manuals
(1) Technology drawings updated with final as-built information. This shall be in the form of a complete set of Technology drawings with as-built information indicated in colored pen based upon actual field conditions.

(2) Provide statement of warranty with O&M Manuals.
G. Warranty

(1) This Contractor shall warrant all workmanship, equipment and material provided under this contract for a period of one (1) year from the date of approval of certificate of contract completion by the Owner. Provide statement of warranty with O&M Manuals.

(2) During the warranty period, report to the site and repair or replace any defective materials or workmanship without cost to the Owner. Warranty service shall be rendered within 24 hours after request by the Owner. Equivalent replacement equipment shall be temporarily provided when immediate on-site repairs cannot be made.

(3) Where warranties on individual pieces of equipment exceed twelve months, the guarantee period shall be extended to the warranty period of the particular items.

(4) After completion of the work, the Contractor shall submit a Certificate of Warranty, stating commence and expiration dates and conditions of the warranty, for signature of both participating parties. Incremental warranties for complete portions of the work may be negotiated at the discretion of the Owner, if delays occur beyond the control of the Contractor.

END OF SECTION
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282129 – VIDEO SURVEILLANCE CAMERAS, REMOTE DEVICES & SENSORS

1. GENERAL

A. SECTION INCLUDES
   (1) Cameras.
   (2) Switches
   (3) Cable and accessories.
   (4) Licenses

B. REFERENCES

C. SYSTEM DESCRIPTION
   (1) Description: Provide video communications between points of surveillance indicated on Drawings and Central recording/distribution system.

D. SUBMITTALS
   (1) See Section 01 30 00 - Administrative Requirements, for submittal procedures.
   (2) Shop Drawings: Indicate electrical characteristics and connection requirements, including system wiring diagram.
   (3) Product Data: Provide showing electrical characteristics and connection requirements for each component.
   (4) Manufacturer’s Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
   (5) Project Record Documents: Record actual locations of cameras and routing of cable.
   (6) Operation Data: Instructions for starting and operating system.
   (7) Maintenance Data: Routine trouble shooting procedures.

E. QUALITY ASSURANCE
   (1) Conform to requirements of NFPA 70.
   (2) Installer Qualifications: Authorized installer of specified
(3) Products: Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

2. PRODUCTS

A. COMPONENTS

(1) Manufacturers:

(2) Arecontvision; www.arecontvision.com

(3) Domes/Enclosures

(4) Application: Indoor or Outdoor as environment dictates

(5) Outdoor Domes/Enclosures

a. Operating Temperature: +40º F (+5ºC) to +150ºF (+66ºC)
b. Input Voltage: 12VDC, 24VAC, 110-220VAC
c. Vandla proof IP.v66
d. Pressurized
e. Built-in surge & lightning protection
f. System Components and Supplied Accessories:

(6) Camera enclosure, camera bracket, fan, humidity absorber, thermostat, thermo-dynamic cooling module

B. Indoor Domes/Enclosures

(1) OptiClear polycarbonate 7" dome,

(2) Housing extends maximum 3.5" below ceiling

(3) Fixed mount camera bracket

(4) Plenum rated metal top

(5) System Components and Supplied Accessories:

a. Camera enclosure, camera bracket, fan, humidity absorber, thermostat, thermo-dynamic cooling module

C. Cameras

(1) Application: Indoor or Outdoor as noted

(2) Megapixels: 5MP/12MP as noted

(3) Resolution: no less than 2560(H) x 1920(V) pixels relative.

(4) Remote Zoom/Autofocus

(5) Aspect Ratio: user configurable and not limited to 4:3 or 16:9 aspect ratios.
Light Requirement: Minimum light requirement to produce a color image shall be approximately 0.30 lux (0.03 fc) with a f1.2 lens.

Night mode: less than 0.05 lux (.005 fc) shall be required to produce a black and white image.

Automatic white balance, automatic exposure, gain control, electronic shutter, and backlight compensation.

Memory: at least 64MB of RAM and 4MB of flash memory.

Remote Zoom: Digital

Power: IEEE 802.3af Power-over-Ethernet ready and can also be powered directly using 12-24 VDC or 24 VAC

Authentication: Digital image authentication shall be available and licensed to verify that images have not been altered, manipulated, or tampered with, in any way.

Progressive scan CMOS imager with a 1/2-inch optical format

Dual encoder MJPEG, H264 compatible

Built-in web server and FTP server

HTTPS encryption with IP filtering

IK-10 Impact Resistant

LUX
i. Color: 0.3 @ f1.4
ii. B&W: 0.005 @ f1.4

Iris: Auto

Frame Rate: 25/30 per second at highest resolution

Flash upgradeable

Approved Camera:
  a. Arecontvision - AV12276DN-## appropriate lenses and all accessories
  b. Arecontvision – AV5555DN-F-## appropriate lenses and all accessories

D. ACCESSORIES

License:

Provide license & 3 year support for each camera installed. Add licenses to existing Owner contract

Main Video Cable: Category 6A for cameras under 90 meters-Multimode fiber for cameras over 90 meters.
3. EXECUTION

A. INSTALLATION
   (1) Install in accordance with manufacturer's instructions.

B. ADJUSTING
   (1) Adjust lens to meet lighting conditions. All lenses to maximize depth of field and field of view
   (2) Coordinate with owner for coverage of cameras adjust per owners requirements
   (3) Ensure all cameras communications to central NVR

C. DEMONSTRATION
   (1) Conduct walking tour of project and briefly describe function, operation, and maintenance of each component.

END OF SECTION

END OF DIVISION
DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

283100 FIRE ALARM SYSTEM

1 GENERAL

A GENERAL

(1) Drawings, Section I - Legal Documents and Division 1 Specification Sections, apply to this Section.

B SCOPE AND GENERAL REQUIREMENTS

(1) The contractor shall provide all equipment and accessories for expansion of the existing electrically supervised Class "A" fire alarm system with addressable initiating circuits as described herein and as shown on the plans.

(2) The new building shall have emergency voice alarm notification as described herein and as shown on the plans.

(3) All equipment, wiring and operation of the system shall comply with Local and National Codes and Ordinances. Specific reference is made to current adopted editions of:

   a. Underwriters Laboratory listing and labeling of equipment.
   b. NFPA 70.
   c. NFPA 72.
   f. Requirements of the State of Arizona Fire Marshal.
   g. Americans with Disabilities Act (ADA).

(4) Equipment and accessories furnished under the terms of this specification shall be the standard products of a single manufacturer where possible and shall be U.L. listed and labeled.

(5) Main Fire Alarm Control Panel (FACP) is existing and shall be modified and upgraded as required to provide coordinated fire safety features as described herein.

(6) No signal circuit shall be initially loaded in excess of 85% of its rated ampere capacity.

(7) Fire Alarm equipment and panels shall be powered from dedicated 20 ampere, 120 volt circuits. The circuit breakers in the panel feeding the equipment shall have a handle lock-on device and shall
be identified in the circuit directory. The panel name and circuit number shall also be identified on the fire alarm equipment.

(8) The system shall contain battery backup power. The batteries shall be rechargeable and be of a gel-cell type. The panel shall contain a battery charger to insure fully powered batteries at all times. It shall be supervised and indicate system trouble when the batteries are not capable of supplying power under demand.

(9) Field devices (manual stations, horns, bells, strobes, smoke and heat detectors) shall have four (4) screw terminals for wiring connections for a true four (4) wire system throughout. Do not T-tap to any device. All devices except smoke and heat detectors shall be red in color.

(10) Provide a digital alarm communicating transmitter for transmission of alarm and supervisor signals to an approved central monitoring station. Provide 3/4" conduit with telephone cables from fire alarm panel to the telephone terminal board for the wiring to the alarm transmitter.

(11) A floor plan map of the building shall be made and reference made to zone location wording to geographic location within the building. The map shall be color coded and protected by a glassed frame securely fastened to the wall in the immediate area of the fire alarm panel. If an annunciator panel is used, a similar map shall be furnished and mounted in the immediate area of the annunciator.

(12) Contractor shall submit plans to the Authority Having Jurisdiction (AHJ) for approval prior to installation. Comply with all AHJ requirements at no additional cost to the contract. Submit shop drawings on same size drawing sheets as the bid documents.

C SYSTEM OPERATION

(1) Activation of any fire alarm station, fire sprinkler flow switch, heat detector or smoke detector circuit shall cause the following to happen:

   a. Sound a pre-recorded evacuation message over all audible signals. (General Alarm) Evacuation message shall continue sounding until manually silenced or reset at the panel.
   b. Visual alarm signals shall flash.
   c. Light the control panel mounted red alarm lamp to indicate the zone initiating the alarm.
   d. Provide contact closure for Central Monitoring Station signal.
e. Shut down or redirect HVAC systems when so scheduled and described on the drawings.

(2) Activation of any HVAC duct smoke detector circuit shall cause the following to happen:

a. Open the holding coil circuit to all HVAC fan starters in the building.
b. Light the control panel mounted amber alarm lamp to indicate the zone causing the alarm and activate a buzzer at the control panel.
c. Send trouble signal (dry contacts for trouble signal close) to central monitor station.
d. HVAC fans shall not restart until the FACP is reset.
e. Do not sound audio alarms or flash visual alarm signals unless specifically indicated.

(3) The system shall be fully supervised and cause the following to happen:

a. When a ground fault occurs within the fire alarm panel, it shall illuminate the panel (amber) ground fault lamp. Also, a local sounding device within the panel only shall sound, indicating a trouble condition.
b. When a ground fault occurs within zone or signal circuit wiring, the amber zone or circuit module lamp shall illuminate indicating which zone or circuit the ground fault occurred. Also, a local sounding device within the panel only shall sound, indicating a trouble condition.
c. When an open circuit occurs within zone or signal circuit wiring, the amber zone or circuit module lamp shall illuminate, indicating which zone or circuit the open occurred, as well as the system trouble amber lamp. Also, a local sounding device within the panel only shall sound, indicating a trouble condition.
d. When the battery backup supply has become inadequate to power the system, the system trouble amber lamp shall illuminate. Also, a local sounding device within the panel only shall sound, indicating a trouble condition.
e. Indication shall be given at the fire alarm panel when A.C. power to the fire alarm panel has been removed.

D SUBMITTALS

(1) Submit for approval complete shop drawings for system. This to include drawings of panel layout, component list, and system wiring diagram prepared by equipment supplier for submittal to AHJ.
Submit shop drawings to Architect prior to making submittal to AHJ. Catalog cuts only are not acceptable.

(2) As part of Maintenance and Operating Instructions, include schematic wiring diagrams and parts lists for all components and assemblies.

(3) Submittals shall be in accordance with Division 1 and Section 16100 requirements.

2 PRODUCTS

A APPROVED MANUFACTURERS

(1) The catalog numbers listed are those of the Simplex division of Johnson Controls and indicate design, quality and type of material as well as operating characteristics. New equipment shall be same manufacturer, type and ratings as the existing fire alarm system and new installation shall maintain the listing of the existing system.

B ALARM CONTROL PANEL

(1) Existing Simplex Type 4100 panel.

(2) Batteries shall be sealed gel-cell type of sufficient capacity to provide power for the entire system upon loss of normal 120V AC power for a period of 24 hours with ten minutes of alarm signaling at the end of the 24 hour period. Batteries shall be housed within the panel cabinet when possible or in a separate enclosure of identical design to the FACP cabinet, mounted adjacent to FACP main cabinet.

(3) Notification Appliance Circuit Power Extender Panel shall be Simplex type 4009-9002 panel complete with power supply, batteries and four (4) style Y 2A notification appliance circuits. This panel to be used to power alarm strobe lights only.

(4) Provide type 4003-9002 voice control panel to provide voice and tone generation, 75W of amplifier power to supply four (4) style Z Audio Notification Appliance Circuits.

C NOTIFICATION APPLIANCES

(1) Speaker/Strobe devices

   a. With 15cd strobe -- type 4903-9350. Use for all speaker/strobe applications except where high cd output
strobes are indicated or required. Strobe operating current shall not exceed 60mA average.

b. With 75cd strobe -- type 4903-9351. Strobe operating current shall not exceed 155mA average.

c. With 110cd strobe -- type 4903-9352. Strobe operating current shall not exceed 200mA average.

(2) Strobe devices:

a. Wall Mounted -- type 4906-9101. Device operating current shall not exceed 60mA, 94mA, 186mA and 252mA for 15cd, 30cd, 75cd and 110cd strobe settings, respectively.

b. Ceiling Mounted -- type 4906-9102. Device operating current shall not exceed 75mA, 125mA, 233mA and 316mA for 15cd, 30cd, 75cd and 110cd strobe settings, respectively.

c. Provide type 4905-9926 wire guard for ceiling mount devices mounted in areas subject to damage such as Toilet Rooms.

(3) All visual alarm signals shall be synchronized. If necessary, provide sync modules as needed.

(4) Speaker (only) devices:

a. Type 4902-9703.

b. When mounted outside or in high humidity location provide type 4902-9703H with 4905-9907 gasket kit.

D EXTERIOR BELLS

(1) Simplex type 2901-9322 with weatherproof back box and type 2905-0051 dome guard.

E COMMUNICATING DEVICES

(1) Individual Addressable Module (IAM):

a. Type 2190-9172. Mount in outlet box at contact type device to connect contact type device to MAPNET addressable initiating circuit.

b. Use only to connect individual contact device to MAPNET circuit. When two (2) or more contact devices are connected as a single initiating point provide Contact Monitor ZAM.

(2) Zone Adapter Module (ZAM):

a. Contact Monitor Module, style D type 2190-9153 (surface) or 2190-9154 (flush).
b. Control Signal Module, style Z type 2190-9159 (surface) or 2190-9160 (flush).
c. Control Relay Module, type 2190-9163 (surface) or 2190-9164 (flush).
d. Use specific type ZAM as indicated on drawings.

F MANUAL ALARM STATIONS

(1) Semi-flush, non-coded, type 2099-9761 double action non-breakglass alarm stations where shown on plans. Manual alarm stations shall be red color molded polycarbonate construction. Force required to activate the station shall not exceed 5 pounds and shall be in conformance with ADA. Suitable for individual addressable communication on MAPNET initiating circuit.

G SMOKE DETECTORS

(1) Spot type smoke detectors shall be type 4098-9714 analog photoelectric detector head with type 4098-9792 addressable base. Smoke detectors shall comply with U.L. Standard 268.

H SPRINKLER SYSTEM FLOW SWITCH

(1) Sprinkler flow switches shall be furnished and installed by fire sprinkler contractor and wired under this Division.

(2) Provide IAM or ZAM to connect to IdNET addressable initiating circuit.

I SPRINKLER SYSTEM SUPERVISORY SWITCH

(1) Sprinkler gate valve supervisory switches shall be type OSYS-B designed for universal mounting.

(2) Sprinkler post indicator valve switches shall be type PIVS-B.

(3) Provide IAM or ZAM to connect to IdNET addressable initiating circuit.

J CONDUIT AND BOXES FOR FIELD DEVICES

(1) Conduit shall be as specified in Section 16100 for electrical work.

(2) Provide a green insulated 14AWG solid copper equipment grounding conductor in all fire alarm conduits.

(3) Boxes shall be as specified in Section 260500 for electrical work. Minimum size box shall be 4 inch square, 1-1/2 inch deep. See PART 3 of this section for additional requirements on box sizing.
K LIGHTNING PROTECTION

(1) Provide lightning protection on all circuits entering control panel or annunciator from separate building when wiring path runs underground.

L TERMINAL STRIPS

(1) When required, terminal strips in junction boxes shall be as manufactured by Cinch-Jones, or equivalent and shall be securely mounted to the junction box.

M CONDUCTORS

(1) Conductors for system shall be 98% minimum conductivity copper.

(2) IDNet initiating circuit shall use West Penn #1975 cable, #18 AWG solid twisted, shielded pair (TSP) installed in raceway.

(3) For 24V DC circuits use #14 AWG solid conductor. Stranded wire not acceptable. Insulation for all circuits type "THHN" except for underground circuits use type "THW" or "XHHW." Do not use type "THHN or THWN" wire for underground circuits. See PART 3 of this section for color coding.

(4) For 120V AC circuits conductors shall be as specified in Section 260500.

(5) Listed Fire Alarm Cables installed without conduits or raceways may be used for horizontal wiring in accessible above ceiling spaces.

3 EXECUTION

A INSTALLATION OF EQUIPMENT

(1) Installation shall be accomplished in a professional manner by qualified personnel regularly engaged in and experienced in this type of work.

B INSTALLATION OF CONDUIT AND JUNCTION BOXES

(1) Do not change conduit layouts or wiring from that indicated when a specific circuit/conduit layout is shown on drawings. In this instance, shop drawings shall reflect the circuit/conduit layout per the engineer’s design drawings. When no circuit layout is shown on drawings, provide shop drawings indicating specific circuit and
Old Vail Middle School
New Library

conduit layout. Actual installation shall be as indicated on the shop drawings.

(2) Junction boxes shall be sized so that when covered, the wires occupy only 50% of the box area. (Boxes must reasonably be capable of housing twice the number of wires.)

(3) All junction and pull boxes and their covers shall be painted red. Painting shall be done prior to box installation.

(4) No junction box, pull box or auxiliary box shall be without cover.

(5) When more than eight (8) conductors are spliced in a box, provide a terminal strip. For eight (8) or less conductors, wire nut splices are acceptable.

(6) Installation requirements of Section 260500 shall apply to this work.

(7) EMT raceways used for fire alarm system shall be factory color coded red color.

(8) All continuous raceways shall have electrical (ground) continuity back to the F.A.C.P. Isolated sections of metallic raceways used as sleeves for cable type wiring methods in inaccessible spaces shall be grounded.

(9) All back boxes for devices (pull stations, notification appliances, etc.) shall be appropriate boxes as designed by manufacturer. (Extension boxes bolted to back boxes to achieve sufficient depth are not acceptable.)

C FIELD WIRING INSTALLATION

(1) Install all system wiring in raceways per paragraph 3.2 and as indicated on the drawings, or Fire Alarm Cables without raceways only in accessible ceilings. Fire Alarm Cables installed without raceways may be used only above accessible t-grid ceilings, never in walls or in inaccessible hard ceiling spaces or otherwise closed-up where the cables cannot be accessed.

(2) When more than one zone or circuit occupies a junction or pull box, all conductors shall be identified with zone numbers.

(3) Field wiring shall be color coded and be consistent throughout the entire installation.

These colors shall be used:

Red and Black = signal devices (horns and bells)
Yellow and Blue = initiating devices (manual station, heat and smoke detectors)
Orange and Brown = flow and tamper switches
White and Violet = auxiliary (door release/door latch release and HVAC shutdown and annunciator)
Green = equipment ground

(4) Wire color code shall be White and Violet wires for any function other than Signal Devices, Initiating devices, flow and tamper switches.

(5) Any wire pulled from a spool and field installed either internal or external to the F.A.C.P. shall comply with the color coding requirements in the specifications and "C" above. Any wire used within the F.A.C.P. for interconnection shall not use the same colors as the field wiring unless approval from the Architect is obtained.

(6) Wiring carrying line voltage (120V AC) and wiring carrying low voltage (24V AC or DC) shall not share the same conduit.

(7) Provide conduit sleeves in walls and through inaccessible ceiling spaces when Fire Alarm Cable type wiring methods are used. All outlet boxes in walls shall have EMT conduit sleeves from the box up to ceiling space. Minimum size 3/4” EMT. Provide larger conduit if needed for wire fill.

D INSTRUCTION TO OWNER

(1) Contractor shall provide instruction to Owner with regard to proper use and operation of system. This to include not less than four hours time with manufacturer/supplier’s representative on site to demonstrate all aspects of the system.

E WARRANTY

(1) Refer to Division 1.

(2) When manufacturer's standard warranty exceeds the requirements stated in Division 1 the full manufacturer's warranty shall apply.

F TESTING AND ACCEPTANCE

(1) Contractor shall conduct a complete and thorough test to insure that the system will satisfy all the requirements of the National and Local Codes, as well as this specification. The test and acceptance shall be scheduled at a time when the building is not occupied or shall be scheduled so as to have the least amount of interruption to
building occupants. Test shall be coordinated with and witnessed by the AHJ and Architect.

(2) After the AHJ and Architect have been satisfied that the installation meets all requirements, an instructional session shall be scheduled with the Owner demonstrating the operation and the function of the system.

(3) The following test procedures shall be performed:

a. Fire alarm system shall be tested on battery operation (AC power removed).

b. All sprinkler flow switches shall be tested to verify that they will create alarm condition and sound fire horns.

c. All sprinkler tamper switches shall be tested to verify that they will create a trouble condition in the zone module.

d. At random, wiring to initiating and signaling circuits shall be tested for ground faults. (Ground faults will be simulated to verify that the panel will detect them and indicate ground fault trouble condition.)

e. A visual inspection of conduit and wiring will be made to insure all junction and pull boxes are covered and painted red.

(4) It is the responsibility of the general contractor that these test procedures be satisfied.

END OF SECTION
DIVISION 31 – EARTHWORK

311000 – EARTHWORK

1. GENERAL

A. SCOPE: This section of the specifications includes furnishing all labor, materials and equipment necessary to complete all site and earthwork as indicated on the drawings and/or as hereinafter specified including but not necessarily limited to the following:

1. Project layout and verification
2. General protection responsibilities
3. Site preparation and rough grading
4. Earth excavation, filling and compaction
5. Finished grading

B. Related Sections:

1. 312150 - Excavation, Filling and Backfilling
2. 312210 - Trenching and Backfilling

C. Related Documents: Drawings and general provisions of the Contract, including general and supplementary conditions, apply to the work of this section. Other related documents include:


D. Geotechnical Engineering Report: The Owner has secured a Geotechnical Engineering Report from Western Technologies Inc.; Report #2929JH065, dated September 20, 2019, for this project. A copy is included at the end of this section for reference. The Contractor shall adhere to all recommendations contained therein.

E. Project Layout: Contractor shall employ and pay for the services of a registered surveyor licensed to practice in the State of Arizona to lay out the work and check and verify all elevations, dimensions, etc., prior to starting construction. Any discrepancies in the above shall be immediately reported to the Architect. All grades, lines, levels and benchmarks shall
be established by the general Contractor who shall be responsible for same. From time to time, the surveyor shall check the work for proper alignment, location, elevations, etc.

F. General Protection Responsibilities:

(1) Engineering Responsibility: Contractor for this work shall be responsible for all engineering and safety for execution of his work. Provide and install shoring, needles, bracing and wedging to support or protect any excavation, banks, sidewalks, walls and other structures. All shores, needles or braces shall be located so as not to interfere with the construction. Work shall be done in accordance with competent engineering practices and local building codes. Location of cuts, fills, and excavations shall be the responsibility of the Contractor.

(2) Protection of Persons: Protection of all persons shall be provided at all times. The work shall proceed in such manner as to prevent the undue spread of dust and flying particles. Provide all necessary temporary protective barriers and fencing as required.

(3) Preservation and Restoration of Property: The Contractor shall be responsible for the preservation of all public and private property on the surface or underground, along and adjacent to the work, and shall conduct his operation so as to insure the prevention of injury or damage thereto. No land monuments or similar property shall be disturbed or moved until an authorized agent of the Architect has witnessed or otherwise referenced their location. When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, or as the consequence of the non-execution thereof on the part of the Contractor, such property shall be restored by the Contractor, at his own expense, to a condition equal to that existing before rebuilding, or otherwise restoring same, or he shall make good such damage or injury in an acceptable manner.

(4) Existing Utilities: The existing utilities service lines and utilities structures, whether shown on the drawings or not, shall be protected and safeguarded from damage during earthwork operations and, if damaged, shall be repaired by the Contractor at his expense.

   a. The above provisions are applicable to all or any portion of utilities service lines and utilities structures which project above the original surface or lie beneath
the ground surface within any grading area.

(5) **Landscape Protection:** Contractor shall take all necessary precautions to preserve without damage any trees or landscaping within the property lines, except those specifically designated for removal and disposal. Verify with Architect.

(6) **Burning Debris:** No materials or debris shall be burned on the premises.

(7) **Dynamite and Powder:** No dynamite or powder shall be used or brought to the site.

(8) **Dust Control:** Contractor is responsible for water and equipment required to keep dust to a minimum during grading and excavation.

G. **Soils Engineering and Tests:**

(1) Qualified Soils Testing agency shall be employed to observe the placement and compaction of all fill at the site, to take all samples required for tests as required. Testing shall be done by an approved and independent testing laboratory.

(2) Payment of tests and services of testing agency shall be the responsibility of the Owner.

(3) Test reports shall be delivered to the Owner and duplicate copies to the Architect and Engineer.

(4) Contractor's Responsibility: To notify the soils testing agency when filling and compaction are to take place and know that tests are taken.

2. **PRODUCTS:**

A. **Fill and Backfill:**

(1) Fill required to backfill walls or to construct building site shall conform to the referenced geotechnical engineering report for the project.

B. **Base Course:** An aggregate base course of 4" thickness (compacted thickness) shall be placed under all on-grade concrete slabs, consisting of sand and gravel as directed by the soils report and shall be compacted to
311000 EARTHWORK

3. EXECUTION:

A. Site Preparation:

1. General: The site, where indicated on the drawings, shall be cleared of all natural obstructions and any other items which will interfere with the construction operations or as designated for removal a minimum of 5' beyond the perimeter of the new buildings as directed by this specification and the soils report.

2. Grubbing: All stumps and subsurface roots larger than three inches (3") in diameter and matted roots existing within the area bounded by lines five feet (5') outside of structure foundations shall be removed. In other areas of construction all stumps and subsurface roots larger than three inches (3") in diameter and all matted roots shall be removed to a depth of 18" below any sub-grade shoulder slope or existing grade.

3. Strip and remove all existing rubble, debris, vegetation, obviously loose surface soils from the building areas. Any depressions, ditches, trenches, etc. should be cleaned and widened to accommodate compaction equipment.

4. The criteria provided in the geotechnical engineering report should be used in determining the minimum depth of any over-excavation and engineered fill required below the shallow footings and the minimum distance it should extend beyond the footing edges. It may be more practical to remove soils to the maximum depth beneath all portions of the structure area. If this is done, the removal and re-compaction should extend at least five feet beyond the perimeter footings.

5. After any over excavation has been accomplished, the exposed soils should be scarified, moistened, or dried as required, and compacted to a minimum depth of 10 inches. If clay soils are exposed at finished sub-grade in floor slab areas, the clayey soils shall be removed replaced with engineered fill to the depths indicated in the geotechnical engineering report.

6. Place fill in maximum 10-inch loose lifts and compact the fill such that specified densities are achieved. All earthwork for the building pad should extend at least 5 feet beyond the perimeter footings.

7. Separate Topsoil: All topsoil affected by rough grading, and/or
excavations shall be stockpiled on site separately and shall not be used for backfill, but shall be conserved as directed by the Architect and utilized for topsoil in rough and final grading as specified herein.

(8) Planting Areas: All foreign matter shall be removed to a depth of at least two feet (2') below the new finish grade.

(9) Rough Grading: Uniformly smooth grading of all areas covered by the project, including excavated and filled sections and adjacent transition areas shall be accomplished. The finished surface shall be reasonably smooth, compacted, and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from either blade-grader or scraper operations, except as otherwise specified. All ditches shall be finished so as to drain readily.

B. Compaction:

(1) The sub-grade shall be scarified, moistened (or dried, as required), and re-compacted for a minimum depth of 10 inches before placement of fill materials.

(2) Compaction of backfill and fill shall be performed in horizontal lifts not exceeding 10" loose thickness, and shall attain the following specified percent of maximum density at the appropriate optimum moisture content as determined in accordance with ASTM Designation D698.

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>% COMPACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-site sub-grade soils (reworked) and sub-base fill:</td>
<td></td>
</tr>
<tr>
<td>Below footings</td>
<td>95</td>
</tr>
<tr>
<td>Below slabs -on-grade</td>
<td>95</td>
</tr>
<tr>
<td>Below pavement</td>
<td>95</td>
</tr>
<tr>
<td>Imported fill:</td>
<td></td>
</tr>
<tr>
<td>Below footings</td>
<td>95</td>
</tr>
<tr>
<td>Below slabs-on-grade</td>
<td>95</td>
</tr>
<tr>
<td>Below pavement</td>
<td>95</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>% COMPACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base course (beneath floor slabs)</td>
<td>95</td>
</tr>
<tr>
<td>Base course (beneath pavements)</td>
<td>100</td>
</tr>
<tr>
<td>Miscellaneous backfill</td>
<td>90</td>
</tr>
</tbody>
</table>
Any soil disturbed during construction should be re-compacted to the percent compaction as specified above.

Soils below paved areas in which moisture contents have been increased above in-situ moistures, shall be compacted to full depth and width of the increased moisture. Compaction shall be in accordance with the above or to the satisfaction of the soils engineer.

(3) Moisture Content: On-site clayey soils and approved import fill soils should be compacted at moisture contents outline below.

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>% Range of Moisture Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below footings</td>
<td>Minimum -3</td>
</tr>
<tr>
<td></td>
<td>Maximum +3</td>
</tr>
<tr>
<td>Below slabs -on-grade</td>
<td>-1</td>
</tr>
<tr>
<td></td>
<td>+3</td>
</tr>
<tr>
<td>Below pavement</td>
<td>-3</td>
</tr>
<tr>
<td></td>
<td>+3</td>
</tr>
<tr>
<td>Base course (beneath floor slabs)</td>
<td>-3</td>
</tr>
<tr>
<td></td>
<td>+3</td>
</tr>
<tr>
<td>Base course (beneath pavements)</td>
<td>-3</td>
</tr>
<tr>
<td></td>
<td>+3</td>
</tr>
<tr>
<td>Miscellaneous backfill</td>
<td>-3</td>
</tr>
<tr>
<td></td>
<td>+3</td>
</tr>
</tbody>
</table>

(4) Preparation and placement of fill materials: Fill materials shall be thoroughly mixed to a uniform moisture content. Materials shall be placed and compacted in 10” maximum horizontal lifts at a depth compatible with the compaction equipment being used.

C. All excavation of the building site and for footings shall be carried to a depth as shown on the plans.

Bottoms of all footings shall be finished by hand to insure solid bearing free of loose earth. All debris and large stones uncovered shall be removed from the premises. Earth obtained from excavation and not used as fill for other parts of the site shall be removed from the premises, unless directed by the Architect.

(1) Excavation shall comprise and include the satisfactory removal and disposition of all materials excavated regardless of the nature of materials encountered and which shall therefore be understood to include both rock excavation and common excavation when both classes are present. All suitable excavated materials shall be transported to and placed in the fill areas within the limits of the work except as otherwise directed by the Soils Testing Agency and/or Architect.
(2) Where material encountered within the limits of the work is considered unsuitable by the Soils Testing Agency and/or Architect, such material shall be excavated below the grade shown on the drawings as directed, and the excavation shall be re-compacted with suitable material to the compaction required in structural notes. Native soils are considered suitable for use in compacted fills below building areas, if the criteria of Paragraph 2.a.(2)(a) are met.

(3) Excavation and filling shall be performed in a manner and sequence that will provide drainage at all times.

(4) Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms, installation of services, and for inspection, except where the concrete for walls and footings is authorized to be deposited directly against excavated surfaces. Undercutting will not be permitted.

(5) Shoring, including sheet piling, shall be installed to protect workmen and the banks, adjacent paving structures, and utilities.

D. Fill and Backfill:

(1) Sub-base fill shall be placed in lifts thin enough that at least the minimum recommended density is obtained throughout each lift.

(2) Except for otherwise specified, each layer shall be spread uniformly by the use of a road machine or other approved device and rolled with an approved tamping roller, heavy pneumatic roller, 3-wheeled power roller or by other suitable equipment sufficient to compact as specified.

(3) After completion of foundation footings and walls, and other construction below the elevation of the final grade and prior to backfilling, all forms shall be removed and the excavation shall be cleaned of all trash and debris.

(4) Material for backfilling shall conform with the specification for the "Sub-base Fill" herein before specified.

(5) No backfill to be placed against footings or walls until concrete is thoroughly set. Backfill shall be placed symmetrically to prevent eccentric loading upon or against structures. Backfill, including utility trench backfill, shall be placed in six inch (6") horizontal layers, and compacted to 95% of the maximum density of the optimum moisture content as determined in accordance with ASTM D-698.
(6) All topsoil secured from rough grading and/or excavation operations shall be distributed on the site during finish grading operations as directed by the Soils Testing Agency and/or Architect.

(7) Topsoil: Previously stockpiled shall be used for backfill in planters. Six inch (6") minimum thickness, finishing level with finish grades required, and a surplus shall be used on areas designated for lawns, also finishing level with the finish grades required.

E. Grading:

(1) Existing and finish grades are indicated on the plans. The site where shown on the plans only shall be rough graded with ground surface being cut or filled as required to meet the finished grades shown, leaving no depressions in which water may puddle.

(2) Finish grading around the building shall be reasonably smooth and carried out from the building in a manner to provide uniform drainage way from the building.

(3) Grading required for paved areas shall be done in a manner that the specified thickness of paving will meet the finish grades shown. This area shall be compacted with water and a heavy roller before paving.

(4) Newly graded areas shall be protected from the action of the elements and any settlement or washing that may occur from that or any other cause, prior to acceptance of the work shall be required and grades re-established to the required elevations and slopes.

END OF SECTION
GEOTECHNICAL EVALUATION REPORT

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September 20, 2019

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1.0 PURPOSE

This report contains the results of our geotechnical evaluation for a proposed library building to be located in Pima County (Vail), Arizona. The purpose of these services is to provide information and recommendations regarding:

- Foundation design parameters
- Corrosivity (soil to concrete)
- Lateral earth pressures
- Slabs-on-grade
- Earthwork guidelines
- Seismic conditions
- Drainage
- Excavation conditions

Results of the field exploration, field tests, and laboratory testing program are presented in the Appendices.

2.0 PROJECT DESCRIPTION

We understand the proposed library building will be single-story, slab-on-grade structure of about 3500 square feet in plan area using wood or metal-frame and/or masonry construction with conventional spread footings. Maximum wall and column loads are assumed to be 3 kips per linear foot (klf) and 45 kips, respectively. We anticipate that ground floor level will be within 2 feet of existing site grade. Final site grading plans were not available at the time of this report. Should this information not be correct, we should be notified immediately.

3.0 SCOPE OF SERVICES

3.1 Field Exploration

Two borings were drilled to depths of about 16.5 feet below existing site grade in the proposed building area. The borings were at the approximate locations shown on the
attached Boring Location Diagram. A field log was prepared for each boring. These logs contain visual classifications of the materials encountered during drilling as well as interpolation of the subsurface conditions between samples. Final logs, included in Appendix A, represent our interpretation of the field logs and may include modifications based on laboratory observations and tests of the field samples. The final logs describe the materials encountered, their thickness, and the locations where samples were obtained.

The Unified Soil Classification System was used to classify soils. The soil classification symbols appear on the boring logs and are briefly described in Appendix A. Local and regional geologic characteristics were used to estimate the seismic design criteria.

3.2 **Laboratory Analyses**

Laboratory analyses were performed on representative soil samples to aid in material classification and to estimate pertinent engineering properties of the on-site soils for preparation of this report. Testing was performed in general accordance with applicable ASTM and Arizona methods. The following tests were performed and the results are presented in Appendix B.

- Water content
- Dry density
- Compression
- Expansion
- Plasticity
- Minus #200 sieve

3.3 **Analyses and Report**

Analyses were performed and this report was prepared for the exclusive purpose of providing geotechnical engineering and/or testing information and recommendations. The scope of services for this project does not include, either specifically or by implication, any environmental assessment of the site or identification of contaminated or hazardous materials or conditions. If the owner is concerned about the potential for such contamination, other studies should be undertaken. We are available to discuss the scope of such studies with you.

This geotechnical engineering report includes a description of the project, a discussion of the field and laboratory testing programs, a discussion of the subsurface conditions, and design recommendations as required to satisfy the purpose previously described.
4.0 SITE CONDITIONS

4.1 Surface

At the time of our exploration, the site was essentially undeveloped. The ground surface was relatively flat and contained a sparse growth of mesquite trees and brush. Site drainage trended to the southeast as sheet surface flow. Based on Arizona 811 markings, underground utilities were identified on the south and east side of the building area. The site is bound by gymnasium building to the north, parking lots and driveways to the south and east, and a covered walkway to the west.

4.2 Subsurface

As presented on the Boring Logs, surface soils to depths of 7 feet exploration consisted of medium dense to very dense Clayey SAND. Near-surface soils are of low to medium plasticity. The materials underlying the surface soils and extending to the full depth of exploration consisted of dense to very dense Poorly-graded SAND; with clay. No apparent zones of carbonate cementation were encountered. Groundwater was not encountered in any boring at the time of exploration.

5.0 GEOTECHNICAL PROPERTIES & ANALYSIS

5.1 Laboratory Tests

Laboratory test results (see Appendix B) indicate that on-site subsoils near shallow foundation level exhibit low compressibility at existing water contents. High additional compression occurs when the water content is increased.

Near-surface soils are of low to medium plasticity. These soils exhibit low expansion potential when recompacted, confined by loads approximating floor loads and saturated. Slabs-on-grade supported on recompacted on-site soils have a low potential for heaving if the water content of the soil increases.
5.2 **Field Tests**

On-site subsoils near shallow foundation level exhibited medium to high resistance to penetration using the standard penetration test method (ASTM D1586) and ring-lined barrel sampler (ASTM D3550).

---

6.0 **RECOMMENDATIONS**

6.1 **General**

Recommendations contained in this report are based on our understanding of the project criteria described in Section 2.0 and the assumption that the soil and subsurface conditions are those disclosed by the borings. Others may change the plans, final elevations, number and type of structures, foundation loads, and floor levels during design or construction. Substantially different subsurface conditions from those described herein may be encountered or become known. Any changes in the project criteria or subsurface conditions shall be brought to our attention in writing. This report does not encompass the effects, if any, of underlying geologic hazards or regional groundwater withdrawal and expresses no opinion regarding their effects on surface movements at the project site.

6.2 **Foundations**

Shallow spread-type footings may be used to support the proposed structures. Since the on-site soils exhibit collapse potentials, the foundations should bear on engineered fills achieved by removal and recompaction of the soils below foundations. The depth and lateral extent of the engineered fills is presented in the **EARTHWORK** section of this report.
Alternative footing depths and allowable bearing capacities are presented in the following tabulation:

<table>
<thead>
<tr>
<th>Footing Depth Below Finished Grade¹ (ft)</th>
<th>Allowable Bearing Capacity² (psf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>2000</td>
</tr>
<tr>
<td>2.0</td>
<td>2500</td>
</tr>
<tr>
<td>2.5</td>
<td>3000</td>
</tr>
</tbody>
</table>

We anticipate that total settlement of the proposed structure, supported as recommended, should be less than ¾ inch. Differential settlement is anticipated to be less than ½ inch. Additional foundation movements could occur if water from any source infiltrates the foundation soils. Therefore, proper drainage should be provided in the final design and during construction.

Footings should have minimum widths in accordance with local building codes. The bearing capacities given are net bearing capacities and the weight of the concrete in the footings may be ignored.

All footings, stem walls and masonry walls should be reinforced to reduce the potential for distress caused by differential foundation movements. The use of joints at openings or other discontinuities in masonry walls is recommended.

We recommend that the geotechnical engineer or his representative observe the footing excavations before reinforcing steel and concrete are placed. This observation is to assess whether the soils exposed are similar to those anticipated for support of the footings. Any soft, loose or unacceptable soils should be undercut to suitable materials and backfilled with approved fill materials or lean concrete. Soil backfill should be properly compacted.

¹ Finished grade is the lowest adjacent grade for perimeter footings and floor level for interior footings.

² Allowable bearing capacities assume fulfillment of EARTHWORK recommendations. Pounds per square foot (psf).
6.3 **Lateral Design Criteria**

Lateral loads may be resisted by concrete interface friction and by passive resistance. For shallow foundations bearing on dense native soil or properly compacted fill at this site, we recommend the following lateral resistance criteria:

- **Passive:**
  - Shallow wall footings ................................................................. 250 psf/ft
  - Shallow column footings ............................................................... 400 psf/ft
- **Coefficient of base friction (passive)** ........................................ 0.30

Earth retaining structures less than 6 feet in height, above any free water surface, with level backfill and no surcharge loads may be designed using the equivalent fluid pressure method. Recommended active equivalent fluid pressures and coefficients of base friction for unrestrained elements are:

- **Active:**
  - Undisturbed subsoil................................................................. 40 psf/ft
  - Compacted granular backfill ....................................................... 30 psf/ft
  - Compacted site soils (non-clay) ............................................... 35 psf/ft
- **Coefficient of base friction (active)** ........................................ 0.40

Where the design includes restrained elements, the following equivalent fluid pressures are recommended:

- **At-rest:**
  - Undisturbed subsoil................................................................. 60 psf/ft
  - Compacted granular backfill ....................................................... 55 psf/ft

The equivalent fluid pressures presented herein do not include the lateral pressures arising from the presence of:

- hydrostatic conditions, submergence or partial submergence
- sloping backfill, positively or negatively
- surcharge loading, permanent or temporary
- seismic or dynamic conditions
We recommend a free-draining soil layer or manufactured geosynthetic material be constructed adjacent to the back of any retaining walls. A filter may be required between the soil backfill and drainage layer. This drainage zone should help prevent development of hydrostatic pressure on the wall. This vertical drainage zone should be tied into a gravity drainage system at the base of the wall. It is important that all backfill be properly placed and compacted. Backfill should be mechanically compacted in layers. Flooding or jetting should not be permitted. Care should be taken not to damage the walls when placing the backfill. Backfills should be observed and tested during placement.

Fill against footings, stem walls, and any retaining walls should be compacted to densities specified in EARTHWORK. Clayey soils should not be used as backfill against retaining walls. Compaction of each lift adjacent to walls should be accomplished with hand-operated tampers or other lightweight compactors. Over-compaction may cause excessive lateral earth pressures that could result in wall movements.

6.4 **Seismic Considerations**

Structures should be designed in accordance with applicable building codes. The seismic design parameters presented in the following table, in accordance with the 2018 International Building Code and ASCE 7-16, are applicable to the project site:

<table>
<thead>
<tr>
<th>Seismic Design Parameters</th>
<th>International Building Code 2018, ASCE 7-16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Site Class</td>
<td>D</td>
</tr>
<tr>
<td>Mapped Spectral Response Acceleration at 0.2 sec period ($S_s$)</td>
<td>0.260g</td>
</tr>
<tr>
<td>Mapped Spectral Response Acceleration at 1.0 sec period ($S_1$)</td>
<td>0.081g</td>
</tr>
<tr>
<td>Site Coefficient for 0.2 sec period ($F_a$)</td>
<td>1.592</td>
</tr>
<tr>
<td>Site Coefficient for 1.0 sec period ($F_v$)</td>
<td>2.400</td>
</tr>
<tr>
<td>Design Spectral Response Acceleration at 0.2 sec period ($S_{DS}$)</td>
<td>0.276</td>
</tr>
<tr>
<td>Design Spectral Response Acceleration at 1.0 sec period ($S_{D1}$)</td>
<td>0.130</td>
</tr>
</tbody>
</table>

The soil site class is based upon conditions identified in shallow exploratory borings and local knowledge of the soil conditions in the vicinity of the site. Soil conditions extending beyond the depth of our borings to a depth of 100 feet were assumed for the purposes of providing the information presented in the table.
6.5 **Conventional Slab-on-Grade Support**

Floor slabs can be supported on properly placed and compacted fill. The slab subgrade should be prepared by the procedures outlined in this report. A minimum 4-inch layer of base course should be provided beneath all slabs to help prevent capillary rise and a damp slab. The modulus of subgrade reaction (k) is estimated to be 250 pounds per cubic inch (pci), based upon a 30-inch diameter plate.

The use of vapor retarders or barriers is desirable for any slab-on-grade where the floor will be covered by products using water based adhesives, wood, vinyl backed carpet, impermeable floor coatings (urethane, epoxy, acrylic terrazzo, etc.) or where the floor will be in contact with moisture sensitive equipment or product. When used, the design and installation should be in accordance with the recommendations given in ACI 302.1R and 302.2R. Final determination on the use of a vapor retarder should be left to the slab designer.

All concrete placement and curing operations should follow the American Concrete Institute manual recommendations. Improper curing techniques and/or high slump (high water-cement ratio) could cause excessive shrinkage, cracking or curling. Concrete slabs should be allowed to cure adequately before placing vinyl or other moisture sensitive floor covering.

6.6 **Drainage**

It is important that foundation soils not be allowed to become saturated during or after construction. Grades should be such that drainage is away from the structure. Water and sewer utility lines should be properly installed to avoid possible sources for subsurface saturation. It is important that all utility trenches be properly backfilled. If practicable, planters and/or landscaping should not be constructed adjacent to, or near the structure. If planters and/or landscaping are adjacent to or near the structure, we recommend the following:

- Planters should be sealed.
- Grades should slope away from the structure.
- Only shallow rooted landscaping should be used.
- Watering should be kept to a minimum.
6.7 **Corrosivity**

In order to be consistent with standard local practice and for reasons of material availability, it is recommended that Type II portland cement be utilized in all concrete in contact with site soils. Detailed corrosion protection should be designed by a qualified corrosion engineer.

7.0 **EARTHWORK**

7.1 **General**

The conclusions contained in this report for the proposed construction are contingent upon compliance with recommendations presented in this section. Any excavating, trenching, or disturbance that occurs after completion of the earthwork must be backfilled, compacted and tested in accordance with the recommendations contained herein. It is not reasonable to rely upon our conclusions and recommendations if any future unobserved and untested trenching, earthwork activities or backfilling occurs.

Although underground facilities such as septic tanks, cesspools, basements and dry wells were not observed, such features might be encountered during construction. These features should be demolished in accordance with the recommendations of the geotechnical engineer. Any loose or disturbed soils resulting from demolition should be removed or recompacted as engineered fill and any excavations should be backfilled in accordance with recommendations presented herein.

7.2 **Site Clearing**

Strip and remove any existing fill material, vegetation, debris, and any other deleterious materials from the building areas. The building area is defined as that area within the building footprint plus 5 feet beyond the perimeter of that footprint. All exposed surfaces should be free of mounds and depressions that could prevent uniform compaction.

7.3 **Excavation**

We anticipate that excavations for shallow foundations and utility trenches for the proposed construction can be accomplished with conventional equipment. Excavations
penetrating the underlying dense to very dense soil may require the use of heavy-duty, specialized equipment to facilitate removal. The speed and ease of excavation is dependent on the nature of the deposit, the type of equipment used, and the skill and experience of the equipment operator.

The soils to be penetrated by the proposed excavations may vary significantly across the site. Our soil classifications are based solely on the materials encountered in widely spaced exploratory test borings. The contractor should verify that similar conditions exist throughout the proposed area of excavation. If different subsurface conditions are found at the time of construction, we should be contacted immediately to evaluate the conditions encountered.

7.4 **Temporary Excavations and Slopes**

Temporary, non-surcharged construction excavations should be sloped or shored. The individual contractor should be made responsible for designing and constructing stable, temporary excavations as required to maintain stability of both the excavation sides and bottom. All excavations should be sloped or shored in the interest of safety following local and federal regulations, including current OSHA excavation and trench safety standards. OSHA recommends a maximum slope inclination of ¾:1 (horizontal:vertical) for Type A soils, 1:1 for Type B soils, and 1½:1 for Type C soils.

As a safety measure, it is recommended that all vehicles and soil piles be kept a minimum lateral distance back from the crest of the slope at least equal to the slope height. The exposed slope face should be protected against the elements.

7.5 **Foundation Preparation**

In footing areas, remove existing soils as required to a minimum depth of 2 feet below the bottom of the footing, or 2 feet below the existing ground surface whichever depth is greater. Removal may be terminated at a shallower depth where very dense soils are encountered and identified by the geotechnical engineer during construction. Removal should extend a minimum of 2 feet beyond the footing edges. Replace with engineered fill material.

It may be more practical to remove soils to the maximum depth beneath all portions of the structure area. If this is done, the removal and recompaction should extend at least 3 feet beyond the perimeter footings.
7.6 **Conventional Interior Slab Preparation**

Scarify, moisten or dry as required, and compact all subgrade soils to a minimum depth of 12 inches. The subgrade preparation is to be accomplished in a manner that will result in uniform water contents and densities after compaction.

7.7 **Materials**

Clean on-site soils with low expansive potentials and maximum dimension of 6 inches or imported materials may be used as fill material for the following:

- Foundation areas
- Interior slab areas
- Pavement areas
- Backfill

Imported soils should conform to the following:

- Gradation (ASTM C136):
  - 6" .............................................................................................................. 100
  - 4" .............................................................................................................. 85-100
  - ¾” ............................................................................................................... 70-100
  - No. 4 Sieve ................................................................................................. 50-100
  - No. 200 Sieve ............................................................................................ 40 (max)

- Maximum expansive potential (%)\(^3\) ............................................................. 1.5

- Maximum soluble sulfates (%)...................................................................... 0.10

\(^3\) Measured on a sample compacted to approximately 95 percent of the ASTM D698 maximum dry density at about 3 percent below optimum water content. The sample is confined under a 100 psf surcharge and submerged.
Base course should conform to PAG (Pima Association of Governments) *Standard Specifications for Public Improvements* or other local government specifications.

### 7.8 Placement and Compaction

a. Place and compact fill in horizontal lifts, using equipment and procedures that will produce recommended water contents and densities throughout the lift.

b. Uncompacted lift thickness should not exceed 10 inches.

c. Materials should be compacted to the following:

<table>
<thead>
<tr>
<th>Material Compaction (ASTM D698)</th>
<th>Minimum Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-site and imported soil:</td>
<td></td>
</tr>
<tr>
<td>Below footings</td>
<td>95</td>
</tr>
<tr>
<td>Below slabs-on-grade</td>
<td>95</td>
</tr>
<tr>
<td>Below pavement</td>
<td>95</td>
</tr>
<tr>
<td>Base course below slabs-on-grade</td>
<td>95</td>
</tr>
<tr>
<td>Nonstructural backfill</td>
<td>90</td>
</tr>
</tbody>
</table>

On-site and imported soils should be compacted within a water content range of 3 percent below to 3 percent above optimum.

### 7.9 Compliance

Recommendations for slabs-on-grades and foundations supported on compacted fills or prepared subgrade depend upon compliance with EARTHWORK recommendations. To assess compliance, observation and testing should be performed under the direction of a WT geotechnical engineer. Please contact us to provide these observation and testing services.
8.0 ADDITIONAL SERVICES

The recommendations provided in this report are based on the assumption that a sufficient schedule of tests and observations will be performed during construction to verify compliance. At a minimum, these tests and observations should be comprised of the following:

- Observations and testing during site preparation and earthwork,
- Observation of foundation excavations, and
- Consultation as may be required during construction.

Retaining the geotechnical engineer who developed your report to provide construction observation is the best way to verify compliance, and to help you manage the risks associated with unanticipated conditions.

9.0 LIMITATIONS

This report has been prepared assuming the project criteria described in 2.0 PROJECT DESCRIPTION. If changes in the project criteria occur, or if different subsurface conditions are encountered or become known, the conclusions and recommendations presented herein shall become invalid. In any such event, WT should be contacted in order to assess the effect that such variations may have on our conclusions and recommendations. If WT is not retained for the construction observation and testing services to determine compliance with this report, our professional responsibility is accordingly limited.

The recommendations presented are based entirely upon data derived from a limited number of samples obtained from widely spaced explorations. The attached logs are indicators of subsurface conditions only at the specific locations and times noted. This report assumes the uniformity of the geology and soil structure between explorations, however variations can and often do exist. Whenever any deviation, difference, or change is encountered or becomes known, WT should be contacted.

This report is for the exclusive benefit of our client alone. There are no intended third-party beneficiaries of our contract with the client or this report, and nothing contained in the contract or this report shall create any express or implied contractual or any other relationship with, or claim or cause of action for, any third party against WT.
This report is valid for the earlier of one year from the date of issuance, a change in circumstances, or discovered variations. After expiration, no person or entity shall rely on this report without the express written authorization of WT.

**10.0 CLOSURE**

We prepared this report as an aid to the designers of the proposed project. The comments, statements, recommendations and conclusions set forth in this report reflect the opinions of the authors. These opinions are based upon data obtained at the location of the explorations, and from laboratory tests. Work on your project was performed in accordance with generally accepted standards and practices utilized by professionals providing similar services in this locality. No other warranty, express or implied, is made.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allowable Soil Bearing Capacity</td>
<td>The recommended maximum contact stress developed at the interface of the foundation element and the supporting material.</td>
</tr>
<tr>
<td>Backfill</td>
<td>A specified material placed and compacted in a confined area.</td>
</tr>
<tr>
<td>Base Course</td>
<td>A layer of specified aggregate material placed on a subgrade or subbase.</td>
</tr>
<tr>
<td>Base Course Grade</td>
<td>Top of base course.</td>
</tr>
<tr>
<td>Bench</td>
<td>A horizontal surface in a sloped deposit.</td>
</tr>
<tr>
<td>Caisson/Drilled Shaft</td>
<td>A concrete foundation element cast in a circular excavation which may have an enlarged base (or belled caisson).</td>
</tr>
<tr>
<td>Concrete Slabs-On-Grade</td>
<td>A concrete surface layer cast directly upon base course, subbase or subgrade.</td>
</tr>
<tr>
<td>Crushed Rock Base Course</td>
<td>A base course composed of crushed rock of a specified gradation.</td>
</tr>
<tr>
<td>Differential Settlement</td>
<td>Unequal settlement between or within foundation elements of a structure.</td>
</tr>
<tr>
<td>Engineered Fill</td>
<td>Specified soil or aggregate material placed and compacted to specified density and/or moisture conditions under observations of a representative of a soil engineer.</td>
</tr>
<tr>
<td>Existing Fill</td>
<td>Materials deposited through the action of man prior to exploration of the site.</td>
</tr>
<tr>
<td>Existing Grade</td>
<td>The ground surface at the time of field exploration.</td>
</tr>
<tr>
<td>Expansive Potential</td>
<td>The potential of a soil to expand (increase in volume) due to absorption of moisture.</td>
</tr>
<tr>
<td>Fill</td>
<td>Materials deposited by the actions of man.</td>
</tr>
<tr>
<td>Finished Grade</td>
<td>The final grade created as a part of the project.</td>
</tr>
<tr>
<td>Gravel Base Course</td>
<td>A base course composed of naturally occurring gravel with a specified gradation.</td>
</tr>
<tr>
<td>Heave</td>
<td>Upward movement.</td>
</tr>
<tr>
<td>Native Grade</td>
<td>The naturally occurring ground surface.</td>
</tr>
<tr>
<td>Native Soil</td>
<td>Naturally occurring on-site soil.</td>
</tr>
<tr>
<td>Rock</td>
<td>A natural aggregate of mineral grains connected by strong and permanent cohesive forces. Usually requires drilling, wedging, blasting or other methods of extraordinary force for excavation.</td>
</tr>
<tr>
<td>Sand and Gravel Base Course</td>
<td>A base course of sand and gravel of a specified gradation.</td>
</tr>
<tr>
<td>Sand Base Course</td>
<td>A base course composed primarily of sand of a specified gradation.</td>
</tr>
<tr>
<td>Scarify</td>
<td>To mechanically loosen soil or break down existing soil structure.</td>
</tr>
<tr>
<td>Settlement</td>
<td>Downward movement.</td>
</tr>
<tr>
<td>Soil</td>
<td>Any unconsolidated material composed of discrete solid particles, derived from the physical and/or chemical disintegration of vegetable or mineral matter, which can be separated by gentle mechanical means such as agitation in water.</td>
</tr>
<tr>
<td>Strip</td>
<td>To remove from present location.</td>
</tr>
<tr>
<td>Subbase</td>
<td>A layer of specified material placed to form a layer between the subgrade and base course.</td>
</tr>
<tr>
<td>Subbase Grade</td>
<td>Top of subbase.</td>
</tr>
<tr>
<td>Subgrade</td>
<td>Prepared native soil surface.</td>
</tr>
</tbody>
</table>
### Coarse-Grained Soils

#### Less than 50% Fines

<table>
<thead>
<tr>
<th>Group Symbols</th>
<th>Description</th>
<th>Major Divisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>GW</td>
<td>Well-graded gravel or well-graded gravel with sand, less than 5% fines</td>
<td>Gravels</td>
</tr>
<tr>
<td>GP</td>
<td>Poorly-graded gravel or poorly-graded gravel with sand, less than 5% fines</td>
<td>Gravels</td>
</tr>
<tr>
<td>GM</td>
<td>Silty gravel or silty gravel with sand, more than 12% fines</td>
<td>Gravels</td>
</tr>
<tr>
<td>GC</td>
<td>Clayey gravel or clayey gravel with sand, more than 12% fines</td>
<td>Gravels</td>
</tr>
<tr>
<td>SW</td>
<td>Well-graded sand or well-graded sand with gravel, less than 5% fines</td>
<td>Sands</td>
</tr>
<tr>
<td>SP</td>
<td>Poorly-graded sand or poorly-graded sand with gravel, less than 5% fines</td>
<td>Sands</td>
</tr>
<tr>
<td>SM</td>
<td>Silty sand or silty sand with gravel, more than 12% fines</td>
<td>Sands</td>
</tr>
<tr>
<td>SC</td>
<td>Clayey sand or clayey sand with gravel, more than 12% fines</td>
<td>Sands</td>
</tr>
</tbody>
</table>

**Note:** Coarse-grained soils receive dual symbols if they contain 5% to 12% fines (e.g., SW-SM, GP-GC).

### Fine-Grained Soils

#### More than 50% Fines

<table>
<thead>
<tr>
<th>Group Symbols</th>
<th>Description</th>
<th>Major Divisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>ML</td>
<td>Silt, silt with sand or gravel, sandy silt, or gravelly silt</td>
<td>Silts and clays</td>
</tr>
<tr>
<td>CL</td>
<td>Lean clay of low to medium plasticity, sandy clay, or gravelly clay</td>
<td>Liquid limit less than 50</td>
</tr>
<tr>
<td>OL</td>
<td>Organic silt or organic clay of low to medium plasticity</td>
<td>Silts and clays</td>
</tr>
<tr>
<td>MH</td>
<td>Elastic silt, sandy elastic silt, or gravelly elastic silt</td>
<td>Liquid limit more than 50</td>
</tr>
<tr>
<td>CH</td>
<td>Fat clay of high plasticity, sandy fat clay, or gravelly fat clay</td>
<td>Silts and clays</td>
</tr>
<tr>
<td>OH</td>
<td>Organic silt or organic clay of high plasticity</td>
<td>Silts and clays</td>
</tr>
<tr>
<td>PT</td>
<td>Peat and other highly organic soils</td>
<td>Highly organic soils</td>
</tr>
</tbody>
</table>

**Note:** Fine-grained soils may receive dual classification based upon plasticity characteristics (e.g. CL-ML).

### Soil Sizes

<table>
<thead>
<tr>
<th>Component</th>
<th>Size Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boulder</td>
<td>Above 12 in.</td>
</tr>
<tr>
<td>Cobble</td>
<td>3 in. – 12 in.</td>
</tr>
<tr>
<td>Gravel</td>
<td>No. 4 – 3 in.</td>
</tr>
<tr>
<td>Coarse</td>
<td>⅝ in. – 3 in.</td>
</tr>
<tr>
<td>Fine</td>
<td>No. 4 – ⅜ in.</td>
</tr>
<tr>
<td>Sand</td>
<td>No. 200 – No. 4</td>
</tr>
<tr>
<td>Coarse</td>
<td>No. 10 – No. 4</td>
</tr>
<tr>
<td>Medium</td>
<td>No. 40 – No. 10</td>
</tr>
<tr>
<td>Fine</td>
<td>No. 200 – No. 40</td>
</tr>
<tr>
<td>Fines (Silt or Clay)</td>
<td>Below No. 200</td>
</tr>
</tbody>
</table>

**Note:** Only sizes smaller than three inches are used to classify soils.

### Plasticity of Fine Grained Soils

<table>
<thead>
<tr>
<th>Plasticity Index</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Non-Plastic</td>
</tr>
<tr>
<td>1 – 7</td>
<td>Low</td>
</tr>
<tr>
<td>8 – 20</td>
<td>Medium</td>
</tr>
<tr>
<td>Over 20</td>
<td>High</td>
</tr>
</tbody>
</table>

### Definition of Water Content

- **Dry**
- Slightly damp
- **Damp**
- **Moist**
- **Wet**
- **Saturated**

### Method of Classification

**Plate A-2**

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090414

**Geotechnical Environmental Inspections Materials**

**Western Technologies Inc.**

The Quality People Since 1955

wt-us.com
The number shown in "BORING NO." refers to the approximate location of the same number indicated on the "Boring Location Diagram" as positioned in the field by pacing or measurement from property lines and/or existing features, or through the use of Global Positioning System (GPS) devices. The accuracy of GPS devices is somewhat variable.

"DRILLING TYPE" refers to the exploratory equipment used in the boring wherein HSA = hollow stem auger, and the dimension presented is the outside diameter of the HSA used.

"N" in "BLOW COUNTS" refers to a 2-inch outside diameter split-barrel sampler driven into the ground with a 140 pound drop-hammer dropped 30 inches repeatedly until a penetration of 18 inches is achieved or until refusal. The number of blows, or “blow count”, of the hammer is recorded for each of three 6-inch increments totaling 18 inches. The number of blows required for advancing the sampler for the last 12 inches (2nd and 3rd increments) is defined as the Standard Penetration Test (SPT) “N”-Value. Refusal to penetration is considered more than 50 blows per 6 inches. (Ref. ASTM D1586).

"R" in "BLOW COUNTS" refers to a 3-inch outside diameter ring-lined split barrel sampler driven into the ground with a 140 pound drop-hammer dropped 30 inches repeatedly until a penetration of 12 inch is achieved or until refusal. The number of blows required to advance the sampler 12 inches is defined as the “R” blow count. The “R” blow count requires an engineered conversion to an equivalent SPT N-Value. Refusal to penetration is considered more than 50 blows per foot. (Ref. ASTM D3550).

"CS" in "BLOWS/FT." refers to a 2½-in. outside diameter California style split-barrel sampler, lined with brass sleeves, driven into the ground with a 140-pound hammer dropped 30 inches repeatedly until a penetration of 18 inches is achieved or until refusal. The number of blows of the hammer is recorded for each of the three 6-inch increments totaling 18 inches. The number of blows required for advancing the sampler for the last 12 inches (2nd and 3rd increments) is defined as the “CS” blow count. The “CS” blow count requires an engineered conversion to an equivalent SPT N-Value. Refusal to penetration is considered more than 50 blows for a 6-inch increment. (Ref. ASTM D 3550)

"SAMPLE TYPE" refers to the form of sample recovery, in which N = Split-barrel sample, R = Ring-lined sample, “CS” = California style split-barrel sample, G = Grab sample, B = Bucket sample, C = Core sample (ex. diamond bit rock coring).

"DRY DENSITY (LBS/CU FT)" refers to the laboratory-determined dry density in pounds per cubic foot. The symbol "NR" indicates that no sample was recovered.

"WATER (MOISTURE) CONTENT" (% of Dry Wt.) refers to the laboratory-determined water content in percent using the standard test method ASTM D2216.

"USCS" refers to the “Unified Soil Classification System” Group Symbol for the soil type as defined by ASTM D2487 and D2488. The soils were classified visually in the field, and where appropriate, classifications were modified by visual examination of samples in the laboratory and/or by appropriate tests.

These notes and boring logs are intended for use in conjunction with the purposes of our services defined in the text. Boring log data should not be construed as part of the construction plans nor as defining construction conditions.

Boring logs depict our interpretations of subsurface conditions at the locations and on the date(s) noted. Variations in subsurface conditions and characteristics may occur between borings. Groundwater levels may fluctuate due to seasonal variations and other factors.

The stratification lines shown on the boring logs represent our interpretation of the approximate boundary between soil or rock types based upon visual field classification at the boring location. The transition between materials is approximate and may be more or less gradual than indicated.
DATE DRILLED: 9-11-19
LOCATION: See Location Diagram
ELEVATION: Not Determined

BORING NO. 1

EQUIPMENT TYPE: CME-75
DRILLING TYPE: 8"HSA
LOGGED BY: R. Gowda

MOISTURE CONTENT (% of dry wt.)  DRY DENSITY (lbs/cu ft.)  SAMPLE  BLOW COUNTS  DEPTH (FEET)  USCS  GRAPHIC
9.1  87  G  SC
2.8  114  R  SP

SOIL DESCRIPTION
Clayey SAND; brown, medium dense, slightly damp

with gravel, light brown, dense

Poorly-graded SAND; with clay and gravel, brown, very dense, damp

Boring Stopped at 16.3 Feet

PROJECT: OLD VAIL MIDDLE SCHOOL LIBRARY
JOB NO.: 2929JH065

NOTES: Groundwater not encountered.

Geotechnical Environmental Inspections Materials
Western Technologies Inc. The Quality People Since 1955

PLATE
A-4

BORING LOG
<table>
<thead>
<tr>
<th>MOISTURE CONTENT (%)</th>
<th>DRY DENSITY (LB/CU FT)</th>
<th>SAMPLE TYPE</th>
<th>SAMPLE</th>
<th>BLOW COUNTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Determined</td>
<td></td>
<td>G</td>
<td>SC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>R 50/4&quot;</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>1.8</td>
<td>122</td>
<td>R 50/11&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>11/34</td>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>16/34</td>
<td>N</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Soil Description**

- Clayey SAND; with gravel, light brown, dense, slightly damp
- Poorly-graded SAND; with clay and gravel, brown, dense, slightly damp
- Groundwater not encountered.

**Notes:**

- Boring Stopped at 16.5 Feet

**Equipment Type:** CME-75

**Drilling Type:** 8"HSA

**Logged By:** R. Gowda

**Project:** OLD VAIL MIDDLE SCHOOL LIBRARY

**Job No.:** 2929JH065

**Plate:** A-5
## SOIL PROPERTIES

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Depth (ft.)</th>
<th>Soil Class.</th>
<th>Initial Dry Density (pcf)</th>
<th>Initial Water Content (%)</th>
<th>Compression Properties</th>
<th>Expansion Properties</th>
<th>Plasticity</th>
<th>Percent Passing #200</th>
<th>R-Value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>In-Situ</td>
<td>After Saturation</td>
<td>Surcharge (ksf)</td>
<td>Expansion (%)</td>
<td>Liquid Limit</td>
<td>Plasticity Index</td>
</tr>
<tr>
<td>1</td>
<td>0-5</td>
<td>SC</td>
<td>87</td>
<td>9.1</td>
<td>1.0</td>
<td>2.1</td>
<td>33</td>
<td>16</td>
<td>27</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>1-2</td>
<td>SC</td>
<td>87</td>
<td>9.1</td>
<td>0.0</td>
<td>0.1</td>
<td>2.0</td>
<td>2.4</td>
<td>14.2</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>3-4</td>
<td>SC</td>
<td>114</td>
<td>2.8</td>
<td>0.0</td>
<td>0.2</td>
<td>3.0</td>
<td>2.2</td>
<td>3.0</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>0-5</td>
<td>SC</td>
<td>110</td>
<td>7.6</td>
<td>0.0</td>
<td>0.2</td>
<td>3.1</td>
<td>8</td>
<td>20</td>
<td>1,2</td>
</tr>
<tr>
<td>2</td>
<td>5-6</td>
<td>SC</td>
<td>122</td>
<td>1.8</td>
<td>0.0</td>
<td>0.2</td>
<td>3.1</td>
<td>8</td>
<td>20</td>
<td>1,2</td>
</tr>
</tbody>
</table>

Note: Initial Dry Density and Initial Water Content are in-situ values unless otherwise noted. NP = Non-Plastic

Remarks
1. Compacted density (approx. 95% of ASTM D698 max. density at moisture content slightly below optimum.)
2. Submerged to approximate saturation.
4. Sample disturbance observed.
5. Undisturbed expansion
312150 – EXCAVATION, FILLING, AND BACKFILLING

1. GENERAL:

A. Description of Work:

(1) Work as evident on drawings and specified herein or required by the Geotechnical Report to accomplish the excavation, filling and backfilling, and all operations pertaining thereto for buildings, complete.

(2) The Geotechnical Report by Western Technologies Inc.; Report #2929JH065, dated September 20, 2019, included after section 311000 of the Specifications, is the governing requirement for all earthwork associated with the site.

   a. Borings and subsurface data indicated in the Geotechnical Report shall be general information only and variation therefrom shall not affect the terms of the contract.

B. Work Excluded

(1) Site excavation and backfilling for plumbing, heating and electrical work beyond 5 feet from the building is included in Section 312210, Trenching and Backfilling.

C. Inspections and Tests

(1) Inspections and Tests: The Geotechnical Engineer of record shall inspect, and test the preparation of excavations, filling, stripping of existing fill, compaction, and soil materials as described in 'Excavation, Soil Materials and Placing And Compaction' herein. A letter of compliance, together with copies of inspection reports and test reports, stating conformance to the Geotechnical Engineering Evaluation and Specifications shall be submitted to the Architect/Engineer in triplicate for approval.

(2) The Owner shall pay all testing agency charges for these services. Costs of any re-testing required due to improper compaction shall be accomplished by the same laboratory of record and shall be paid for by the Contractor.

2. PRODUCTS

A. Soil Materials

(1) Fill material shall consist of suitable material removed from excavated areas and imported borrow material as required. Fill
materials shall be free of roots and other organic materials, trash, frozen material, and particles having a dimension greater than 6". Imported fill shall be compatible with approved on site materials. Materials shall be in conformance with the referenced Geotechnical Report.

(2) Base course shall conform to the referenced Geotechnical Report.

3. EXECUTION

A. Excavation

(1) Perform all excavations as indicated on the drawings or as required for a complete installation. All foundations shall bear on materials and at minimum depths as indicated in the Geotechnical Report.

(2) The subgrade within the building pad shall be prepared as indicated in the Geotechnical Report.

(3) Bottom of all excavations shall be level and true. If by error, portions of the excavations are extended too deep, only concrete will be permitted for refill material. No compensation will be allowed for such material.

(4) All foundation excavations shall be reviewed and accepted by the Geotechnical Engineer/Representative before foundation reinforcing and concrete is placed. Architect shall be given at least 24 hours notice before any concrete is placed.

(5) Where suitable supporting soils are encountered at different elevations than those indicated, the Architect and Geotechnical Engineer may direct in writing that the excavations be carried to elevations above or below those indicated. An extra or credit, as the case may warrant, shall be based on a unit price for such excavation and concrete work.

(6) Grading in vicinity of structure shall be controlled to prevent surface water from running into excavated areas or across the building pad. The Contractor shall provide and maintain at all times during construction ample means and devices with which to promptly remove and properly dispose of all water entering the excavation or other parts of the work. If water enters excavations after having been completed to establish bearing levels, additional excavation may be required to a depth exposing dry, firm bearing soils as determined by the Geotechnical Engineer. The excavation shall be filled to original bearing levels with concrete as specified unless otherwise approved by the Geotechnical Engineer. No foundations or floors shall be constructed on disturbed soils or in water.
(7) Where necessary, excavations shall be properly sheeted and braced to furnish safe and acceptable working conditions. The bracing shall be so arranged as not to place any stress on portions of the completed work, without special written approval of the Architect.

(8) All excess materials from excavations shall be disposed of by the Contractor off the building site.

B. Placing and Compaction

(1) Each lift shall be uniformly compacted to not less than the percentage of the maximum density specified below before another lift is placed. Minimum compaction requirements are indicated in the referenced Geotechnical Report.

(2) Where backfill is required on both sides of construction, keep backfill at approximately the same elevation on both sides.

(3) Backfill around all building foundation walls and footings shall be placed and compacted at near optimum moisture content, but shall not be saturated or at a moisture content that results in pumping. In no case shall backfill be water-settled. Non-structural concrete is acceptable for use as back fill (see Section 033000).

(4) Grade to finished elevations as shown on Drawings, or as necessary to provide positive drainage away from the building as approved by Architect. Finish grading within 20 feet of building shall be hand-raked for "fine" finish. Contractor shall coordinate and verify elevations required in landscaped areas, paving, etc.

C. Base Course

(1) Under all interior concrete floors on grade and under all exterior concrete slabs on grade, place a minimum 4 inch thick layer of base course. This material shall not be placed until all work of other trades which passes through or under this work has been properly placed and approved and not until foundations are completed and surface receiving this material is finished as specified. Base course shall be compacted in accordance with the referenced Geotechnical Report.

END OF SECTION
312210 – TRENCHING AND BACKFILLING

1. GENERAL:
   A. Related Documents:
      (1) Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work in this section.
   B. Description of Work:
      (1) Work as evident on drawings and specified herein or required to accomplish the designated excavation, trenching and backfilling for site utilities systems, to the points of connection with the building utilities 5 feet outside the building.

2. PRODUCTS:
   A. Fill Material:
      (1) See Section 311000 Earthwork.

3. EXECUTION:
   A. Excavation:
      (1) General: All excavation of every description of whatever substances encountered shall be performed to the depths indicated or as otherwise specified. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. All excavated materials not required or suitable for backfill shall be removed and wasted as indicated or as directed. Grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations, and any water accumulating therein shall be removed by pumping or by other approved methods. All trenching must be shored and/or otherwise protected as required to meet all local and OSHA Safety Standards.
      (2) Trench Excavation: Trenches shall be of the necessary width for proper laying of pipe. The banks of pipe trenches shall be as nearly vertical as practicable. Care shall be taken not to over-excavate. The bottom of the trenches shall be accurately graded. Clean coarse sand, well graded gravel or well graded crushed rock
must be used as trench bedding. The trench must be filled with this material to the springline of the pipe, placed in 6” maximum lifts and compacted to 95% maximum density - ASTM D-1557. The remainder of the trench shall be backfilled with specific backfill material. The width of the trench at and below the top of the pipe shall be such that the clear space between the barrel of the pipe and the trench wall shall not exceed 8 inches on either side of the pipe. The width of the trench above that level shall be as wide as necessary for sheeting and bracing and the proper performance of the work.

B. Removal of Utility Lines:

(1) When utility lines that are to be removed are encountered within the area of operations, the Contracting Officer's Representative shall be notified in ample time for the necessary measures to be taken to prevent interruption of the service.

C. Backfilling:

(1) The trenches shall not be backfilled until all required pressure tests are performed and until the utilities systems as installed conform to the requirements specified in the several sections covering the installation of the various utilities. Where, in the opinion of the Architect, damage is likely to result from withdrawing sheeting, the sheeting shall be left in place and the contract price will be adjusted accordingly. Except as otherwise specified for special conditions of overdepths, trenches improperly backfilled shall be reopened to the depth required for proper compaction, then refilled and compacted as specified, or the condition shall be otherwise corrected as approved.

(2) The surface shall be restored to its original condition as near as practicable and as hereinafter specified. Pavement, base course, and compacted subgrade disturbed by trenching operations shall be replaced in an acceptable manner with materials equal to the adjacent compacted subgrade, base course, and pavement for a minimum distance of 12 inches on each side of the trench.

(3) Lower Portion of Trench: Backfill material shall be deposited in 6-inch-maximum-thickness layers and compacted with suitable tampers to density of the adjacent soil or graded as hereinafter specified until there is a cover of not less than 2 feet over sewers and 1 foot over other utility lines. The backfill material in this portion of the trench shall consist of a selected material at a moisture content that will facilitate compaction, free from stones
larger than 3 inches in any dimension and hard clods and frozen conglomerates larger than 3 inches in any dimension, except that where the pipe is coated or wrapped for protection against corrosion the backfill material shall be free from stones larger than 1 inch in any dimension. If any portion of the cover in the lower portion of the trench is in the depth of special compaction and materials requirements under pavement the special requirements shall control. Special care shall be taken not to damage the coating or wrapping of pipes.

(4) Remainder of Trench: Except for special materials for pavements, the remainder of the trench shall be backfilled with material that is free of stones larger than 3 inches or 1/2 the layered thickness, whichever is smaller, in any dimension. Backfill material shall be deposited in layers not exceeding the thickness specified, and each layer shall be compacted to the minimum density specified as applicable to the particular areas (except that in areas other than under parking areas, and other paved areas subject to vehicular movement, settling of granular, noncohesive material with water will be permitted). Degree of compaction shall be as follows, expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D-698.

a. Under Pavements: Six-inch layers, 95 percent maximum density up to the elevations at which the requirements for pavement subgrade materials and compaction control.

b. Under Sidewalks: Six-inch layers, 95 percent maximum density.

c. Under Other Areas: Six-inch layers, 90 percent maximum density.

(5) Testing: All trench backfill material shall be tested as indicated in Division 1.

END OF SECTION
313116 – TERMITE TREATMENT

1. GENERAL:
   A. Treat all areas under building and footings to form an impermeable barrier and as required to provide warranty.

   B. Warranty:

      (1) New Structures: Furnish Owner with Certificate of Performance from approved company insuring Owner against damage from termites for five (5) years.

   C. All chemicals shall meet all EPA regulations.

   D. Submit information on proposed chemicals.

2. PRODUCTS:

   A. The Contractor shall propose the termiticide to be utilized.

3. EXECUTION:

   A. Apply solution along the inside of foundation walls, both sides of interior partitions and expansion joints and around all plumbing and other utilities that penetrate the slab at a rate of two (2) gallons per five (5) linear feet or as required by manufacturer.

   B. Apply in strict accordance with all manufacturer’s labeled directions and Federal regulations.

END OF SECTION
END OF DIVISION
320180 – OPERATION AND MAINTENANCE OF LANDSCAPE AND IRRIGATION

1. GENERAL

A. DESCRIPTION OF WORK

   (1) The work shall consist of furnishing all labor, tools, motorized and non-motorized equipment, vehicles, appliances, materials, permits, insurance, and taxes as necessary to execute complete grounds maintenance of the entire park project. The work shall include, but not necessarily be limited to, the following work:

   a. Litter Control
   b. Weed Control
   c. Pest and Disease Control
   d. Rodent Control
   e. Irrigation System Maintenance
   f. Plant Replacement
   g. Pruning
   h. Sweeping and Washing of Sidewalks, Curbs, Paving, Tables and Benches.
   i. Cleaning and Raking of Planting and Field Areas
   j. Temporary Protection

B. MAINTENANCE PERIOD

   (1) The maintenance period shall be three hundred sixty-five (365) days from substantial completion of the project.

C. MAINTENANCE ACTIVITY

   (1) Maintenance shall be performed a minimum of one time per week. Work which the Contractor fails to do when necessary during the maintenance period may be performed by others as directed by the Owner’s Representative, the cost to be borne by the Contractor.
2. PART 2 - PRODUCTS

A. MATERIALS

(1) Materials for irrigation and landscaping maintenance shall be as specified in the irrigation and landscaping sections, respectively. Materials shall not be used until they have been approved by the Owner’s Representative who shall have the power to condemn any material or defective workmanship.

3. PART 3 - EXECUTION

A. TREE SUPPORTS

(1) Maintain tree support ties, hoses, guy wires, tree stakes and wires which maintain upward and proper support of the trees. Protect the trees from wind and storm damage. Allow for movement of the trunks to encourage strong growth of trunks.

B. LITTER REMOVAL AND CLEAN UP

(1) All litter and dead vegetation which is loose shall be removed from the entire project site at intervals not to exceed five (5) calendar days.

(2) Contractor shall clean concrete curbs, sidewalks, and other paving by sweeping and hosing down as necessary on a weekly basis.

(3) Contractor shall clean picnic tables, benches, etc. by hosing down as necessary on a weekly basis.

C. WEED CONTROL

(1) Weed control shall be provided over the entire project site through the use of herbicides and manual labor, which method or methods shall be at the discretion of the Contractor. Grass type weeds and other weeds which spread by underground roots shall be permanently eradicated by the use of translocating herbicides, such as ‘Round-Up’.

(2) Herbicides employed during the term of the maintenance period shall not cause the extermination of any landscape plant nor have detrimental side effects
(3) No chemical shall stain or cause to stain, nor cause damage to any portion of the site or improvements, including landscape plant material. If staining or damage occurs, requisite repairs or replacements shall be made by the Contractor at his expense.

(4) A record shall be kept of all chemical applications noting the date applied, location of application, rate of application, whether pre-emergent or post-emergent, and method of application. A copy shall be submitted to the Owner’s Representative at the end of the maintenance period.

(5) Applications of chemicals shall be in such a manner so as not to cause injury to the personal health of anyone working on the site, observing, or passing by. Care shall be taken such that no puddles or pools of water which contain toxic amounts of chemicals remain after completion of operations. Chemicals shall not be allowed to fall on or translocate to other areas of the site.

(6) Chemicals shall be approved by the EPA for the intended use and applied in strict accordance with EPA guidelines and the manufacturer’s instructions, Chemicals shall be applied by an individual with proper training and possessing the required licenses and certifications for applying herbicides and other chemicals in the State of Arizona.

D. PEST AND DISEASE CONTROL

(1) A. All landscape plants and turf grass shall be provided protection which shall include, but not be limited to, eradication or control of insects, mites, fungi, and non-fungus diseases through the application of appropriate insecticides, miticides, and fungicides, which shall in form be sprays or dusts, all necessary to maintain plants in a healthy and vigorous growing condition.

(2) All insecticides, fungicides, and miticides employed during the term of the Contract shall not cause extermination of any landscape plant material, nor cause damage to the growth characteristics such that the plants will not be able to recover in a normal manner.

(3) All precautionary provisions of paragraph “Weed Control” shall apply to the application of pest and disease control chemicals.
E. PRUNING

(1) Pruning of plants shall be done in a manner which preserves the plant’s natural growth characteristics and appearance. No shearing will be required or allowed.

(2) Trees shall be pruned to remove suckers and low branching, to maintain tree branching above 6’ in the sight visibility triangles, and to promote safety. Trees shall be pruned up to allow clear access for pedestrians on sidewalks. Dead or diseased branches shall be removed at their point of origin.

(3) Shrubs and accent plants generally will not require any pruning. Pruning shall only be done to remove dead, diseased, or damaged branches and to control branches which are substantially longer than the main portion of the plant or that create a hazard.

F. INERTS

(1) Decorative rock areas shall be raked to maintain a finished appearance where disturbed. Replace decorative rock, which is removed, damaged or otherwise no longer suitable for the use in which it was intended.

(2) Raked earth areas shall be raked to maintain a finished appearance where disturbed.

G. PLANT REPLACEMENT

(3) All landscape plant material determined by the Owner’s Representative to possess health or vigor insufficient to develop a normal plant habit shall be replaced by the Contractor within ten (10) calendar days after receipt of notification.

(4) Replacements shall be of the same genus, species, and variety and of the same size as originally provided. Such replacements shall be at the expense of the Contractor and be subject to the approval of the Owner’s Representative.

(5) Replacement at the Contractor’s expense shall be occasioned due to causes beyond the control of the Contractor such as, but not limited to, vandalism, and unseasonably severe either conditions. Contractor shall repair damaged areas due to circumstances beyond the Contractor’s control, after submitting request for change order and obtaining approval for same from the Owner’s Representative.
H. IRRIGATION

(6) Irrigation shall be operated at programmed intervals as necessary to maintain good color and sturdy growth of all plant material and turf.

(7) Precautions shall be taken to avoid soil erosion by the irrigation system. Soil eroded by the irrigation system shall be replaced with topsoil conforming to the landscape specifications.

(8) The entire irrigation system shall be maintained by the Contractor to insure balanced and necessary watering. This maintenance shall include, but not be limited, to the following:
   a. Removal of sand and debris causing restriction within the emitter orifices.
   b. Flushing of drip system filters and the reclaimed water filter at the irrigation point-of-connection as required to remove debris.
   c. Necessary timing adjustments to the automatic controller(s), as provided within the mechanism of the equipment.
   d. Adjustment of turf sprayheads to maintain efficient, uniform application of water to turf areas.
   e. Adjusting sprayheads to minimize overspray onto adjacent paved surfaces and other non-turf areas.
   f. Repair or replacement of damage caused by the Contractor. All such repairs or replacements shall be subject to the approval of the Owner’s Representative.

I. RODENT CONTROL

(1) Rodents, especially burrowing rodents, shall be controlled on the entire project site by the Contractor, using methods approved by the Owner’s Representative. Control methods shall safeguard the public from tripping and falling hazards from rodent burrows, rodent spread diseases, etc.

J. CONTRACTOR’S RESPONSIBILITY

(1) This Contractor shall be bound by all requirements of the General Conditions and Specifications which in any way apply to his work.
(2) The Contractor shall not be held responsible for any damages effected on or within the project site due to accidental or malicious causes by the public, or an “Act of God”. It shall be the responsibility of the Contractor to inform the Owner’s Representative of any damage due to the aforementioned causes as soon as detected.

K. INSPECTIONS

(1) The Owner’s Representative, accompanied by the Contractor, will inspect the site at least six times during the maintenance period and at its expiration; and at other times when deemed necessary by the Owner’s Representative or Contractor. When, in the opinion of the Owner’s Representative, the methods being used to control or eradicate pests and weeds or perform other maintenance functions are unsatisfactory, the Contractor shall immediately modify his methods, as directed by the Owner’s Representative. Final acceptance of the project shall be granted after satisfactory completion of the Maintenance period.

END OF SECTION
321540 – CRUSHED STONE SURFACING

1. GENERAL

A. RELATED DOCUMENTS

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

B. SUMMARY

(1) Treat areas designated to receive decorative rock, size rock, and decomposed granite, extra, with pre-emergent herbicide.

(2) Furnish and Place Decorative Rock, Sized Rock, Decomposed Granite Rip-rap, extra in areas designated to receive inert materials.

C. CONDITIONS

(1) Examine related work and surfaces before starting work on this Section. Report to the Owner's Representative, in writing, conditions which will prevent proper provision of this work. Beginning work of this Section without reporting unsuitable conditions to the Architect constitutes acceptance of conditions by Contractor. Any required removal, repair, or replacement shall be done at no additional cost to the Owner.

D. SUBMITTALS

(1) Contractor shall pull sample material for site for comparison with color and size for additional material and provide 3 samples for owner review and approval.

(2) Submit samples of the inert materials for each type of inert material proposed along with copies of labels of any pre-emergent herbicides to the Architect for approval prior to beginning work under this section.

(3) Submit quantity invoices or bills of lading for verification of volumes and quantities of material prior to construction for approval by the Architect. Omission of verification will constitute grounds for non-acceptance of any material or procedure.

2. PRODUCTS
A. MATERIALS

(1) Place Decorative Rock, Sized Rock, Decomposed Granite Rip-Rap extra for landscape areas shall be size indicated on plans; color to be submitted to the Owner’s Representative for review and approval.

(2) Pre-Emergent Herbicide shall meet all applicable local, State and Federal environmental and labeling laws. Under no conditions shall a soil sterilant be used on the site. Product shall be Surflan.

3. EXECUTION

A. PREPARATION

(1) Remove all weeds and debris from the areas designated for place decorative rock, sized rock, decomposed granite rip-rap.

(2) Verify subgrade elevations are accurate to allow the addition of 2” of material in landscape areas. If grade is too high, excavate and remove material.

(3) Verify subgrade elevations are accurate to allow the addition of “x” depth of material in rip-rap and other areas. If grade is too high, excavate and remove material. Grades shall be concaved to collect drainage toward center of swales and water collection areas.

(4) Smooth subgrade and remove all rocks, clods, roots or other debris larger than 1/2” in diameter.

(5) Apply pre-emergent herbicide in conformance with the manufacturer's instructions.

B. INSTALLATION IN LANDSCAPE AREAS

(1) Install decorative rock, sized rock, and decomposed granite, rip-rap extra to a depth of X” minimum or as specified on the plans.

(2) Finish grade of material shall be 1” below adjacent hardscape surface.

(3) Swales and water collection areas shall be concaved to collect water within central flow.

(4) Re-apply pre-emergent herbicide in accordance with the manufacturer's instructions.
C. CLEAN UP

(1) Upon completion of the work, remove all excess material, equipment and waste to the satisfaction of the Architect.

END OF SECTION
1. GENERAL

A. SUMMARY

(1) Provide all materials, labor, equipment and services necessary to furnish and install site amenities including: bicycle racks, bicycle lockers, waste/recycling receptacles, benches and pots/planters.

B. REFERENCES

(1) ASTM Testing Standards:
   g. ASTM D 3363 – Standard Test Method for Film Hardness by Pencil Test.

(2) B. ISO Testing Standards:
   a. ISO 1520 – Paints and Varnishes – Cupping Test.
   b. ISO 2815 – Paints and Varnishes – Buchholz Indentation Test.

(3) C. ANSI/BIFMA Testing Standards:
   a. ANSI/BIFMA X5.5-2008– Standard Test for Desk / Tables.

C. SUBMITTALS

(1) Product Data: Submit manufacturer’s product data, storage and handling requirements and recommendations, installation methods, available colors, finishes, styles, patterns, textures and optional accessories.
(2) Shop Drawings: Submit manufacturer’s shop drawings, including plans and elevations, indicating overall dimensions.

(3) Samples: Submit manufacturer’s samples of materials, finishes, and colors.

(4) Warranty: Manufacturer’s standard warranty.

D. QUALITY ASSURANCE

(1) Manufacturer’s Qualifications: Manufacturer regularly engaged in manufacture of site furnishings since 1969.

(2) Product Support: Products are supported with complete engineering drawings and design patents.

(3) Base Worth: An installed base of products worth in excess of one hundred million dollars.

(4) Assets: Excess of twenty million dollars in assets.

(5) Production: Orders are filled within a 40-day schedule.

(6) Facility Operator: Welders and machine operators are certified.

E. 1.05 DELIVERY, STORAGE, AND HANDLING

(1) Delivery: Deliver materials to site in manufacturer’s original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

(2) Storage: Store materials in clean, dry area in accordance with manufacturer’s instructions. Keep materials in manufacturer’s original, unopened containers and packaging until installation.

(3) Handling: Protect materials and finish during handling and installation to prevent damage.

F. WARRANTY

(1) Products will be free from defects in material and/or workmanship for a period of three years from the date of invoice.

(2) The warranty does not apply to damage resulting from accident, alteration, misuse, tampering, negligence, or abuse.

(3) Product, at the option of manufacturer, repair, replace, or refund the purchase price of any items found defective upon inspection by an authorized service representative.

(4) Purchasers should be aware that normal use of these high-quality products can result in superficial damage affecting the finish. Scratches, nicks, and dents are to be considered normal wear and tear and are not the responsibility of the manufacturer.
2. PRODUCTS
   A. Refer to Site Amenities Legend on the Landscape plans and Furnishings, Fixtures and Equipment Schedule per Architectural plans.
      (1) Submit product cuts sheets to include materials, color and finish charts and installation details per the associated Site Amenities Legend and Furnishings, Fixtures and Equipment Schedule per Architectural plans.

3. EXECUTION
   A. Examination
      (1) Examine areas to receive site furnishings.
      (2) Notify Architect of conditions that would adversely affect installation or subsequent use.
      (3) Do not begin installation until unacceptable conditions are corrected.

   B. Installation
      (1) Install all site furnishings in accordance with manufacturer’s instructions, specification and/or specified details within the contract documents and at locations indicated on the Drawings.
      (2) Install site furnishings plumb and level.
      (3) Anchor site furnishings securely in place.
      (4) Bike racks installed with sub-surface anchor and surface mount, refer to plan for placement and required installation requirements.

   C. Adjusting
      (1) Finish Damage: Repair minor damages to finish in accordance with manufacturer’s instructions and as approved by Architect.
      (2) Component Damage: Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

   D. Cleaning
      (1) Clean site furnishings promptly after installation in accordance with manufacturer’s instructions.
      (2) Do not use harsh cleaning materials or methods that could damage finish.

   E. Protection
(1) Protect site furnishings during construction to ensure that, except for normal weathering, site furnishings will be without damage or deterioration at time of project acceptance.

END OF SECTION
1. GENERAL

A. SUMMARY

(1) Furnish all work and material, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with the installation of underground sprinkler system complete, as shown on drawings and/or specified herein. When the term "Contractor" is used in this section, it shall refer to the irrigation contractor.

B. RELATED DOCUMENTS

(1) Conditions of the contract and Division 1 General Conditions are hereby made a part of this section.

C. APPLICABLE STANDARDS

(1) ASTM D2241 - Poly (Vinyl Chloride)(PVC) Plastic Pipe (SDR-PR)
(2) D2464 - Poly (Vinyl Chloride)(PVC) Plastic Pipe Fittings, Threaded, Schedule 40
(3) D2564 - Solvent cements for Poly (Vinyl Chloride)(PVC) Plastic Pipe and Fittings
(4) D2855 - Making Solvent - Cemented Joints with Poly (Vinyl Chloride)(PVC) Pipe and Fittings
(5) F-477 - Gasket Pocket Pipe

D. WARRANTEE AND MAINTENANCE

(1) Warrantee:
   a. The Contractor is required to guarantee the sprinkler irrigation system in accordance with the requirements below. A copy of the guarantee form shall be included in the Operations and Maintenance Manual. The guarantee form shall be on the Contractor’s letterhead and contain the following information:
GUARANTEE FOR SPRINKLER IRRIGATION SYSTEM

We hereby guarantee that the sprinkler irrigation system we provided to be free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear, and unusual abuse or neglect expected. We agree to repair or replace any defects in material or workmanship including repair of backfill settlement which may develop during the period of two years from the date of Substantial Completion and to repair or replace any damage related to such defects at no additional cost to the Owner. We shall make such repairs or replacements within a reasonable time, as determined by the Owner, after receipt of written notice from the Owner, we authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

Project:

Location:

Signed:

Address:

Phone:

Date of Acceptance:

(Contractor to fill out upon project acceptance)

(2) Maintenance

a. Work shall include but not be limited to:

1. Adjustment of sprinkler height and plumb to compensate for settlement and/or plant growth.
2. Backfilling of all trenches.
3. Adjustment of head coverage (arc of spray) as necessary.
4. Unstopping heads plugged by foreign material.
5. Adjustment of controller as necessary to insure proper sequence and watering time.
6. All maintenance necessary to keep the system in good operating condition.
b. Exclusions

1. Guarantee and maintenance after final acceptance does not include alterations as necessitated by re-landscaping, regrading, addition of trees or the addition and/or changes in sidewalks, walls, driveways, etc., except to the extent that such work is caused or necessitated by the irrigation Contractor or his general Contractor.

E. SUBMITTALS

(1) The Contractor shall submit to the Owner's Representative one (1) pdf copy of shop drawings or manufacturer's "cut sheet" for each type of sprinkler head, pipe, controller, valves, check valve assemblies, valve boxes, wire, conduit, fittings and all other types of fixtures and equipment which he proposes to install on the job. The submittal shall include the manufacturer's name, model number, equipment capacity and manufacturer's installation recommendation, if applicable, for each proposed item.

(2) A contract will not be issued to the Contractor until he has submitted the required information. No partial submittal will be accepted and submittals shall be neatly bound into a brochure and logically organized. After the submittal has been approved, substitutions will not be allowed except by written consent of the Owner's Representative.

(3) Shop drawings

a. Include dimensions, elevations, construction details, arrangements and capacity of equipment, as well as manufacturer's installation recommendations.

(4) Record Drawings

a. Record dimensioned locations and depths for each of the following:

a. Sprinkler pressure line routing (Provide dimensions for each 100 lineal feet (maximum) alone each routing, and for each change in directions).

b. Gate Valves, Irrigation control valves, Control wire routing, Sleeves under paving and other related items as may be directed by the Owner's Representative.

(5) Dimensioning
a. Locate all dimensions from two permanent points (buildings, monuments, sidewalks, curbs or pavements).

(6) Changes

a. Record all changes which are made from the Contract Drawings, including changes in the pressure and non-pressure lines.

b. Record all required information on a set of blackline prints of the drawings. Do not use these prints for any other purpose.

c. Maintain information daily. Keep drawings at the site at all times and available for review by the Owner's Representative.

(7) Record Drawing Submittal

a. When record drawings have been approved by the Owner's Representative, transfer all information to a set of bond prints using permanent blue ink.

b. Changes using ball point pen are acceptable, Highlighter felt are not acceptable.

c. Make dimensions accurately at the same scale used on the original drawings, or larger.

d. If photo reduction is required to facilitate controller chart housing, notes or dimensions shall be a minimum 1/4" in size.

F. CONTROLLER CHARTS

(1) Do not prepare charts until record drawings have been approved by the Owner's Representative.

(2) Provide one controller chart for each automatic controller installed. Chart may be a reproduction of the Record Drawing, if the scale permits the chart to fit into the controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility.

(3) Chart shall be blackline print of the actual system showing the area covered by that controller. Identify the area of coverage of each remote control valve, using a distinct different pastel color drawn over the entire area of coverage.
(4) Following approval of charts by the Owner's Representative, they shall be sealed between two layers of 20 mil plastic sheets.

(5) Charts must be completed and approved prior to final acceptance of the irrigation system.

G. OPERATING AND MAINTENANCE MANUAL

(1) Provide two individually bound manuals detailing operating and maintenance requirements for the irrigation system.

(2) Manuals shall be delivered to the Owner's Representative no later than 10 days prior to completion of work.

(3) Provide descriptions of all installed materials and systems in sufficient detail to permit maintenance personnel to understand, operate and maintain the equipment.

(4) Information Required

   a. Index sheet, stating the Irrigation Contractor's name, address, telephone number and name of person to contact, Duration of guarantee period, Equipment list providing the following for each item:

      1. Manufacturer's name
      2. Make and model number
      3. Name and address of local manufacturer's representative
      4. Spare parts list in detail
      5. Detailed operating and maintenance instructions for major equipment.

H. SUBSTITUTION OF MATERIALS

(1) This irrigation system has been designed around the irrigation components herein stated and as shown on the plans. Any changes of brand name, trade name, trademarked, patented articles, or any other substitutions will be allowed only by written order signed by the Owner's Representative. The Owner is under no obligation to accept materials other than as specified. If a bidder wishes for a substitute item to receive consideration as an approved equal, the bidder and each item must meet all the following requirements without exceptions.

   a. Criteria
1. An item, to be considered a substitute, must meet the same specifications of materials, fabrication or construction, dimension or size, shape, finish, performance standards, warranty or guarantee, and any other pertinent and salient features of quality, as indicated in manufacturer's specifications for the original specified item.

b. Submittal for Consideration

1. A sample of the item, along with a written request for consideration, shop drawings, and written specifications, must have been received by the Owner's Representative a minimum of ten (10) calendar days after bid opening date. The item shall then be examined, and the bidder shall be notified, in writing, seven (7) days later, whether or not the item is an approved equal. The Owner's Representative shall be the final judge of whether or not an item submitted for consideration qualifies as being an acceptable substitute.

2. Under no circumstances shall an item be given consideration as an "approved equal" substitute later than ten (10) days after the bid opening. After that date, all items shall be furnished per the original specifications. Likewise, unless certified as "approved equal" per the time frame and the requirements above, the successful bidder (known as Contractor after signing the contract) shall install all items per the original plans and specifications. Equipment or material installed or furnished without prior approval of the Owner's Representative as herein specified, may be rejected and the Contractor required to remove such materials at his own expense.

3. The Contractor alone shall bear complete responsibility for the installation and operation of any material or equipment installed on the job (as a substitute for specified equipment or material) should such substituted material prove to be defective, inoperable or inapplicable.

c. Codes and Permits

1. All work under this contract shall comply with the provisions of these specifications, as illustrated on the accompanying drawings, or as directed by the Owner's Representative and shall satisfy all applicable local codes, ordinances, or regulations of the governing bodies and all authorities having jurisdiction over this project.
2. Installation of equipment and material shall be done in accordance with the requirements of the National Electric Code, local and national Plumbing Codes and standard plumbing procedures. The drawings and these specifications are intended to comply with the necessary rules and regulations; however, some discrepancies may occur. Where such discrepancies occur, the contractor shall immediately notify the Owners Representative in writing of the discrepancies and apply for an interpretation. Should the discovery and notification occur after the execution of a contract, any additional work required for compliance with the regulations shall be paid for as covered by these contract documents.

3. The Contractor shall give all necessary notices, obtain all permits and pay all costs in connection with his work; file with all governmental departments having jurisdiction; obtain all required certificates of inspection for his work and deliver to the Owner's Representative before request for acceptance and final payment for his work.

4. The Contractor shall include in the work any labor, materials, services, apparatus or drawings in order to comply with all applicable laws, ordinances, rules and regulations whether or not shown on the drawings and/or specified.

I. QUALITY ASSURANCE

(1) The installation of the irrigation system shall be made by an individual or firm duly licensed under the State of Arizona Registrar of Contractors.

a. Superintendent: A superintendent satisfactory to the Owner's Representative shall be on in the employ of the Contractor and shall be on the site at all times while the specified herein is being performed.

b. The superintendent shall not be changed, except with the consent of the Owner's Representative

c. The superintendent shall be authorized to represent the Contractor.

d. The superintendent shall have a minimum of 7 years' irrigation installation experience and a minimum of 2 years supervisory experience.
J. NOTIFICATION OF OWNER'S REPRESENTATIVE

(1) The Owner's Representative shall have free access to the work whenever it is in preparation or progress and proper facilities for such access and inspection. The Contractor shall notify the Owner's Representative when he will and will not be on the job. Should the Contractor work periodically on the job, the Owner's Representative shall have the right to require the Contractor to give a 24-hour notice of each and every day or partial day that he intends to work on the project. The Contractor shall perform no work unless the Owner's Representative has been properly notified. Failure to notify the Owner's Representative may require the Contractor to redo, uncover pipe, expose for inspection, etc., all that the Owner's Representative was unable to inspect.

K. EXISTING UTILITIES

(1) Location and Elevations: The Contractor shall examine the site and verify to his own satisfaction the locations and elevations of all utilities both public and private and availability of utilities and services required. The Contractor shall inform himself as to their relation to the work and the submission of bids shall be deemed as evidence thereof. The Contractor shall repair at his own expense, and to the satisfaction of the Owner's Representative, for damage to any utility shown or not shown on the plans.

(2) Should utilities not shown on the plans be found during excavations Contractor shall promptly notify Owner's Representative for instructions as to further action.

(3) Contractor shall make necessary adjustments in the layout as may be required to connect too existing stub outs, should any such stub outs not be located exactly as shown and as may be required to work around existing work, at no increase in cost to the Owner. All such work will be recorded on record drawings and turned over to the Owner's Representative prior to final acceptance.

L. COOPERATION

(1) Work under this contract may be accomplished with other Contractors and trades on the project site at the same time. The Contractor shall allow each Contractor and trade adequate time at the proper stage of construction to fulfill his contract.
M. ELECTRIC POWER

(1) Electric power to operate the controller is provided to controller location with final location field verified. General contractor shall coordinate electrical and landscape sub-contractors to ensure sleeving, conduit and electrical outlets are installed and approved by architect or owner representative. Service wiring to the controller cabinet shall be furnished by the irrigation contractor.

N. EARTH GROUNDING

(1) Use grounding electrodes that are UL listed or manufactured to meet the minimum requirements of Article 250-52 of the 2002 edition of the NEC.

(2) Minimum grounding requirements for grounding circuit shall include copper clad steel ground rod, a solid copper ground plate and 100 lbs. of Power Set earth contact material.

(3) Contractor shall install grounding elements as required by controller manufacture’s specifications on 2-wire system.

O. WATER FOR TESTING

(1) The Owner shall furnish all water necessary for testing, flushing and jetting.

P. EXTRA EQUIPMENT

(1) Supply as part of this contract the following tools:

a. Two keys for the automatic controller

b. The above-mentioned equipment shall be turned over to the Owners Representative at the conclusion of the project. Before final inspection can occur, evidence that the Owner has received this material must be shown to the Owner's Representative.

Q. SLEEVES AND ELECTRICAL CONDUITS

(1) Sleeves and electrical conduits will need to be installed as noted on the Construction Drawings. Contractor shall be responsible for
timely placement of all sleeves and conduits at no additional cost to the Owner.

R. PROGRESS MEETINGS

(1) Contractor shall attend all progress meetings as requested by the Owner’s Representative during installation and as needed to keep work progressing.

S. LOCATING UNDERGROUND FACILITIES

(1) All mainlines and irrigation lines greater than 2" in diameter shall have a purple #18 insulated tracer wire securely attached to it at 8' o.c. and shall have 12" of tracer wire accessible above grade at the termination and be securely attached at that point.

2. PRODUCTS

A. GENERAL REQUIREMENTS

(1) Unless otherwise noted on the plans, all materials shall be new and unused. This irrigation system has been designed around the irrigation components herein stated and as shown on the plan. Any changes of brand name, trade name, trademarked, patented articles, or any other substitutions will be allowed only by written order as outlined in Section 1.06.

B. EQUIPMENT

(1) PVC Pressure Mainline Pipe Fittings

a. Pressure mainline piping shall be Schedule 40 PVC 1” – 3” and Class 200 for 4” and larger. Class 315 SDR 21 as specified on plans. Refer to Irrigation Legend.

b. Pipe shall be made from NSF approved type I, grade I PVC compound conforming to ASTM specification D - 2241. Piping up to and including 4" size shall be SDR solvent weld. Pressure mainline piping 6" size and larger to be gasket pocket type as manufactured by the Swanson Company or equal and shall conform to ASTM F-477.
c. PVC solvent weld fittings shall be Schedule 80k, Type I NSF approved conforming to ASTM test procedure D2466 (for sizes up to and including 3”) and shall be as manufactured by Spears, Lasco or Dura.

d. Solvent cement and primer for PVC solvent-weld pipe and fittings shall be Red Hot Blue Glue and Christy’s Purple Primer. Manufacturer’s installation requirements shall be strictly adhered to.

e. All PVC pipe shall bear the markings showing the Manufacturer’s name, Nominal pipe size, Schedule or class, Pressure rating in psi, National Sanitation Foundation (NSF) approval and Date of extrusion.

f. All fittings shall bear the manufacturer’s name or trademark, material designation, size, applicable IPS schedule and NSF seal of approval.

(2) PVC Non-Pressure Lateral Piping

a. Non-pressure buried lateral line piping shall be PVC Schedule 40 with solvent weld joints for sizes 1/2” to 8”.

b. Pipe shall be made from NSF approved, Type I, Grade II PVC compound conforming to ASTM resin specifications D1784. All pipe shall meet requirements set forth in Federal Specification PS-22-70, for the appropriate standard dimension ratio (SDR).

c. PVC Solvent weld fittings shall be Schedule 40, Type I NSF approved conforming to ASTM test procedure D2466 as manufactured by Spears, Lasco or Dura.

(3) Galvanized Pipe & Fittings

a. Where indicated on the drawings and on the details, use galvanized steel pipe ASA Schedule 40 mild steel screwed pipe.

b. Fittings shall be medium galvanized screwed beaded malleable iron. Galvanized couplings may be merchant coupling.

c. All galvanized pipe and fittings installed below grade shall be painted with two coats of Koppers # 50 Bitumastic (except swing joint assembly).
(4) Backflow Preventer
   a. Backflow Preventer shall be a reduced pressure type of the size shown on the project plans.

(5) Isolation Valves
   a. Brass lead-free ball valve similar to those manufactured by Nibco for 1" to 2-1/2". Gate valves similar to those manufactured by Matco-Norea 3" and Larger. Valves shall be installed in control valve boxes.
   b. Ball valves shall be set on side to all for ease of turning on and off and handle pointing up in "Off" situation.

(6) Valve Boxes
   a. A box shall be provided for all valves and equipment as detailed on the project plans. Valve boxes shall be made of high-strength, plastic suitable for turf irrigation purposes. Boxes shall be suitable in size and configuration for the operability and adjustment of the valve. Extension sections will be used as appropriate to the depth of piping. All valve box covers shall bolt down and shall be colored green and imprinted "irrigation".
   b. Boxes for valves shall have a locking or bolt down cover. Box shall be as manufactured by Ametek. Only one remote control valve/gate valve assembly shall be installed per valve box. Box shall be rectangular in shape and be sufficiently large to allow easy access, maintenance and repair of the equipment contained therein.

(7) Quick Coupling Valves and Wire Splices
   a. Box shall be a 10" diameter round, plastic valve box.

(8) Electric Control Valves
   a. Valve shall be of size indicated on Drawings Valves shall be as indicated on the drawings.

(9) Control Wire
   a. Control wire shall be UF-UL listed, color coded copper conductor direct burial size 14. Tape control wires to side of main line every 10 feet. Where control wire leaves main or lateral line, bury a minimum of 24" deep. Use 3M DBY
waterproof wire connectors at splices and locate all splices within valve boxes. Use white color for common wire and red for signal wire. Each common wire may serve only one controller. Do not use black on any 24V circuit. One extra control wire shall be run from panel continuously from valve to valve throughout system controlled by that controller, similar to common wire for use if a wire fails. Wire shall be different color than all other wires, shall not be green, and shall be marked in control box as an extra wire.

b. 2-Wire shall be Rain Master Compatible – TW-CAB-14, 14-gauge (red/black) polycoated (blue) wire cable for 2-wire path.

c. Decoder – TW-D-1, 2, OR 4, size as required per field conditions.

(10) Irrigation Controller

a. Electric and Battery Automatic Controllers shall be of the sizes and model shown on the plans. Controller shall provide a minimum of 2 spare stations for future connection.

b. Grounding per Manufactures specifications with TW-LA-1, Lighting arrestor, provided every 250 feet or as identified within manufactures specifications.

c. All Controllers shall be earth ground per American Society of Irrigation Consultants (ASIC) Guild line 100-2002 (www.asic.org, “Design Guides”). Contractor shall submit shop drawing for grounding materials and location review and approval prior to installation.

(11) Pressure Regulator

a. Self contained, single seat, direct acting, spring loaded, diaphragm actuated type as manufactured by Senniger or approved equivalent.

(12) Filters

a. Filters used downstream of the Remote-Control Valves shall be a Y strainer type with minimum of 200 mesh filtration. The filter shall have a threaded opening to allow attachment of a hose for flushing. The filter shall have features similar to the Rain Bird RBY-100-150MX.

(13) Emitter Assembly
a. Emitters shall be of the pressure compensating, self flushing type.

b. The cases of the emitters shall be made of durable black, heat resistant acetal plastic material. It shall be resistant to temperature variation, ultraviolet radiation, smog (ozone), common liquid fertilizer and weed spray.

c. The emitter shall be capable of continuous, clog free operation with 140 mesh (minimum) filtration. The emitter shall be capable of being installed in any position and maintain its given flow characteristics. The emitter shall be non-adjustable.

d. The emitter shall function with a system pressure range of 15 psi minimum to 50 psi maximum. The emitters shall be available in flow ranges from .85 to 2.0 gph.

e. The emitter assemblies as shown on the plans shall consist of the emitter and .22" OD spaghetti distribution tubing which shall not exceed 8" in length.

f. Trees shall be irrigated with multi-port 1 or 2 gph/port, six ports per tree pending of species. Refer to Emitter schedule for required gallons per minute (see plans).

(14) Emitter Hose

a. The flexible emitter hose, which shall deliver water to the emitter assembly shall be manufactured from virgin polyethylene material having the following physical characteristics:

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>O.D.</td>
<td>.704&quot;</td>
</tr>
<tr>
<td>I.D.</td>
<td>.600 min.</td>
</tr>
<tr>
<td>Wall</td>
<td>.0052&quot;</td>
</tr>
<tr>
<td>Carbon Black</td>
<td>1.5 - 3.5</td>
</tr>
<tr>
<td>Density</td>
<td>.92 - .93</td>
</tr>
<tr>
<td>Melt/Environmental Stress/Crack Resistance</td>
<td>0/100/100</td>
</tr>
</tbody>
</table>

b. Fittings for use with the emitter hose shall be of the compression, internal barb type, constructed of virgin PVC or glass-filled polypropylene materials, and as detailed on the project plans.

(15) Sleeves:
a. Provide where shown on the drawings and specified herein.

b. All mainlines, lateral line piping, emitter headers and lateral piping and all control wire shall be installed in a sleeve under all paving, walls and concrete surfaces.

c. All sleeving shall be SCH 40 PVC solvent weld pipe.

d. All joints shall be solvent welded.

e. All sleeves shall be installed as detailed on the project plans.

f. All sleeves shall extend a minimum of 18" beyond the edge of the item being sleeved.

g. Each sleeve shall be taped along its entire length with metallic locator tape manufactured for that purpose.

h. Sleeves shall have a minimum horizontal clearance of 12" from each other and other piping. Sleeves shall not be installed parallel and directly over another line. Sleeves shall have a minimum of 9. inches vertical clearance where they cross other lines.

P. Other equipment:

a. Other Components shall be as recommended by Manufacturer and subject to Architect's review and acceptance and as necessary to complete and make system operational.

b. No Pre-manufactured Swing joints are accepted.

c. No male adapters are accepted; Utilize Sch. 80 Toe Nipples or Nipples sized as required.

3. EXECUTION

A. GENERAL

(1) Contractor Responsibility: The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in equipment usage, area dimensions or static water pressure exist that might not have been considered in the engineering. Such obstructions or differences shall be brought to the attention of the
Owner’s Representative. In the event this notification is not performed, the Contractor shall assume full responsibility for any revision necessary.

(2) All material and equipment shall be delivered to the job site in unbroken reels, cartons or other packaging to demonstrate that such material is new and of a quality and grade in keeping with the intent of these specifications.

B. SITE CONDITIONS

(1) All scaled dimensions are approximate. The Contractor shall check and verify all size dimensions and receive the Owner's Representative's approval prior to beginning work.

(2) Contractor shall be responsible for layout of all equipment and piping in the irrigation system. This layout shall be in conformance with notations on the Construction Drawings.

(3) Exercise extreme care in excavating and working near existing utilities. Contractor shall be responsible for damage to utilities which are caused by his operation or neglect. Contractor shall check existing utility drawings and contact Blue stake prior to any excavation.

(4) Coordinate installation of irrigation materials, including pipe so there shall be no interference with utilities or other construction or difficulty in planting trees, shrubs and ground covers. Contractor shall coordinate with other trades to insure timely placing of necessary sleeves, wires and pipes under walks, curbs and paving.

(5) Design Pressure: This irrigation system has been designed to operate with a minimum static inlet water pressure as shown on the drawings. The Contractor shall take a pressure reading prior to beginning construction. If the pressure reading is less than indicated, the Contractor shall notify the Owner's Representative.

C. PREPARATION

(1) Prior to installation, the Contractor shall stake out all pressure supply lines, location of remote-control valves, sprinkler heads, controllers, backflow preventers, gate valves, quick coupling valves and other irrigation equipment.
All layout shall be approved by the Owner's Representative prior to installation. Prior approval shall be obtained for valves, controllers, main line routing, quick coupling valves, backflow preventers, water meters and sprinkler locations.

D. WATER SUPPLY

(1) Irrigation system shall be connected to the new water mainline at the approximate location shown on the drawings. Contractor is responsible for minor changes caused by actual site conditions and tap locations.

E. EXCAVATION AND BACKFILL

(1) Trenching

a. Dig trenches straight and support pipe continuously on bottom of trench. Lay pipe to an even grade. Trenching excavation shall follow the layout as approved by the Owner's Representative in the field. If the bottom of a pipe trench excavation is found to consist of rock, caliche, or any other material that, be reason of its hardness or sharpness, cannot be excavated to give a uniform bearing surface, said rock or other material shall be removed for at least three (3) inches below the specified trench depth and refilled to the specified trench depth with sand or other approved shading material.

(2) Burial of Pipe

a. Depth of Pipe shall be as shown on the construction details

(3) Backfilling

a. The trenches shall not be backfilled until all the required tests are performed. Trenches shall be carefully backfilled in 8" lifts with the excavated materials, less any stone or clods of earth larger than 1/2" in any dimension. Backfill shall be mechanically compacted in landscape areas to a dry density equal to adjacent undisturbed soil. Backfill shall conform to adjacent grades without dips, sunken areas, humps or other surface irregularities. Backfilling shall not be performed while trenches or backfill material is in a wet or muddy condition.

b. A fine granular material backfill will be initially placed on all lines to a depth of 3" over the top of the pipe. No foreign
matter or particles larger than 1/2" in any one dimension will be permitted in this backfill. Existing site soil that conforms to this gradation requirement may be used for this initial backfill.

c. Flooding of trenches will be permitted only with approval of the Owner's Representative.

d. If settlement occurs and subsequent adjustments in pipe, valves, sprinkler heads, lawn or planting, or other construction are necessary, the Contractor shall make all required adjustments without cost to the owner. Contractor shall also make repairs or replacements to any item damaged by settlement of trenches or irrigation equipment, whether said item was part of the original scope of construction or not.

e. All buried private landscape sprinkler lines greater than 2" in diameter shall have a purple #18 insulated tracer wire securely attached to it at 8’ o.c. and shall have 12” of tracer wire accessible above grade at the termination and be securely attached at that point.

(4) Trenching and backfill under paving

a. Trenches located under areas where paving, asphaltic concrete or concrete will be installed shall be backfilled with sand for a depth of 3” below the bottom of the pipe (or sleeve) and 3” above the top of the pipe (or sleeve), and compacted to 90% compaction or the required subgrade compaction for that area (whichever is greater), using manual or mechanical tamping devices. All trenches shall be left flush with the adjoining grade. The Contractor shall set in place, cap, and pressure test all piping under paving prior to the paving work.

b. Provide for a minimum cover of 18" between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete paving.

(5) Assemblies

a. Routing of sprinkler irrigation lines as indicated on the drawings is diagrammatic. Install lines and various assemblies to conform with the details shown on drawings and in accordance with the manufacturer’s recommendations.

b. Install no multiple assemblies on plastic lines. Provide each assembly with its own outlet.
c. Install all assemblies specified herein in accordance with respective detail. In absence of detail drawings or specifications pertaining to specific items required to complete work, perform such work in accordance with best standard practice with the prior approval of the Owner's Representative.

d. PVC pipe and fittings shall be thoroughly cleaned of dirt, dust and moisture before installation. Installation and solvent-welding methods shall be recommended by the pipe and fitting manufacturer. Primer shall be used on all solvent weld joint. No solvent weld joint shall be submitted to water pressure until curing for 24 hours minimum.

e. On PVC to metal connections, the Contractor shall work the metal connections first. Teflon paste shall be used on all threaded PVC to PVC joints, and on all threaded PVC to metal joints. Light wrench pressure is all that is required. Where threaded PVC connections are required, use threaded PVC adapters into which the pipe may be welded. Teflon tape shall not be accepted.

f. Gasket pocket pipe and fittings shall be assembled in strict accordance with the manufacturer's recommendations. Only recommended lubricant will be permitted.

(6) Concrete thrust blocks

a. Installed at specific locations per manufacturer's recommendations and instructions. Thrust blocks shall be installed for main lines at all changes in direction, tees, and gate valves.

(7) PVC Pipe Installation:

a. Piping shall be snaked in the trench to allow for thermal expansion and contraction.

b. After all curing of solvent weld joints and after having received the approval of the Owner's Representative, the mainline shall be filled. Extreme care will be taken to slowly fill the piping while releasing entrapped air at the ends of the main line.

c. All lines shall have a minimum clearance of six inches from each other, and from lines of other trades. This clearance shall not supersede any clearance required by local, regional or national building, health or safety codes. Parallel lines shall not be installed directly over one another.

d. Manufacturer's installation recommendations shall be strictly adhered to.

(8) Flushing of System
a. After all new sprinkler pipe lines and risers are in place and connected, all necessary diversion work has been completed, and prior to installation of sprinkler, heads, the control valves shall be opened and a full head of water used to flush out the system.
b. Sprinkler shall be installed only after flushing of the system has been accomplished to the complete satisfaction of the Owner's Representative.

(9) Temporary Repairs

a. The Owner reserves the right to make temporary repairs as necessary to keep the sprinkler system equipment in operating condition. The exercise of this right by the Owner's Representative shall not relieve the Contractor of his responsibilities under the terms of the guarantee as herein specified.

(10) Pressure Regulator

1. Install in a valve box in conformance with the project details.

(11) Emitter Assembly

a. The emitter and distribution tubing shall be assembled using the manufacturer's recommended tools and accessories.
b. The maximum length of the .22" distribution tubing shall be 8'. In the event the distance in the field exceeds the maximum length, the Contractor shall extend the poly tubing as required by adding a tee and shall add a hose end cap to this extension at the Contractor's expense.
c. The Contractor shall assemble the emitter assembly in conformance with the applicable detail on the project plans. This detail will depend on whether the emitter is irrigating a tree in turf or other ground plane material.

(12) Emitter Hose

a. The emitter hose location, as shown on the plans, is diagrammatic. The Contractor shall layout this hose so as to conform to the maximum distance requirements as specified under the emitter assembly section of these specifications.
b. The Contractor shall flush the emitter hose prior to and after installation of the emitter assemblies.

F. FIELD QUALITY CONTROL
(1) Adjustment of the system

a. The Contractor shall flush and adjust all sprinkler heads for optimum performance and to prevent, as much as possible, over spray into walks, roadways and buildings.

b. If it is determined that adjustment in the irrigation equipment will provide proper and more adequate coverage, the Contractor shall make such adjustments prior to planting. Adjustments may also include changes in nozzle sizes and degrees of arc as required. Such changes shall be approved in advance by the Owner's Representative, at no cost to the Owner.

c. Lowering raised sprinkler heads by the Contractor shall be accomplished within 10 days after notification by the Owner.

d. All sprinkler heads shall be set perpendicular to finished grades unless otherwise designated on the plans. On slopes, heads shall be angled for optimum coverage and performance.

e. Owner's Representative to approve all head locations and reserves the right to request the contractor to make minor adjustments to head placement or nozzle selection at no cost to the Owner.

f. All parts of the irrigation system and associated equipment shall be adjusted to function properly and shall be turned over to the Owner in operating condition.

(2) Testing of the Irrigation System

a. The Contractor shall request the presence of the Owner's Representative at least 48 hours in advance of testing.

b. Test all pressure lines under hydrostatic pressure of 150 lbs. per square inch and prove water tight.

c. All piping under paved areas shall be tested under hydrostatic pressure of 150 lbs. per square inch and proved water tight prior to paving.

d. All PVC lateral line pipe shall be tested at working line pressures with coupling exposed and swing joints and other outlets capped.

e. Sustain pressure in the lines for not less than two hours. Pipe sections shall be center loaded and all coupling shall be exposed. Before testing, the line shall have been filled with water for at least four (4) hours and provisions made for thoroughly bleeding the line of air.
f. All hydrostatic tests shall be made only in the presence of the Owner's Representative. No pipe shall be backfilled until it has been inspected, tested and approved in writing.

g. Furnish necessary force pump and all other equipment necessary to perform test.

h. When the sprinkler irrigation system is completed, perform a coverage test in the presence of the Owner's Representative to determine if the water coverage for the planting areas is complete and adequate. Furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from plans or where the system has been willfully installed as indicated on the drawings when it is obviously inadequate without bringing this to the attention of the Owner's Representative. This test shall be accomplished before any planting or turf has been installed.

i. Upon completion of each phase of work, entire system shall be tested and adjusted to meet site requirements.

G. MAINTENANCE

(1) The entire irrigation system shall be under full automatic operation for a period of seven days prior to planting.

(2) The Owner's Representative reserves the right to waive or shorten this operation period.

(3) Contractor shall provide job maintenance of the entire irrigation system and shall continue until job acceptance by the Owner. Maintain all system components and assure proper watering of all plants. Repair all leaks and replace any defective components. After all landscape and irrigation operations are complete and in conformance with the contract documents, the Owner shall grant provisional acceptance.

(4) Following provisional acceptance, the Contractor shall provide job maintenance daily consisting of all items covered under maintenance specification. Following the 90-day maintenance period, the Owner shall grant final job acceptance after verifying all work and system components are in conformance with the Contract Documents.
H. CLEANUP

(1) Cleanup shall be made as each portion of work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be broomed or washed down, and any damage sustained to the work of others shall be repaired to the original conditions acceptable to the Owner's Representative.

I. FINAL OBSERVATION PRIOR TO ACCEPTANCE

(1) The Contractor shall operate each system in its entirety for the Owner's Representative at the time of final observation. Any items deemed not acceptable shall be reworked to the complete satisfaction of the Owner's Representative.

(2) The Contractor shall show evidence to the Owner's Representative that the owner has received all accessories, charts, record drawings, and equipment as required before final observation can occur.

J. OBSERVATION SCHEDULE

(1) Contractor shall be responsible for notifying the Owner's Representative in advance for the following observations according to the time indicated:

- Pre-job conference - 7 days
- Pressure supply line installation and testing - 48 hours
- Automatic controller installation - 48 hours
- Control wire installation - 48 hours
- Lateral line and sprinkler installation - 48 hours
- Coverage test - 48 hours
- Final observation - 7 days

(2) When the inspections have been conducted by other than the Owner's Representative, show evidence and by whom these inspections were made.

(3) No observation shall commence without as-built drawings.

   a. In the event the Contractor calls for an observation without as-built drawings, without completing previously noted corrections, or without preparing the system for observations, he shall be responsible for reimbursing the Owner's Representative at the hourly rate in effect at the time of the observation, portal to portal (plus transportation
cost) for the inconvenience. No further inspections will be scheduled until this charge has been made. Delays in schedules caused by Contractor's non-payment of these charges shall not be grounds for extension of the construction schedule.

END OF SECTION
329313 – PLANTS

1. GENERAL

A. RELATED DOCUMENTS

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

B. SUMMARY

   (1) Furnish and install landscaping plants as described in Contract Documents.

C. SUBMITTALS

   (1) Submit technical data on soil amendments.

   (2) Submit spreadsheet and photographs in pdf format and include entire proposed plant material list. Submittal shall include, Scientific Name, Common Name, Container size, Quantity and Supplier.

   (3) All tree species shall be selected by contractor with representative photo including measurement of canopy height width and caliper size for approval.

   (4) Any plant species not available during the time of bidding and anticipated installation shall be submitted in writing for a request of alternative species. No contractor substitutions will be permitted after bid is awarded.

D. QUALITY ASSURANCE

   (1) All work shall be performed by a licensed landscape contractor with a minimum of 5 years experience.

E. SEQUENCING

   (1) Do not install plant material until major construction operations are completed and grade is accepted by owner representative.

   (2) Do not install plant material until the irrigation system is complete and functional.
F. WARRANTY

(1) Guarantee furnished all plant materials to live and remain in healthy condition for 365 days minimum from date landscape installation is accepted as complete.

G. OWNER’S INSTRUCTIONS

(1) Provide written instructions on maintenance requirements after the end of the maintenance period. Refer to section 32 01 80 Operation and Maintenance of Landscape and Irrigation.

2. PRODUCTS

A. MATERIALS

(1) Plants

a. Conform to requirements of Plant List and Key on Drawings and to "Horticultural Standards" of American Association of Nurserymen as to kind, size, age, etc.

b. Nomenclature - Plant names used in Plant List conform to "Standardized Plant Names" by American Joint Committee on Horticultural Nomenclature except in cases not covered. In these instances, follow custom of nursery trade. Plants shall bear a tag showing the genus, species, and variety of at least 10% of each species delivered to site.

c. Plants shall be sound, healthy, vigorous, free from plant disease, insect pests or their eggs, noxious weeds, and have healthy, normal root systems. Container stock shall be well established and free of excessive root-bound conditions.

d. Do not prune plants or top trees prior to delivery.

e. Plant materials shall be subject to approval by Architect as to size, health, quality, and character.

f. Bare root trees, ocotillo are not acceptable.

g. Provide plant materials from a licensed nursery.

h. Plant materials larger than those specified may be supplied with approval of Architect, if the material complies in all other respects and if the material is at no additional cost to the Owner.

i. Plant materials shall be symmetrical or typical for variety and species.

(2) Planting Mix shall consist of a mixture of two parts site soil and one-part mulch.
(3) Planting Tablets shall be 21-gram Agriform (20-10-5).

(4) Tree Stakes shall be 2” x 2” x 8’0” Fir or 2-inch diameter 8-foot-long Lodgepole Pine stakes.

(5) Tree Staking Ties shall be 16 ga. wire with new rubber hose or strap to protect tree.

3. EXECUTION

A. EXAMINATION

(1) Check and verify dimensions and quantities before proceeding with any work under this section. Report variations between Drawings and site to Architect before proceeding with work of this Section.

(2) Verify quantities shown on Drawings, they are provided for convenience only and are not guaranteed. Contractor shall be responsible for all planting indicated on Drawings unless indicated otherwise.

B. PROTECTION

(1) Take care and precautions in work to avoid conditions which will create hazards. Post signs or barriers as required.

(2) Provide adequate means for protection from damage through excessive erosion, flooding, heavy rains, etc. Repair or replace damaged areas.

C. EXCAVATION

(1) Layout individual tree locations and areas for multiple plantings. Stake locations and outline areas. Secure Architect’s approval before planting. Make minor adjustments as may be requested.

(2) If underground obstructions are encountered in excavation of tree holes, Architect will select alternate locations.

(3) Excavate holes in accordance with the sizes shown on the Contract Documents.

(4) Roughen sides and bottom of excavations.
Once hole is dug, bore 4” dia. hole 3 feet below bottom of plant pit or deeper to ensure deep root growth development, and positive drainage can occur.

Fill hole with good, tamped planting mix (backfill mix) sufficient to bring plant to proper elevation after watering and settling.

In heavy clay soils or where hard pan exists, auger 8-inch hole 6 feet deep or through hard pan. Fill bottom half of hole with crushed rock and top half with amended topsoil.

Fill hole with water and verify that water drains away within two hours so there will be no drainage problem after tree or shrub is planted. Inform Architect in writing if water does not drain properly. Do not plant trees or shrubs in holes that do not properly drain.

D. PLANTING

Plant immediately after removing plant from container.

Place trees and shrubs in holes so, after watering and settling and in relation to finished grade, plant shall be equal to the grade around the plant in the container.

Cut off broken or frayed roots in a neat, even manner in accordance with accepted horticultural practice.

Center plant in hole and backfill with specified planting mix making ring of mounded soil around the hole’s perimeter to form watering basin. Do not backfill with soil in a muddy condition.

Add fertilizer tablets in plant pit as follows:

- One (1) Gallon Shrub - 1 tablet
- Five (5) Gallon Shrub/Tree - 3 tablets
- Fifteen (15) Gallon Tree and Larger size - 4 tablets

Settle by firming and watering to bring ball down to proper level, just slightly higher than surrounding soil.

Thoroughly water all plantings immediately after planting with the automatic irrigation system.
(8) Install tree stakes in accordance with the Construction Details. Trees less than 4’ tall shall not be staked unless these trees are not self supporting shall have stake installed.

(9) Space groundcovers evenly to produce a uniform effect, staggered in rows and intervals shown.

END OF SECTION