SPECIFICATIONS

FOR

OFFICE AND SHOP BUILDING FOR

R. L. CONSULTING, INC.

TUSCUMBIA, ALABAMA

OCTOBER 14, 2019

LAMBERT EZELL DURHAM

ARCHITECTURE, LLC

P.O. BOX 934

401 EAST COLLEGE STREET

FLORENCE, ALABAMA 35631

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JOB NO. 1860 SET NO. _____

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SECTION 00 21 13 — INSTRUCTIONS TO BIDDERS

1.1 Bid Date: Bids from invited General Contractors will be received until 2:00 p.m., C.S.T., Thursday, November 14, 2019 in the offices of Lambert Ezell Durham Architecture, LLC, 401 East College Street, Florence, Alabama.

1.2 Pre-Bid Conference: A mandatory Pre-Bid Conference for all bidding General Contractors will be held at 2:00 p.m. C.D.T. on Tuesday, October 29, 2019 in the offices of Lambert Ezell Durham Architecture, LLC, 401 East College Street, Florence, Alabama.

1.3 Contract Documents:

A. Copies of the Drawings and Specifications may be obtained at the office of Lambert Ezell Durham Architecture, LLC, P.O. Box 934, 401 East College Street, Florence, Alabama 35631 upon deposit of $200.00 per set payable to the Architect. Any unsuccessful bidder, upon returning such set in good condition within ten (10) days after the bid date, will be refunded his deposit. General Contractors not submitting a Bid after obtaining Drawings and Specifications will be refunded their deposit less cost of reproduction upon return of such sets in good condition. Separate sheets of Drawings and Specifications are available from the Architect for $2.50 per print and $.15 per page of Specifications. Cost of reproduction will be charged on all sets in excess of one (1) to General Contractors.

B. The Drawings and Specifications may be examined at the Plan Rooms of Dodge Analytics and Data, Hot Springs, Arkansas; AGC Plan Room, Florence, Alabama; and at the office of the Architect. Electronic images of the documents may be viewed on the Architect's website (www.ledarchitecture.com) and printed by General Contractors, Subcontractors, and Suppliers by contacting the Architect at info@ledarchitecture.com to obtain a username and password.

1.4 Site: Bidders shall examine the site and all conditions thereon since the proposal must take into consideration all such conditions as may affect work. Should the General Contractor find any structures existing on the site not indicated on the Drawings, he shall notify Architect prior to Bid Date.

1.5 Proposals: Proposals shall be submitted in duplicate on the form accompanying these Specifications. Additional copies may be obtained at the Architect's office, or the Proposal may be submitted on a photocopy of the Proposal Form.

A. All bidders must include the bidder's current license number displayed on the sealed envelope in which the bid is delivered or the bid will not be accepted.

B. All blanks on the form shall be filled; numbers shall be given both in words and figures; no part of the form shall be deleted; no unauthorized statements shall be added; and the signature shall be both printed and in writing.

C. No oral, telegraphic, or telephonic proposals or modifications of submitted proposals shall be considered.

1.6 Addenda: Neither Owner nor Architect will give or be responsible for any oral instructions. If information is needed, Addenda will be issued to all Bidders. Should Bidders find any discrepancies, omissions, ambiguities, or conflicts in or among Contract Documents or be in doubt as to their meaning, bring questions to attention of the Architect not later than three (3)

days prior to date for receipt of Bids. Question will be reviewed and where information sought is not clearly indicated or specified, a clarifying Addendum will be issued which will become a part of the Contract.

1.7 Bonds:

A. Each Proposal shall be accompanied by a Bid Guarantee of not less than Five Percent (5%) of the amount of the Base Bid, which may be a Bid Bond, Certified Check, or Cashier's Check made payable to the Owner.

B. A satisfactory Performance Bond and Payment Bond, each in an amount equal to One Hundred Percent (100%) of the Contract Sum will be required of the successful Bidder.

1.8 Obligation:

A. The Owner reserves the right to reject any or all Proposals and waive technicalities.

B. No Bidder may withdraw his Bid for a period of thirty (30) days after time set for receiving Bids.

END OF SECTION 00 21 13

SECTION 00 22 00 — GENERAL AND SUPPLEMENTARY CONDITIONS

PART 1 — GENERAL

1.1 General Conditions: "The General Conditions of the Contract for Construction", American Institute of Architects Document A201-2017, including Articles 1-15 inclusive and pages 1-38 inclusive, is hereby made a part of the Contract Documents with the same force and effect as though set forth in full. This Document is on file in the Architect's office for the Contractor's review.

1.2 Supplementary Conditions: The following supplements modify, change, delete from or add to the "General Conditions of the Contract for Construction", AIA Document A201-2017. Where any Article of the General Conditions is modified or any Paragraph, Subparagraph or Clause thereof is modified or deleted by these Supplementary Conditions, the unaltered Provisions of that Article, Paragraph, Subparagraph or Clause shall remain in effect.

ARTICLE 3: CONTRACTOR:

Add the following Subparagraph 3.8.4 to Paragraph 3.8:

3.8.4 Allowances: The Contractor shall include the following cash allowances in the Base Bid:

.1 Four Hundred and no/100 Dollars Per Thousand ($400.00/M) for Face Brick specified in Section 04 20 00 – Unit Masonry.

.2 Three Thousand and no/100 Dollars ($3,000.00) for Door Signs specified in Section 10 14 00 - Signage.

.3 Three Thousand and no/100 Dollars ($3,000.00) for Landscaping allowance as specified in Section 32 93 00 - Plants.

Add the following Subparagraph 3.15.3 to Paragraph 3.15:

3.15.3 In addition to general broom cleaning, the Contractor shall thoroughly clean all glass, remove stains, marks and dirt from painted and other decorated work; clean and polish all hardware; remove paint spots from all surfaces; clean all fixtures; wash all hard finish floors, and ensure that resilient tile floors have been cleaned and waxed in accordance with the Specifications.

ARTICLE 9: PAYMENTS AND COMPLETION:

Add the following Subparagraph 9.3.4 to Paragraph 9.3:

9.3.4 Until the Work is 50 percent complete, the Owner will pay ninety-five (95) percent of the amount due the Contractor on account of progress payments. At the time the Work is 50 percent complete and thereafter, if the manner of completion of Work and its progress are and remain satisfactory to the Architect, and in the

absence of other good and sufficient reasons, the Architect will (on presentation by the Contractor of Consent of Surety pay each Application) authorize any remaining partial payments to be paid in full.

.1 The full Contract retainage may be reinstated if the manner of completion of the Work and its progress do not remain satisfactory to the Architect (or if the Surety withholds its consent), or for other good and sufficient reasons.

.2 The Contractor shall submit application for payment no later than the last day of the month and applications received from the Architect by the Owner by the 5th day of the month will be paid by the 15th day of the month following application for payment.

Add the following Paragraph 9.11 to Article 9:

9.11 Liquidated Damages:

9.11.1 The Contractor and the Contractor's surety shall agree that from the compensation otherwise paid, the Owner may retain the sum of One Hundred Dollars ($100.00) for each day thereafter, Sundays and holidays included, that the Work remains incomplete, which sum is agreed upon as the proper measure of liquidated damages which the Owner will sustain per diem by the time stipulated and this sum is not to be construed as a penalty.

ARTICLE 11: INSURANCE:

Add the following Clause 11.1.2.1 to Subparagraph 11.1.2:

11.1.2.1 The insurance required by Subparagraph 11.1.1 shall be written for not less than the following, or greater if required by law and the insurance shall be written by a company licensed to do business at the place of building:

.1 Workman's Compensation and Employer's Liability:

a. Workers' Compensation coverage shall be provided in accordance with the statutory coverage required in Alabama. A group insurer must submit a certificate of authority from the Alabama Department of Industrial Relations approving the group insurance plan. A self-insurer must submit a certificate from the Alabama Department of Industrial Relations stating the Contractor qualifies to pay its own workers' compensation claims.

b. Employer’s Liability Insurance limits shall be at least:

1) Bodily Injury by Accident - $1,000,000 each accident

2) Bodily Injury by Disease - $1,000,000 each employee

.2 Commercial General Liability Insurance:

a. Commercial General Liability Insurance, written on an ISO Occurrence Form (current edition as of the date of Advertisement for Bids) or equivalent, shall include, but need not be limited to, coverage for bodily injury and property damage arising from premises and operations liability, products and completed operations liability, blasting and explosion, collapse of structures, underground damage, personal injury liability and contractual liability. The Commercial

General Liability Insurance shall provide at minimum the following limits:

1) General Aggregate: $2,000,000.00 per Project
2) Products, Completed Operations Aggregate: $2,000,000.00 per Project
3) Personal and Advertising Injury: $1,000,000.00 per Occurrence
4) Each Occurrence: $1,000,000.00

b. Additional Requirements for Commercial General Liability Insurance:
   1) The policy shall name the Owner, Architect, and their agents, consultants and employees as additional insureds, state that this coverage shall be primary insurance for the additional insureds; and contain no exclusions of the additional insureds relative to job accidents.
   2) The policy must include separate per project aggregate limits.

.3 Commercial Business Automobile Liability Insurance:
   a. Commercial Business Automobile Liability Insurance which shall include coverage for bodily injury and property damage arising from the operation of any owned, non-owned or hired automobile. The Commercial Business Automobile Liability Insurance Policy shall provide not less than $1,000,000 Combined Single Limits for each occurrence.
   b. The policy shall name the Owner, Architect, and their agents, consultants, and employees as additional insureds.

.4 Commercial Umbrella Liability Insurance:
   a. Commercial Umbrella Liability Insurance to provide excess coverage above the Commercial General Liability, Commercial Business Automobile Liability and the Workers' Compensation and Employers' Liability to satisfy the minimum limits set forth herein.
   b. Minimum <u>Combined</u> Primary Commercial General Liability and Commercial/Excess Umbrella Limits of:
      1) $ 5,000,000 per Occurrence
      2) $ 5,000,000 Aggregate
   c. Additional Requirements for Commercial Umbrella Liability Insurance:
      1) The policy shall name the Owner, Architect, and their agents, consultants, and employees as additional insureds.
      2) The policy must be on an "occurrence" basis.

Delete Subparagraph 11.4.1 in its entirety and substitute the following:

11.4.1 The Contractor shall purchase and maintain property insurance upon the entire Work at the site to the full insurable value thereof. Such insurance shall be in a company or companies against which the Owner has no reasonable objection. This insurance shall include the interests of the Owner, the Contractor, Sub-contractors and Sub-subcontractors in the Work and shall insure against the perils of fire and extended coverage and shall include "all risk" insurance of physical loss or damage including, without duplication of coverage, theft, vandalism and malicious mischief. If not covered under "all risk" insurance or otherwise provided in the Contract Documents, the Contractor shall effect and maintain similar property insurance on portions of the Work stored off the site or in transit when

such portions of the Work are to be included in an Application for Payment under Subparagraph 9.3.2.

END OF SECTION 00 22 00

SECTION 00 42 00 – PROPOSAL FORM

R. L. Consulting, Inc. Date:_____
Tuscumbia, Alabama
c/o Lambert Ezell Durham Architecture, LLC
P. O. Box 934
401 East College Street
Florence, Alabama 35631

Gentlemen:

We hereby submit our proposal for construction of "Office and Shop Building for R. L. Consulting, Inc., Tuscumbia, Alabama" in accordance with Drawings and Specifications prepared by Lambert Ezell Durham Architecture, LLC dated October 14, 2019.

Having carefully examined all Conditions and Specifications entitled "Office and Shop Building for R. L. Consulting, Inc., Tuscumbia, Alabama," dated October 14, 2019, including Addendum Numbers _____to_____inclusive, similarly entitled Contract Drawings numbered SD-1 through SD-2, LSP-1, A-1.1 through A-6.2, S-1.0 through S-3.2, P001 through P303, M001 through M502, and E-1 through E-9 inclusive dated October 14, 2019; and having visited site and examined all conditions affecting Work; Undersigned proposes to furnish all labor, materials, equipment and appliances necessary and required for entire Work of Base Contract for the following Stipulated Sum:

BASE BID:

_____ Dollars ($_____).

UNIT PRICES: Should the Undersigned be required to perform work over and above that required by Contract Documents, he will be paid extra, on basis of Unit Prices quoted herein, prices quoted being sum total compensation payable or creditable for such items of work.

1. Earth Excavation:
   - General.....$_____per cubic yard
   - In Trenches .....$_____per cubic yard

2. Earth Backfill and Compaction:
   - General.....$_____per cubic yard
   - In Trenches .....$_____per cubic yard

3. Extra Concrete (in place):.....$_____per cubic yard

4. General Rock Excavation and Disposal:.....$_____per cubic yard

5. Flowable Fill 500 p.s.i. Concrete (in place):..... $_____per cubic yard

6. Bermuda Sod (in place): ..... $_____per square yard

7. Bermuda Seed (in place): ..... $_____per pound

COMPLETION TIME: If Undersigned be notified of proposal acceptance within thirty (30) days after above date, he agrees to execute Contract for Work, for which Contract shall be the AIA "Standard Form of Agreement", A101-2007, Supplemented by AIA Document A201-2007, "General Conditions for the Contract for Construction," both as modified and completed by the Owner. If awarded Contract, Undersigned agrees to full completion of the work within _____ consecutive calendar days. It is understood that all periods of time stated above extend from the date of receipt of Notice to Proceed with days to be added for time lost to construction due to strikes, legal holidays, or rainy days and/or inclement weather where one-half (1/2) day or more is lost.

The Undersigned further agrees that from the compensation otherwise to be paid, the Owner may retain the six percent per annum for the total Contract Sum for each day thereafter, Sundays, and holidays included, that the Work remains incomplete, which sum is agreed upon as the proper measure of liquidated damages which the Owner will sustain per diem by the time stipulated, and this sum is not to be construed as a penalty.

BONDS: Undersigned agrees, if awarded Contract, to furnish and deliver to Architect, within fifteen (15) days after signing of Contract, satisfactory Performance Bond and Payment Bond in form currently issued by the American Institute of Architects, in amount equal to 100% of Contract Sum.

_____
(Business Name)

By: _____

_____
(Business Address)

END OF SECTION 00 42 00

SECTION 01 21 00 — ALLOWANCES

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Summary:

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

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

B. Types of allowances include the following:

1. Lump-sum allowances.
2. Unit-cost allowances.
3. Contingency allowances.

C. Related Sections include the following:

1. Division 1 Section "Unit Prices" for procedures for using unit prices.
2. Division 1 Section "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.
3. Divisions 2 through 31 Sections for items of Work covered by allowances.

1.3 Selection and Purchase:

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

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

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

1.4 Submittals:

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

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

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 Coordination:

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 Lump-Sum and Unit-Cost Allowances:

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner under allowance and shall include taxes, freight, and delivery to Project site.
B. Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.7 Contingency Allowances:
A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.
B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.
C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.
D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.8 Unused Materials:
A. Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
1. If requested by Architect, prepare unused material for storage by Owner when it is not economically practical to return the material for credit. If directed by Architect, deliver unused material to Owner's storage space. Otherwise, disposal of unused material is Contractor's responsibility.

PART 2 — PRODUCTS (Not Used)

PART 3 — EXECUTION

3.1 Examination:
A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 Preparation:
A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 Schedule of Allowances:
A. Allowance No. 1: Include in the Base Bid an Allowance of Four Hundred and no/100 Dollars per Thousand ($400.00/M) for Face Brick specified in Section 04 20 00 – Unit Masonry.
B. Allowance No. 2: Include in the Base Bid an Allowance of Three Thousand and no/100 Dollars ($3,000.00) for Door Signage specified in Section 10 14 00 – Signage.
C. Allowance No. 3: Include in the Base Bid an Allowance of Three Thousand and no/100 Dollars ($3,000.00) for Plant Materials. This amount shall include purchase and

installation of plants selected by the Architect and installed in accordance with Specification Section 32 93 00 – Plants.
Note: Sod and seed grass materials specified in Section 32 93 00 – Plants and noted on the Drawings shall not be considered part of this allowance.

END OF SECTION 01 21 00

SECTION 01 31 19 — PROJECT MEETINGS

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:

A. This Section specifies administrative and procedural requirements for project meetings, including, but not limited to, the following:
   1. Preconstruction conferences.
   2. Preinstallation conferences.
   3. Progress meetings.

1.3 Preconstruction Conference:

A. Schedule a preconstruction conference before starting construction, at a time convenient to the Owner and the Architect, but no later than 15 days after execution of the Agreement. Hold the conference at the Project Site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

B. Attendees: Authorized representatives of the Owner, Architect, and their consultants; the Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

C. Agenda: Discuss items of significance that could affect progress, including the following:
   1. Tentative construction schedule.
   2. Critical work sequencing.
   3. Designation of responsible personnel.
   4. Procedures for processing field decisions and Change Orders.
   5. Distribution of Contract Documents.
   6. Submittal of Shop Drawings, Product Data and Samples.
   7. Preparation of record documents.
   8. Use of the premises.
   9. Parking availability.
   10. Office, work and storage areas.
   11. Equipment deliveries and priorities.
   12. Safety procedures.
   13. First aid.
   14. Security.
   15. Housekeeping.
   16. Working hours.

1.4 Preinstallation Conferences:

A. Conduct a preinstallation conference at the Project Site before each construction activity that requires coordination with other construction.

B. Attendees: The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Architect of scheduled meeting dates.
C. Review the progress of other construction activities and preparations for the particular activity under consideration at each preinstallation conference, including requirements for the following:
   1. Contract Documents.
   2. Options.
   3. Related Change Orders.
   4. Purchases.
   5. Deliveries.
   6. Shop Drawings, Product Data and quality-control samples.
   7. Review of mockups.
   8. Possible conflicts.
   9. Compatibility problems.
   10. Time schedules.
   11. Weather limitations.
   12. Manufacturer's recommendations.
   13. Warranty requirements.
   14. Compatibility of materials.
   15. Acceptability of substrates.
   16. Temporary facilities.
   17. Space and access limitations.
   18. Governing regulations.
   19. Safety.
   20. Inspecting and testing requirements.
   21. Required performance results.
   22. Recording requirements.
   23. Protection.
D. Record significant discussions and agreements and disagreements of each conference, and the approved schedule. Promptly distribute the record of the meeting to everyone concerned, including the Owner and Architect.
E. Do not proceed with the installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.5 Progress Meetings:
A. Conduct progress meetings at the Project Site on a monthly basis. Notify the Owner and the Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.
B. Attendees: In addition to representatives of the Owner and Architect, each subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the status of the Project.

1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to insure that current and subsequent activities will be completed within the Contract Time.
2. Review the present and future needs of each entity present, including the following:
   a) Interface requirements.
   b) Time.
   c) Sequences.
   d) Status of submittals.
   e) Deliveries.
   f) Off-site fabrication problems.
   g) Access.
   h) Site utilization.
   i) Temporary facilities and services.
   j) Hours of work.
   k) Hazards and risks.
   l) Housekeeping.
   m) Quality and work standards.
   n) Change Orders.
   o) Documentation of information for payment requests.

D. Reporting: No later than 3 days after each meeting, distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
   1. Schedule Updating: Revise the Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

PART 2 — PRODUCTS (Not Applicable)

PART 3 — EXECUTION (Not Applicable)

END OF SECTION 01 31 19

SECTION 01 33 00 — SUBMITTAL PROCEDURES

PART 1 — GENERAL

1.1 General: The provisions of this section apply to required submittals, related to units of work, not to administrative submittals including payment requests, insurance certificates and progress reports. In addition to specific provisions of General and Supplementary Conditions related to submittals, specification sections of Divisions 2 through 16 contain submittal requirements. Specific requirements in other sections have precedence over general requirements of this section.

1.2 Procedural Requirements:

A. General: Coordinate submittals with progress schedule and actual progress of the work; allow 2 weeks for Architect's/Engineer's initial processing of submittals requiring review and return. Use special transmittal form to establish complete record of submittals. Provide copies required by governing authorities that are in addition to copies specified for submittal to Architect/Engineer.

B. Copies of Shop Drawings: Submit one (1) electronic and one (1) full size hard copy for approval; submit one (1) additional full size hard copy when consultant approval is also required. One (1) electronic copy will be returned. After approval, distribute number required for job use and distribution.

C. Copies of Product Data: Mark each copy to indicate actual product to be provided; show selections from among options in manufacturer's printed product data. Except as otherwise indicated, submittal is for information and record (not for Architect's/Engineer's approval). Submit one (1) electronic and one (1) full size hard copy to Architect for review; submit one additional (1) hard copy when consultant review is also required.

D. Samples: Submit samples to Architect for approval accompanied by letter of transmittal from Contractor which includes a list of samples, name of project, Contractor, manufacturer, and brand. Sample submittals are for Architect's/Engineer's observation of color, texture, pattern and "kind" as applicable.

E. All shop drawings and product data submittals shall have been checked, signed and dated by the Contractor prior to submittal to the Architect for approval. Submittals received without Contractor's approval will be returned to the Contractor for resubmittal.

PART 2 — PRODUCTS (Not Applicable)

PART 3 — EXECUTION (Not Applicable)

END OF SECTION 01 33 00

SECTION 01 50 00 — TEMPORARY FACILITIES AND CONTROLS

PART 1 — GENERAL

1.1 Field Office: Provide and maintain for the duration of the Contract a suitable temporary, weathertight field office at the site for use of the Architect, Contractor and subcontractors.

1.2 Telephone: Provide and maintain for the duration of the Contract a cellular telephone for the Superintendent's use.

1.3 Sanitary Facilities:
- A. Provide and maintain on the site for the duration of the Contract temporary toilet facilities for use of all personnel.
- B. Toilets shall be maintained in a sanitary condition and shall comply with all applicable codes and Health Department requirements.

1.4 Temporary Fencing, Barricades, Scaffolds, and Safety Devices:
- A. Provide, erect and maintain all fencing, barricades, scaffolding, staging, platforms, runways, temporary flooring, guards, railing, temporary stairs, lanterns, and safety devices, etc., as required by local, state, and federal codes or laws for the protection of workmen or the public.
- B. The construction, inspection and maintenance of the above items shall comply with all safety codes and regulations applicable to the Project.

1.5 Temporary Light and Power:
- A. Make necessary arrangements and pay all fees with utility companies required to provide all temporary light and power for the entire construction period.
- B. Each Contractor shall provide his own wiring, lighting, outlets, etc., as required to extend from the point of service to his work.
- C. The permanent installation may be used for temporary work as it becomes available.

1.6 Temporary Water Supply:
- A. Make necessary arrangements and pay all fees with utility companies as required to provide temporary water for the entire construction period. Water meter shall be of size indicated on the Drawings. If not indicated, contact Architect for meter size and location prior to installation by utility company.
- B. The Contractor shall provide any and all hose required to extend from the point of service to his work.

1.7 Cold Weather Protection and Temporary Heat:
- A. Provide for all cold weather protection, temporary heat and fuel as necessary to carry on the work expeditiously during inclement weather, to dry out the building and to provide suitable working conditions for the installation and curing of materials until final acceptance.
- B. The methods of heating and the type of fuel and equipment used are subject to the approval of the Architect.

C. After the building is completely closed, the permanent heating system may be used. The Contractor shall be responsible for use of the permanent heating system. Such use shall not relieve the Contractor of his responsibility to turn over the system to the Owner in perfect condition on completion of the Project.

1.8 Removal: Remove all temporary facilities from the premises at the completion of the Contract.

PART 2 — PRODUCTS (Not Applicable)

PART 3 — EXECUTION (Not Applicable)

END OF SECTION 01 50 00

SECTION 01 57 13 — EROSION CONTROL

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:

A. This work consists of furnishing all materials, equipment, supervision, and labor necessary to provide erosion control measures as shown or reasonably implied in the drawings.

B. It is the responsibility of this contractor to maintain all erosion control measures until project is completed.

C. Erosion Control:

1. The contractor shall install and maintain erosion control devices in general conformance to the BMP Erosion Control Plan. The Erosion Control Plan is provided to indicate minimum erosion control measures required of the Contractor and does not take into account the Contractor's sequence of construction. Additional erosion control measures shall be undertaken by the Contractor as required to minimize impacts to adjacent properties and the drainage system downstream of the site, at no additional cost.
2. The temporary silt fence shall consist of woven wire fence attached to posts with geotextile fabric attached to the upper grade side of the fence. The geotextile fabric shall be anchored to the soil.
3. Riprap for miscellaneous erosion control measure, such as energy dissipation at pipe outlets and stone check dams, shall be dumped or hand placed, in locations indicated on the plans or as directed by the Engineer. Filter fabric for riprap shall be considered incidental to the installation of the riprap.
4. Seeding for erosion control shall be placed on ditch slopes, pond slopes and other areas, as directed by the Engineer.
5. Erosion control structures shall be maintained in satisfactory condition until an approved cover of grass is established to prevent erosion, for the duration of the project, or until removal is approved, whichever occurs first.
6. Silt shall be removed from erosion control devices periodically during the construction as to maintain the erosion control capabilities of the devices. Removal of silt shall be considered incidental to the erosion control measures. Below ground sediment traps (100-2000 square feet 1'-3' deep) may be required as part of the erosion control plan. No separate payment will be made for these in that they shall be considered incidentals to the earthwork operations.
7. The Contractor shall provide erosion control measures necessary to satisfy the governing jurisdiction agencies.
8. The Contractor shall be listed as responsible entity for installing and maintaining all necessary erosion control measures on the "Storm Water Pollution Prevention Plan," SWPPP. The Owner will be the responsible for obtaining any required permits and paying all applicable fees.

9. Any fines or penalties resulting from the discharge of sediment to water of the State, or inadequate erosion control shall be paid for the Contractor. This applies to actions taken by local authorities, State agencies and Federal Agencies, and includes action taken against the Owner or Contractor.

PART 2 — PRODUCTS

2.1 Manufacturer: Subject to compliance with requirements, provide doors of one of the following:

2.2 Temporary Coarse Aggregate:

A. Temporary coarse aggregate shall be either stone or concrete from the demolition of structures.
B. Stone aggregate for stabilized construction entrances shall meet the requirements for ALDOT #2 coarse aggregate.
C. Concrete from the demolition of structures used as temporary coarse aggregate shall meet the gradation requirements for ALDOT #2 coarse aggregate.
D. Reinforcing steel shall be removed from the concrete used for temporary coarse aggregate.
E. Stone aggregate for other erosion and sediment control purposes shall be the size shown on the plans.

2.3 Temporary Riprap:

A. Unless shown otherwise on the plans, temporary riprap shall be either stone or concrete from the demolition of structures.
B. Stone riprap shall meet the requirements for ALDOT Class 1 riprap.
C. Concrete from the demolition of structures shall meet the size and weight requirements given for ALDOT Class 1 riprap.
D. Reinforcing steel shall be cut flush with the surfaces of the demolished concrete.

2.4 Geotextile Fabric:

A. Geotextiles fabric for slope and swale protection shall be a woven fabric, inert to commonly encountered chemicals, hydrocarbons, mildew and rot resistant, resistant to ultraviolet light exposure, insect and rodent resistant.
B. The geotextile shall consist of long chain polymeric fibers or filaments composed of polypropylene, polyamide, and shall be chemically compatible with the expected environment.
C. The geotextile shall be free of any treatment or coating which reduces permeability and shall be inert of chemicals commonly found in the soil.
D. The geotextile shall be uniformly rolled onto a cardboard core, and shall be wrapped in plastic to protect the material from moisture and damage during shipment.
E. The protective wrapping shall be left on the geotextile until installation.
F. The rolls of geotextile shall be externally tagged for easy field identification.

2.5 Wattles:

A. Wattles shall be a tubular shaped product specifically manufactured for erosion and sediment control.
B. Biodegradable wattles shall be manufactured using interwoven biodegradable plant material such as straw, coir, or wood shavings in biodegradable or photodegradable

netting that is of sufficient strength to resist damage during handling, installation and use.

C. Wattles manufactured using non-biodegradable materials shall be completely removed from the project when no longer required or useful.
D. Disposal shall be in accordance with recommendations from the wattle manufacturer.
E. The required minimum diameter of the wattle shall be determined based upon its intended application and shall be as follows unless shown otherwise on the plans.
    1. When installed for the purposes of slowing sheet flow or by interrupting the lengths of longer slopes (slopes longer than 50 feet (15 m)), the minimum diameter of the wattle shall be 9 inches {230 mm}.
    2. For all other applications including perimeter sediment barriers the minimum diameter of the wattle shall be 20 inches (500 mm).
    3. Wattles of smaller than required diameter may be provided as a stacked installation in accordance with manufacturer recommendations for stacking if the total height of the installation is at least 20 inches (500 mm).
    4. The diameter or height will be verified by measuring the wattle after installation.

2.6 Hay Bales: Bales may be either hay or straw containing 5 cubic feet of material and having a weight of not less than 35 pounds with a minimum length of 3 feet.

2.7 Sand Bags:
A. Bags may be cotton, burlap, woven polypropylene, polyethylene, polyamide fabric or other material that will adequately confine the aggregate content for the duration of the use of the bag.
B. Bags shall be filled with sand, limestone screenings or aggregate that is smaller than ALDOT #78.
C. Fill material shall be selected by the Contractor based on the required bag application.
D. Each filled bag shall have minimum dimensions of 18” x 12” x 3” and shall have a minimum weight of 30 pounds.

2.8 Manufactured Inlet Protection Device:
A. Manufactured Inlet Protection Devices shall be provided in accordance with requirements shown on the plans.
B. Manufactured inlet protection devices shall consist of filter fabric held in place by a rigid frame. The frame shall be strong enough to support the stormwater flow and weight of any sediment that accumulates on the filter.
C. The manufactured inlet protection device shall have an overflow feature to allow the passage of water during high flow conditions.
D. The filter fabric shall have the following properties:
    1. Minimum Tensile Strength (Machine Direction) of 80 pounds (ASTM D 4632)
    2. Minimum Permittivity of 0.05 sec-1 (ASTM D 4491)
    3. Maximum Apparent Opening Size of US Std #30 sieve (ASTM D 4751)
    4. Minimum UV Stability of 70% (ASTM D 4355 at 500 hours).

2.9 Any manufacturer offering products complying with the requirements of this section.

PART 3 — EXECUTION

3.1 Construction Schedule:

A. A construction schedule shall be an integral part of the plan. It shall establish a sequence of construction operations which will facilitate the control of erosion. Among the factors to be considered are:
   1. Limiting initiation of work to minimum area necessary to execute work, leaving soil cover on other areas undisturbed.
   2. Completing work on individual areas as quickly as possible to permit installation of planned temporary and permanent erosion control measures.
   3. Whenever land-disturbing activity is undertaken, a ground cover sufficient to restrain erosion must be planted or otherwise provided within 30 working days on that portion of the tract upon which further active construction is not being undertaken.

3.2 Temporary Soil Erosion Measures:
   A. Site grading operation of preparation shall not commence until immediate and temporary soil erosion measures are installed. These temporary measures shall be as indicated on the plans of as required by the local authorities.

END OF SECTION 01 57 13

SECTION 01 60 00 — PRODUCT REQUIREMENTS

PART 1 — GENERAL

1.1 General Limitations: Where possible, provide entire required quantity of each generic product, material or equipment from a single source; and, where not possible to do so, match separate procurements as closely as possible. To the extent the selection process is under Contractor's control, provide compatible products, material and equipment. Where available and complying with requirements, provide standard products which have been used previously and successfully in similar applications, and which are recommended by manufacturers for applications indicated.

1.2 Product Selection Limitation:

A. Where single products or two or more products are named, it shall be understood as descriptive of a type or style of material required; other brands or makes of equal quality and utility may be bid on, subject to Architect's written approval issued five (5) days or more before date of bid opening.

B. The phrase "or equal" referred to throughout these Specifications shall mean that written approval of such materials must be obtained from the Architect. Manufacturers desiring to submit bid for an "equal" must submit full data covering the product to the Architect in ample time to be evaluated and a written approval issued by the Architect no later than five (5) days prior to date of bid opening.

C. Compliance with Standards: Selection of product that complies with requirements, including applicable standards, is Contractor's option where no product names are indicated.

D. Performance Requirements: Selection of product that has been tested to show compliance with requirements, including indicated performances, is Contractor's option where no product names are indicated.

E. Prescriptive Requirements: Selection of product that has been certified by manufacturer to comply with requirements, including indicated performances, is Contractor's option where no product names are indicated.

PART 2 — PRODUCTS (Not Applicable)

PART 3 — EXECUTION (Not Applicable)

END OF SECTION 01 60 00

SECTION 01 70 00 — EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 — GENERAL

1.1 Upon completion of the Project, the Contractor will be required to furnish the following items to the Architect before approval of final payment will be made:

A. Contractor's one-year warranty on all materials, equipment and workmanship, as provided for in the General Conditions.

B. One-year warranties on all materials, equipment and workmanship from plumbing, heating/air conditioning, and electrical subcontractors, where required by the Specifications.

C. Five-year Roofing Guarantee from the General Contractor as required for work specified in Section 13 34 21 – Metal Building Systems of the Specifications. In addition, provide 20-year finish warranty from the metal building system manufacturer.

D. Operating and maintenance instructions for all mechanical and electrical equipment, or any other item requiring maintenance at the building. Furnish at one time in neatly bound form.

E. Evidence that all indebtedness has been paid to subcontractors and material suppliers. (Affidavits from each if requested by Architect).

F. Two (2) sets of Record Drawings and Specifications. These shall be prepared on sets in good condition, from a record set that has been kept in the field office throughout the construction period, and that has been recorded on it all deviations from the construction indicated by Contract Drawings and Specifications, at the time the change is completed.

PART 2 — PRODUCTS (Not Applicable)

PART 3 — EXECUTION (Not Applicable)

END OF SECTION 01 70 00

SECTION 01 78 23 — OPERATION AND MAINTENANCE DATA

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Summary:

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following.
   1. Operation and maintenance documentation directory.
   2. Emergency manuals.
   3. Operation manuals for systems, subsystems, and equipment.
   4. Product maintenance manuals.
   5. Systems and equipment maintenance manuals.

B. Related Requirements:
   1. Section 01 33 00 - Submittal Procedures for submitting copies of submittals for operation and maintenance manuals.
   2. Section 01 91 13 General Commissioning Requirements for verification and compilation of data into operation and maintenance manuals.

1.3 Definitions:

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 Closeout Submittals:

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect and Commissioning Authority will comment on whether content of operations and maintenance submittals are acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:
   1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
      a) Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
      b) Enable inserted reviewer comments on draft submittals.
   2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.

PART 2 — PRODUCTS

2.1 Operation and Maintenance Documentation Directory:

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
   1. List of documents.
   2. List of systems.
   3. List of equipment.
   4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems".

2.2 Requirements for Emergency, Operation, and Maintenance Manuals:

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
   1. Title page.
   2. Table of contents.
   3. Manual contents.

B. Title Page: Include the following information:
   1. Subject matter included in manual.
   2. Name and address of Project.
   3. Name and address of Owner.
   4. Date of submittal.
   5. Name and contact information for Contractor.
   6. Name and contact information for Architect.
   7. Name and contact information for Commissioning Authority.
   8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
   9. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
   1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble

instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
   1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
   2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
   1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
      a) If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
      b) Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
   2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
   3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
   4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
   5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
      a) If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
      b) If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 Emergency Manuals:

A. Content: Organize manual into a separate section for each of the following:
   1. Type of emergency.
   2. Emergency instructions.
   3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
   1. Fire.
   2. Flood.
   3. Gas leak.
   4. Water leak.
   5. Power failure.
   6. Water outage.
   7. System, subsystem, or equipment failure.
   8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:
   1. Instructions on stopping.
   2. Shutdown instructions for each type of emergency.
   3. Operating instructions for conditions outside normal operating limits.
   4. Required sequences for electric or electronic systems.
   5. Special operating instructions and procedures.

2.4 Operation Manuals:

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
   1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
   2. Performance and design criteria if Contractor has delegated design responsibility.
   3. Operating standards.
   4. Operating procedures.
   5. Operating logs.
   6. Wiring diagrams.
   7. Control diagrams.
   8. Piped system diagrams.
   9. Precautions against improper use.
   10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
   1. Product name and model number. Use designations for products indicated on Contract Documents.
   2. Manufacturer's name.
   3. Equipment identification with serial number of each component.
   4. Equipment function.
   5. Operating characteristics.
   6. Limiting conditions.
   7. Performance curves.
   8. Engineering data and tests.
   9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
   1. Startup procedures.
   2. Equipment or system break-in procedures.
   3. Routine and normal operating instructions.

4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 Product Maintenance Manuals:

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

2.6 Systems and Equipment Maintenance Manuals:

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturer's Maintenance Documentation: Manufacturer's maintenance documentation including the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
   1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 3 — EXECUTION

3.1 Manual Preparation:

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturer's Data: Where manuals contain manufacturer's standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
   1. Prepare supplementary text if manufacturer's standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturer's printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
   1. Do not use original project record documents as part of operation and maintenance manuals.
   2. Comply with requirements of newly prepared record Drawings in Section 01 78 39 "Project Record Documents."

G. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

SECTION 01 78 39 — PROJECT RECORD DOCUMENTS

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Summary:

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.

B. Related Sections include the following:
   1. Division 1 Section "Closeout Procedures" for general closeout procedures.
   2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   3. Divisions 2 through 33 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 Submittals:

A. Record Drawings:
   1. Submit one paper-copy set of marked-up record prints.
   2. Submit PDF electronic files of scanned record prints.

B. Record Specifications: Submit one paper copy and one set of annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one annotated PDF electronic file and directory of each submittal.
   1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy and one annotated PDF electronic files and directories of each submittal.

PART 2 — PRODUCTS

2.1 Record Drawings:

A. Record Prints: Maintain one set of black-line white prints of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
   1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record

data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
   a) Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b) Accurately record information in an understandable drawing technique.
   c) Record data as soon as possible after obtaining it.
   d) Record and check the markup before enclosing concealed installations.
   e) Cross-reference record prints to corresponding archive photographic documentation.
2. Content: Types of items requiring marking include, but are not limited to, the following:
   a) Dimensional changes to Drawings.
   b) Revisions to details shown on Drawings.
   c) Depths of foundations below first floor.
   d) Locations and depths of underground utilities.
   e) Revisions to routing of piping and conduits.
   f) Revisions to electrical circuitry.
   g) Actual equipment locations.
   h) Duct size and routing.
   i) Locations of concealed internal utilities.
   j) Changes made by Change Order or Construction Change Directive.
   k) Changes made following Architect's written orders.
   l) Details not on the original Contract Drawings.
   m) Field records for variable and concealed conditions.
   n) Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file with comment function enabled.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.
4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.

2.2 Record Specifications:

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders and Record Drawings where applicable.

B. Submit record Specifications as annotated PDF electronic file.

2.3 Record Product Data:

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

B. Format: Submit record Product Data as annotated PDF electronic file.

2.4 Miscellaneous Record Submittals:

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file(s) of marked-up miscellaneous record submittals.
1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 — EXECUTION

3.1 Recording and Maintenance:

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 01 78 39

SECTION 02 32 00 — GEOTECHNICAL INVESTIGATIONS

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:

A. Copies of subsurface investigation report prepared by OMI, Inc. is available in the Architect's office for Contractor's review, information and action as specified below.

B. Related Work Specified Elsewhere: Section 31 10 00 - Site Clearing and Section 31 20 00 – Earth Moving.

1.3 Subsurface investigation report dated September 25, 2019 contains observations of existing conditions encountered in drill holes taken on September 6, 2019, and recommendations concerning structural design considerations. Structural engineering has been based upon conclusions reached by OMI, Inc.

PART 2 — PRODUCTS (Not Applicable)

PART 3 — EXECUTION

3.1 Recommendations: Contractor is hereby directed to comply with all recommendations contained in report, specifically those found on pages 5 through 8.

END OF SECTION 02 32 00

OMI, Inc.

SUBSURFACE EXPLORATION AND
GEOTECHNICAL ENGINEERING STUDY
Proposed
R.L. Consulting Office and Shop
2083 Denton Road
Tuscumbia, Alabama

OMI Job No. 8844

September 25, 2019

5151 Research Drive, N.W., Suite A Huntsville, AL 35805 Tel: (256) 837-7664 Fax: (256) 837-7677 E-mail: omi@omi-eng.com

OMI, Inc.

September 25, 2019

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1902 Webster Street
Muscle Shoals, AL 35661

ATTN: Mr. Roy Lynch

SUBJECT: Report of Geotechnical Engineering Study
Proposed R.L. Consulting Office and Shop
2803 Denton Road
Tuscumbia, AL 35674
OMI Job No. 8844

Gentlemen:

OMI, Inc., has completed a subsurface exploration and geotechnical engineering study for the referenced project. Enclosed is the report of the findings as well as recommendations for foundation design and construction, site preparation, and other geotechnically related site activities. This work was authorized on August 22, 2019, by Mr. Roy Lynch of L & L Managed Properties, LLC.

OMI, Inc., appreciates the opportunity to be of service to Lambert Ezell Durham Architecture and looks forward to continued involvement with future projects. Please direct any questions concerning this report to the undersigned.

Respectfully submitted,

OMI, Inc.

Wes McKay, E.I.
Staff Engineer

ALABAMA LICENSED No. 31595 PROFESSIONAL ENGINEER JOHN W. CORBELL

John W. Corbell, P.E.
Senior Engineer

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1.0 EXECUTIVE SUMMARY

The site for the proposed office and shop will be sufficient to support the proposed structure on a typical shallow foundation system. Slightly lower than typical bearing pressures are recommended due to areas of weaker soils in the building area. Specific recommendations for foundation design and site earthwork are given in the body of this report.

2.0 INTRODUCTION

OMI, Inc., has completed a design geotechnical engineering study for the proposed office and shop. This report outlines the scope of services provided and presents comments and recommendations based on professional opinions formed during the course of this study. This work was authorized on August 22, 2019, by Mr. Roy Lynch of L & L Managed Properties. The work was performed in general accordance with OMI Proposal No. P-5650B.

Assessment of the environmental aspects of this site, including previous land use or the determination of the presence of any chemical, industrial, or hazardous waste is beyond the scope of this study. However, OMI can provide these services if desired.

3.0 EXPLORATION METHODS

The procedures used by OMI for field and laboratory testing are in general accordance with ASTM procedures and established engineering practice. Brief descriptions of the procedures used in this exploration are contained in the Appendix of this report.

Six building area soil test borings were drilled during this study. Four of the borings were drilled to 15-ft while two were drilled to auger refusal. Borings were drilled using a track-mounted Diedrich D-50 using an automatic hammer (approximately 62 percent efficiency). Boring locations are

shown on the appended Boring Location Map. A member of the OMI professional staff directed the drilling and logged the soils in the field. Subsequently, each sample was sealed and transported to the office. Selected samples were tested to determine the natural moisture content and Atterberg limits of the soil. These tests assist in confirming the visual classifications as well as provide an index of certain engineering properties. The soil classifications, field testing data, and the results of the laboratory tests are provided on the Soil Boring Records in the Appendix of this report.

4.0 SITE CONDITIONS

The site for the proposed office and shop is located at 2083 Denton Road in Tuscumbia, Alabama. According to Google Earth, Denton Road splits into two separate roadways approximately 2,000-ft south of the intersection with Highway 59. The approximately 3.5-acre subject parcel is an open agricultural field located on the east side of the east Denton Road leg, roughly 200-ft south of the roadway split. A parcel with a single-story shop and front office is to the north while more fields are to the south. A gravel driveway separates the site from Big River Airpark to the east. Satellite imagery shows the subject land as a hayfield as recently as 2016. Currently the site is occupied by mowed field grasses and is relatively flat. Surface waters appear to drain to the east at shallow slopes of about one percent.

5.0 SUBSURFACE CONDITIONS

Subsurface conditions were slightly below average to average when compared to other sites in the Tuscumbia/Muscle Shoals area. Topsoil thicknesses ranged from 4-in to 12-in and averaged 6-in the borings.

Residual soils comprising of medium to highly plastic residual clays were encountered. Chert amounts and plasticity generally increased with depth. Moisture contents in these soils ranged from 14 to 39 percent and averaged 23 percent. An Atterberg limits test performed on the 1.5 to 3-ft

sample in Boring B-5 indicated a liquid limit of 57, a plastic limit of 23, and a plasticity index of 34. Automatic hammer SPT (Standard Penetration Test) values ranged from 7 to more than 100 bpf (blows per foot) and generally averaged 17 bpf. Pocket penetrometer values averaged 3.25 tsf (tons per square foot).

Groundwater was encountered at 27.5-ft below the ground surface in boring B-4 during drilling. No groundwater was encountered in any other borings. For safety reasons the borings were filled after drilling; therefore, extended water levels were not taken. Because of the geology of this region, the groundwater levels are generally a function of seasonal precipitation and locally heavy rainfall events. Consequently, the groundwater levels can and do fluctuate with time.

6.0 SITE GEOLOGY

Tuscumbia Limestone

Published geologic information indicates the proposed site is underlain by the Tuscumbia Limestone. The Tuscumbia Limestone formation is of Mississippian age (310 to 345 million years). In the vicinity of the site, the Tuscumbia limestone is composed of light gray to light brownish-gray, fine to coarse-grained, fossiliferous limestone containing chert lenses and nodules. Soils derived from the in-place weathering of the Tuscumbia Limestone are moderately red to reddish-orange clay with variable amounts of chert.

Sinkhole Activity

Sinkholes do typically occur in karst formations (such as limestone). However, surface observations and the subsurface exploration did not disclose evidence of sinkhole activity on this site. This exploration does not, nor was it intended to, address the possibility of future sinkhole development.

7.0 PROJECT INFORMATION

The proposed office and warehouse will be a 15,000 square foot, single-story structure. While no specific loads were given, OMI assumes the structure's front office will be typical light commercial construction with partition walls and a slab on grade. Wall loads are expected to be about 2 klf while floor loads are expected to be no more than 100 psf. The shop area is expected to be a steel-framed structure with light commercial/industrial loads. Column loads are not expected to exceed 100 kips while floor loads are expected to be no more than 100 psf. OMI also assumes that the finished floor of the building will be approximately at the existing grade.

8.0 BASIS FOR RECOMMENDATIONS

The following recommendations are based in part on the preceding project information. This study has utilized the subsurface data, historical information regarding the structural performance of similar structures, and past experience with similar geologic environments to develop professional opinions on which the recommendations are based. Because the structural elements of the design greatly influence the design recommendations, OMI must be provided the opportunity to review the following comments and recommendations in light of changes in building location, elevation, or structural loading.

Standard practice in geotechnical engineering is that all but a few special structures will tolerate 1-in of settlement. Therefore, 1-in is assumed acceptable. Unless otherwise stated, the recommendations in this report are intended to keep post-construction settlement to less than 1-in.

9.0 DESIGN RECOMMENDATIONS

9.1 Foundation Design

Provided the site is prepared in accordance with the recommendations contained in this text, the proposed structure may be supported by a conventional shallow foundation system bearing on the

in-place soils. Footings should be designed based on a maximum allowable bearing pressure of 2,000 psf for individual column footings and 1,500 psf for continuous footings. These pressures include a factor of safety of at least three against general shear failure. To allow for minor inconsistencies in the soil subgrade, individual and continuous footings should have minimum widths of 24-in and 18-in, respectively, regardless of loading. Perimeter footings, and those within unheated areas, should bear at least 2-ft below finished exterior grade to provide adequate confinement and protection against frost and movement due to moisture fluctuations. Interior footings should bear at least 1-ft below the soil subgrade. The ground surface around the building area should be graded to provide positive drainage away from the building.

9.2 Seismic Classification

OMI has reviewed the soils at the site with respect to the criteria for seismic classification. In accordance with Section 1615.1, Table 1615.1.1 of the 2003 International Building Code, OMI judges the soil to be Site Class D.

9.3 Floor Slabs

The slab thickness, reinforcing, and stone base thickness are all a function of the traffic weight, loading frequency, and the soil subgrade strength. A typically loaded light commercial floor slab, where the design floor loads are no more than 100 psf, should be placed on a 4-in thick layer of open-graded compacted gravel. The aggregate layer will distribute the floor load from the slab to the soil and provide protection against the migration of moisture upward through the floor slab. A vapor barrier may be placed beneath the floor slab stone to provide additional protection against moisture migration.

9.4 Fill Soils

Fill soils should be clayey soils free of organics, deleterious debris, or rocks larger than 3-in in diameter. The soil should have a plasticity index (PI) of less than 40 and a maximum dry density of at least 95 pcf as determined by the standard Proctor (ASTM D698). The fill should be compacted to at least 95 percent of the soil's standard Proctor maximum dry density, SPMDD. The top 1-ft beneath the building and pavement areas should be compacted to 100 percent SPMDD. The on-site soil interval appears to meet the guidelines set forth above.

9.5 Pavement Areas

Surface parking and entrance drive areas should be prepared in accordance with the general recommendations for stripping and fill placement stated elsewhere in this text, except the upper 1-ft must be compacted to at least 100 percent of the standard Proctor maximum dry density. Topsoil stripping depths may be reduced within flexible pavement areas to leave some slightly organic soil in place. Close monitoring will be required to achieve this cost savings. The pavement design provided below was based on a CBR of 4. Specific traffic frequency and loading information has not been provided; however, assuming that the paved areas can be broken into two categories with the listed frequencies and loading being acceptable, the following pavement sections may be used.

AUTOMOBILE PARKING - Maximum 1000 vehicles per day (VPD) consisting of automobile traffic and less than 5 percent medium (6 kips per axle) truck traffic. No heavy trucks.

TRUCK PARKING/DOCKS - Maximum 3000 VPD including not more than 2 heavy trucks per day.

FLEXIBLE PAVEMENT DESIGN

PAVEMENT MATERIAL	AUTOMOBILE	TRUCK
ASPHALT SURFACE COURSE (Hot Mix) ALDOT No. 424A, 1/2-in Max. Agg. Size, ESAL Range A/B	2.0 inches	1.5 inches
ASPHALT BINDER COURSE ALDOT No. 424B, ¾-in Max. Agg. Size, ESAL Range A/B	—	3.0 inches
STONE BASE COURSE ALDOT No. 825 B (Compacted to 100% Standard Proctor as per AASHTO T-99)	6.0 inches	6.0 inches
TOTAL THICKNESS	8.0 inches	10.5 inches

All pavement materials and construction methods should conform to the guidelines and requirements of the Alabama Department of Transportation. During placement of the aggregate

base and asphalt courses, density tests and thickness measurements should be performed to compare the design section to the constructed section. The soil subgrade should be graded to provide a smooth transition from one pavement section to another. It is imperative that truck traffic be limited to areas specifically designed to carry those vehicles.

Immediately prior to placement of the aggregate base, the subgrade must be proofrolled to judge the stability of the soil. The soil may require recompaction. The stone base course should only be applied to a stable, compact soil subgrade. Asphalt paving should proceed closely after stone placement. If lengthy delays between stone and asphalt paving occur, the stability of the stone and soil subgrade should be checked prior to paving.

Rigid pavement should be specified for areas that will be used for the storage of refuse bins and the operation of waste removal vehicles.

10.0 CONSTRUCTION CONSIDERATIONS

10.1 Site Preparation

To prepare the site for construction, the construction area should be stripped of trees, topsoil, large root zones, and other organic or soft soil. Stripping should extend at least 10-ft beyond the limits of construction cut and fill. Subsequently, the areas approximately at grade or to receive fill should be proofrolled in the presence of a geotechnical engineer. Proofrolling is performed by repeated passes of a heavy rubber-tired vehicle, such as a loaded dump truck. Any areas judged to deflect excessively during proofrolling should be undercut to a stable soil horizon. Such over-excavation must be backfilled with structural fill placed as described below. Upon reaching subgrade elevation in cut areas, the exposed soil subgrade should be similarly proofrolled and repaired.

10.2 Estimated Topsoil Removal

The depth of topsoil varies across the site. OMI believes that the stripping depth to remove the topsoil will average about 6-in. Close observation by OMI personnel during construction can allow

the disturbed but only slightly organic soils to be compacted in-place or to be used as engineered fill.

10.3 Fill Placement

After proofrolling is complete, placement of structural fill may begin, as necessary. Specific requirements of the soil properties are discussed previously. The soil should be placed in loose lifts, not exceeding 8-in in thickness, and systematically compacted to at least 95 percent of the soil's standard Proctor maximum dry density (ASTM D698) except the top 1-ft should be compacted to 100 percent SPMDD.

10.4 Density Testing

Field density testing should be performed on each lift prior to placement of additional lifts. Test locations should be evenly distributed throughout the fill area and should be performed at the frequencies shown on the following table.

AREA	METHOD OF PLACEMENT AND COMPACTION	INITIAL TEST FREQUENCY	RETEST FREQUENCY
General Site	Large self-propelled equipment	1 test per 5000-ft^2, minimum 3 tests per lift	1 test per failed test
Isolated Areas	Hand-guided equipment	1 test per lift	1 test per failed test
Trench backfill and behind retaining walls	Hand-guided equipment	1 test per 50 linear feet per 6-in of fill	1 test per failed test

Test frequencies may be increased during the early stages of earthwork construction. Compaction requirements should apply to all excavation/backfill operations conducted on the proposed development property.

10.5 Footing Observations

The footing excavation process generates a disturbed layer of soft soil in the excavation bottoms. This soft compressible layer should be removed prior to placement of concrete. Each foundation

excavation should be observed by a member of OMI's professional staff to check for local variations in the soil strength as well as the removal of the disturbed layer.

10.6 Foundation Construction

The soils at this site are moderately to highly plastic. Exposing the soils to excessive wetting or drying during construction can cause problems such as heaving or settlement due to shrinking and swelling of the clay. The foundations should be excavated, hand cleaned, checked, and concrete placed as expeditiously as possible. Footing excavations that will be left open for more than 8 hours should be covered for protection.

10.7 Construction Monitoring

The foundation and site preparation recommendations contained in this report are based on the conditions encountered during the subsurface exploration and past experience in this geologic setting. Because subsurface conditions may vary from the anticipated, it is important to have a well-rounded quality control program. Construction monitoring on a project of this nature can serve as an economical means to achieve the best possible foundation system and reduce the potential for future problems. The involvement in the subsurface exploration portion of this project uniquely qualifies OMI, Inc., to provide these services as a party responsible to the Owner. OMI, Inc., strongly recommends that all construction monitoring be performed under contract with the Owner or the Owner's representative.

APPENDICES

OMI, Inc.

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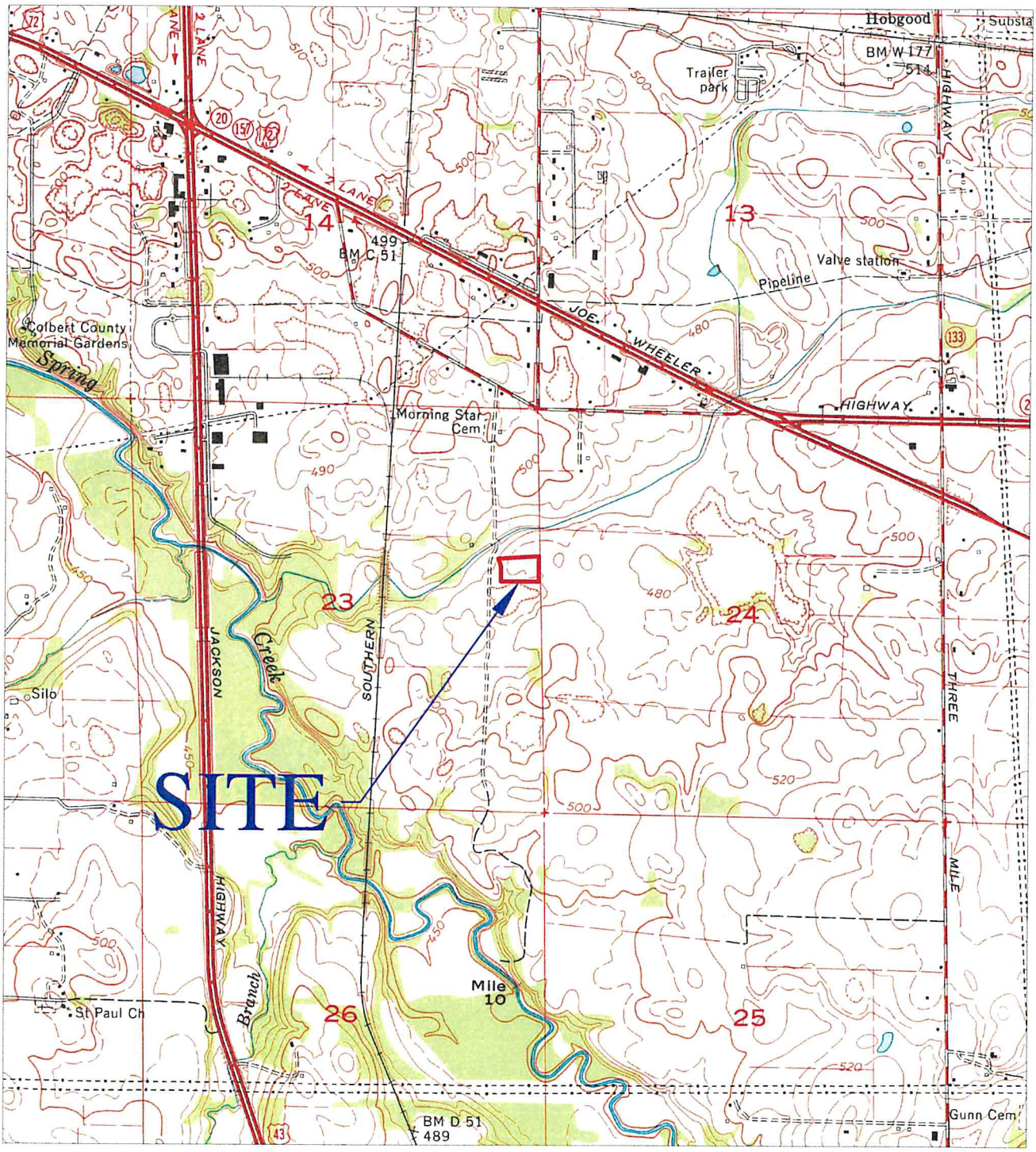
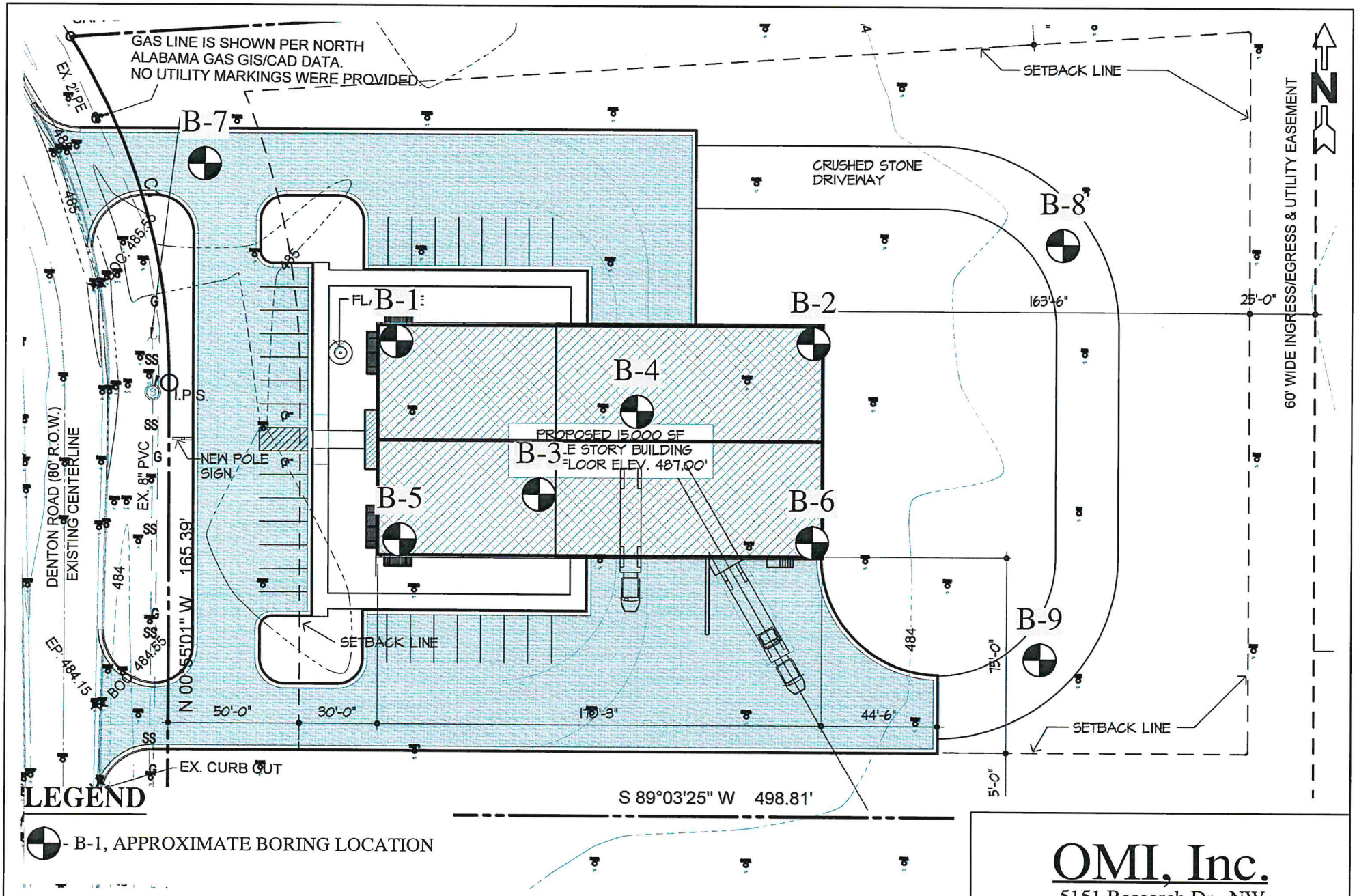


TUSCUMBIA QUAD
7.5 MINUTE SERIES
TOPOGRAPHIC
1971 REVISED 1972

JOB NAME: R.L. CONSULTING OFFICE & SHOP DENTON ROAD TUSCUMBIA, ALABAMA	SITE LOCATION MAP DRAWING NO: 8844 - 1	JOB N0: 8844 DATE: 09-25-2019 SCALE: 1"= 2000' DRAWN BY: DAH



JOB NAME:
R.L. CONSULTING OFFICE & SHOP
DENTON ROAD
TUSCUMBIA, ALABAMA

BORING LOCATION MAP

DRAWING NO: 8844 - 1

JOB N0: 8844
DATE: 09-25-2019
SCALE: 1" = 50'
DRAWN BY: DAH

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Soil Boring Record

JOB NO.: 8844 JOB: R.L. Consulting Office and Shop LOG OF BORING: B-1

Driller: South Bros. Drill Model: Diedrich D-50 Hammer Type: Auto Hammer Efficiency: 62%

Logged By: MWMcKay Boring Location:

City: Tuscumbia County: Colbert State: Alabama

DEPTH, FT	ELEVATION	SAMPLES	GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0				TOPSOIL	13	19	3.25						
				SANDY SILTY CLAY, 15% fine sand, 85% fines, trace oxides and chert gravel, medium plasticity, orangish red, stiff to very stiff, moist, residuum, CH	15	23	3.0						
5					16	20	2.75						
				SANDY GRAVELLY CLAY, 20% chert gravel, 20% fine sand, 60% fines, high plasticity, orange and tan, very stiff to hard, moist, residuum, CH	24	18	4.0						
10					28	26	3.25						
15					50	23	3.25						
				BORING TERMINATED @ 15-ft									
20													
25													
30													
35													

COMPLETION DEPTH: 15 DEPTH TO INITIAL WATER: Dry

DATE: 9-6-19 DEPTH TO EXTENDED WATER: on

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Soil Boring Record

JOB NO.: 8844 JOB: R.L. Consulting Office and Shop LOG OF BORING: B-2

Driller: South Bros. Drill Model: Diedrich D-50 Hammer Type: Auto Hammer Efficiency: 62%

Logged By: MWMcKay Boring Location:

City: Tuscumbia County: Colbert State: Alabama

DEPTH, FT	ELEVATION	SAMPLES	GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0				TOPSOIL									
				SANDY SILTY CLAY, 15% fine sand, 85% fines, trace oxides and chert gravel, medium plasticity, orangish red, stiff to very stiff, moist, residuum, CH	9	21	3.25						
					9	21	2.5						
5					16	25	3.0						
				SANDY GRAVELLY CLAY, 20% chert gravel, 20% fine sand, 60% fines, high plasticity, orange and tan, very stiff to hard, moist, residuum, CH	39	25	1.75						
10					25	--	--						
				CLAYEY GRAVEL with dense lenses of chert, 30% chert gravel, 15% fine sand, 55% fines, high plasticity, tan, very stiff, moist, residuum, CH	25	24	--						
15				BORING TERMINATED @ 15-ft									
20													
25													
30													
35													

COMPLETION DEPTH: 15 DEPTH TO INITIAL WATER: Dry

DATE: 9-6-19 DEPTH TO EXTENDED WATER: on

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Soil Boring Record

JOB NO.: 8844 JOB: R.L. Consulting Office and Shop LOG OF BORING: B-3

Driller: South Bros. Drill Model: Diedrich D-50 Hammer Type: Auto Hammer Efficiency: 62%

Logged By: MWMcKay Boring Location:

City: Tuscumbia County: Colbert State: Alabama

DEPTH, FT	ELEVATION	SAMPLES	GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0				TOPSOIL									
				SANDY SILTY CLAY, 15% fine sand, 85% fines, trace oxides and chert gravel, medium plasticity, orangish red, stiff, moist, residuum, CH	9	17	2.5						
					12	24	2.25						
5					12	23	2.0						
				SANDY GRAVELLY CLAY, 20% chert gravel, 20% fine sand, 60% fines, high plasticity, orange and tan, very stiff, moist, residuum, CH	19	31	3.5						
10				CLAYEY GRAVEL with dense lenses of chert, 30% chert gravel, 15% fine sand, 55% fines, high plasticity, tan, very stiff, moist, residuum, CH	22	30	3.5						
					20	38	3.0						
15				BORING TERMINATED @ 15-ft									
20													
25													
30													
35													

COMPLETION DEPTH: 15 DEPTH TO INITIAL WATER: Dry

DATE: 9-6-19 DEPTH TO EXTENDED WATER: on

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Soil Boring Record

JOB NO.: 8844 JOB: R.L. Consulting Office and Shop LOG OF BORING: B-4

Driller: South Bros. Drill Model: Diedrich D-50 Hammer Type: Auto Hammer Efficiency: 62%

Logged By: MWMcKay Boring Location:

City: Tuscumbia County: Colbert State: Alabama

DEPTH, FT	ELEVATION	SAMPLES	GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0				TOPSOIL									
				SANDY SILTY CLAY, 15% fine sand, 85% fines, trace oxides and chert gravel, medium plasticity, orangish red, firm to stiff, moist, residuum, CH	11	14	4.25						
					8	24	2.25						
5					100+	20	3.0						
				SANDY GRAVELLY CLAY, 20% chert gravel, 20% fine sand, 60% fines, high plasticity, orange and tan, very stiff to hard, moist, residuum, CH	28	39	3.75						
10					21	24	3.5						
				SANDY GRAVELLY CLAY, 20% chert gravel, 20% fine sand, 60% fines, high plasticity, tan, firm to stiff, moist, residuum, CH	15	--	--						
15													
20					8	--	--						
				CLAYEY GRAVEL with dense lenses of chert, 30% chert gravel, 15% fine sand, 55% fines, high plasticity, tan, soft, moist, residuum, CH	1	15	--						
25													
				AUGER REFUSAL @ 28-ft									
30													
35													

COMPLETION DEPTH: 28 DEPTH TO INITIAL WATER: 27.5-ft

DATE: 9-6-19 DEPTH TO EXTENDED WATER: on

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Soil Boring Record

JOB NO.: 8844 JOB: R.L. Consulting Office and Shop LOG OF BORING: B-5

Driller: South Bros. Drill Model: Diedrich D-50 Hammer Type: Auto Hammer Efficiency: 62%

Logged By: MWMcKay Boring Location:

City: Tuscumbia County: Colbert State: Alabama

DEPTH, FT	ELEVATION	SAMPLES	GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0				TOPSOIL									
				SANDY SILTY CLAY, 15% fine sand, 85% fines, trace oxides and chert gravel, medium plasticity, orangish red, very stiff, moist, residuum, CH	16	17	2.75						
					16	24	3.5	57	23				
5					16	25	2.75						
				SANDY GRAVELLY CLAY, 20% chert gravel, 20% fine sand, 60% fines, high plasticity, orange and tan, very stiff, moist, residuum, CH	27	26	4.0						
10					21	38	--						
15				SANDY GRAVELLY CLAY, 20% chert gravel, 20% fine sand, 60% fines, high plasticity, tan, very stiff, moist, residuum, CH	20	15	3.0						
20				CLAYEY GRAVEL with dense lenses of chert, 30% chert gravel, 15% fine sand, 55% fines, high plasticity, tan, hard, moist, residuum, CH	100+	--	--						
				AUGER REFUSAL @ 20-ft									
25													
30													
35													

COMPLETION DEPTH: 20 DEPTH TO INITIAL WATER: Dry

DATE: 9-6-19 DEPTH TO EXTENDED WATER: on

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Soil Boring Record

JOB NO.: 8844 JOB: R.L. Consulting Office and Shop LOG OF BORING: B-6

Driller: South Bros. Drill Model: Diedrich D-50 Hammer Type: Auto Hammer Efficiency: 62%

Logged By: MWMcKay Boring Location:

City: Tuscumbia County: Colbert State: Alabama

DEPTH, FT	ELEVATION	SAMPLES	GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0				TOPSOIL	17	17	4.0						
				SANDY SILTY CLAY, 15% fine sand, 85% fines, trace oxides and chert gravel, medium plasticity, orangish red, firm to stiff, moist, residuum, CH	7	21	2.0						
5					8	23	1.75						
					10	21	2.25						
10					10	19	2.5						
				SANDY GRAVELLY CLAY, 20% chert gravel, 20% fine sand, 60% fines, high plasticity, orange and tan, very stiff, moist, residuum, CH	17	18	3.5						
15				BORING TERMINATED @ 15-ft									
20													
25													
30													
35													

COMPLETION DEPTH: 15 DEPTH TO INITIAL WATER: Dry

DATE: 9-6-19 DEPTH TO EXTENDED WATER: on

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Soil Boring Record

JOB NO.: 8844 JOB: R.L. Consulting Office and Shop LOG OF BORING: B-7

Driller: South Bros. Drill Model: Diedrich D-50 Hammer Type: Auto Hammer Efficiency: 62%

Logged By: MWMcKay Boring Location:

City: Tuscumbia County: Colbert State: Alabama

DEPTH, FT	ELEVATION	SAMPLES	GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0				TOPSOIL	29	14	4.5						
				SANDY SILTY CLAY, 15% fine sand, 85% fines, trace oxides and chert gravel, medium plasticity, orangish red, stiff to very stiff, moist, residuum, CH	13	20	3.0						
5					16	20	3.25						
				BORING TERMINATED @ 5-ft									
10													
15													
20													
25													
30													
35													

COMPLETION DEPTH: 5 DEPTH TO INITIAL WATER: Dry

DATE: 9-6-19 DEPTH TO EXTENDED WATER: on

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Soil Boring Record

JOB NO.: 8844 JOB: R.L. Consulting Office and Shop LOG OF BORING: B-8

Driller: South Bros. Drill Model: Diedrich D-50 Hammer Type: Auto Hammer Efficiency: 62%

Logged By: MWMcKay Boring Location:

City: Tuscumbia County: Colbert State: Alabama

DEPTH, FT	ELEVATION	SAMPLES	GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0				TOPSOIL	13	24	--						
				SANDY SILTY CLAY, 15% fine sand, 85% fines, trace oxides and chert gravel, medium plasticity, orangish red, stiff, moist, residuum, CH	10	24	2.75						
5					19	22	3.25						
				SANDY GRAVELLY CLAY, 20% chert gravel, 20% fine sand, 60% fines, high plasticity, orange and tan, very stiff, moist, residuum, CH									
				BORING TERMINATED @ 5-ft									
10													
15													
20													
25													
30													
35													

COMPLETION DEPTH: 5 DEPTH TO INITIAL WATER: Dry

DATE: 9-6-19 DEPTH TO EXTENDED WATER: on

OMI,Inc.

OMI, Inc.

5151 Research Drive, N.W., Suite A Huntsville, AL 35805

Soil Boring Record

JOB NO.: 8844 JOB: R.L. Consulting Office and Shop LOG OF BORING: B-9

Driller: South Bros. Drill Model: Diedrich D-50 Hammer Type: Auto Hammer Efficiency: 62%

Logged By: MWMcKay Boring Location:

City: Tuscumbia County: Colbert State: Alabama

DEPTH, FT	ELEVATION	SAMPLES	GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0				TOPSOIL	13	15	13						
				SANDY SILTY CLAY, 15% fine sand, 85% fines, trace oxides and chert gravel, medium plasticity, orangish red, firm to stiff, moist, residuum, CH	8	23	1.75						
5					9	19	3.0						
				BORING TERMINATED @ 5-ft									
10													
15													
20													
25													
30													
35													

COMPLETION DEPTH: 5 DEPTH TO INITIAL WATER: Dry

DATE: 9-6-19 DEPTH TO EXTENDED WATER: on

OMI,Inc.

BORING LEGEND

SOIL SYMBOLS

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAIN SOILS — MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVELS — 50% OR MORE OF COARSE FRACTION RETAINED ON #4 SIEVE	CLEAN GRAVELS	GW	WELL-GRADED GRAVELS AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			GP	POORLY GRADED GRAVELS AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS — MORE THAN 50% OF COARSE FRACTION PASSES #4 SIEVE	CLEAN SANDS	SW	WELL-GRADED SANDS AND GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY GRADED SANDS AND GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES	SM	SILTY SANDS, SAND-SILT MIXTURES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAIN SOILS — 50% OR MORE PASSES NO. 200 SIEVE	SILTS AND CLAYS — LIQUID LIMIT 50% OR LESS		ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS — LIQUID LIMIT GREATER THAN 50%		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDS OR SILTS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS			PT	PEAT, MUCK AND OTHER HIGHLY ORGANIC SOILS

ABBREVIATIONS:

SS- SPLIT SPOON SAMPLE

UD- UNDISTURBED SAMPLE

REC-SAMPLE RECOVERY

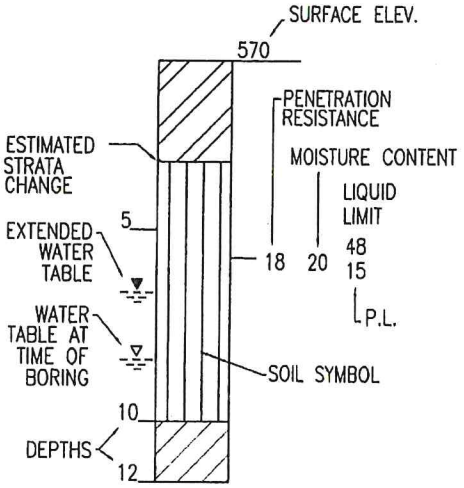
USC-VISUAL UNIFIED SOIL CLASSIFICATION

POCKET PENET- POCKET PENETROMETER READING, TSF

RQD-ROCK QUALITY DESIGNATION

FF- FRACTURE FREQUENCY PER FOOT OF CORE

KEY TO BORING RECORDS OR PROFILES



ROCK SYMBOLS

SANDSTONE

SHALE

GNEISS OR SCHIST

CONGLOMERATE

LIMESTONE OR DOLOMITE

OMI, INC.

5151 Research Drive
Huntsville, AL 35805

FIELD TEST PROCEDURES

OMI, Inc., generally follows field and laboratory testing procedures as outlined by the American Society for Testing and Materials (ASTM) and the U. S. Army Corps of Engineers. Field procedures are outlined and an overview description is provided in ASTM Standard D-420, "Standard Guide to Site Characterization for Engineering, Design, and Construction Purposes." This document is a guide to the selection of various standards for investigating soil, rock, and ground water for earth related construction. Applicable procedures include geophysical, in-situ, and boring methods. A summary of each procedure used during this study is presented below.

SOIL DRILLING PROCEDURES

Several techniques are used to advance borings for collection of soil, rock, or ground water samples. Different techniques are used, depending on the samples desired and the soil and water conditions. Depths for sample intervals, strata changes, and boring termination or refusal are recorded to the nearest 1/10 of a foot. The techniques include the following.

Soil Borings

A) Solid stem continuous flight augers (ASTM D-1452)

B) Hollow stem continuous flight augers (ASTM D-1452)

C) Rotary drilling techniques using roller cone bits or drag bits and water with or without drilling mud or other additives to flush the hole

D) Hand augers

E) Backhoes or other excavating equipment.

Rock Borings

A) Core borings with diamond bits with double or triple core barrels (ASTM D-2113)

B) Rock borings with roller cone bit

C) Rotary hammer drilling.

Hollow and Solid Stem Auger: An auger is a center post with a continuous spiral flange wrapped around it. The post is called the stem. Augers are usually constructed in 5-foot long sections that can be coupled together. As the auger is turned and advanced into the ground; the soil "cuttings" are brought to the surface. Solid stem augers have a solid core and have to be removed from the boring to allow access for sampling tools. Hollow stem augers have the spiral flange connected to a hollow tube (stem). Sampling tools can access the bottom of the boring without removing the augers from the hole.

Rotary Borings: Rotary drilling involves the use of roller cone or drag type drill bits attached to the end of hollow drill rods. A flushing medium, normally water or bentonite slurry, is pumped through the rods to clear the cuttings from the bit face and flush them to the surface. Casing is sometimes set behind the advancing bit to prevent the hole from collapsing and to restrict the penetration of the drilling fluid into the surrounding soils. Cuttings returned to the surface by the drilling fluid are usually collected in a settling tank to allow the fluid to be re-circulated.

Hand Auger Borings: Hand auger borings are advanced by manually twisting a 4-inch diameter steel bucket auger into the ground and withdrawing it when filled to observe the sample collected. Other equipment such as post-hole diggers is sometimes used in lieu of augers to obtain shallow soil samples. Occasionally, these hand auger borings are used for driving 3-inch diameter steel tubes to obtain intact soil samples.

Test Pits: A backhoe or other construction equipment is sometimes used to excavate into soils to observe the soil and collect samples.

Core Drilling: Soil drilling methods are not normally capable of penetrating through hard cemented soil, weathered rock, coarse gravel or boulders, thin rock seams, or sound continuous rock. Material which cannot be penetrated by auger or rotary soil drilling methods at a reasonable rate is designated as "refusal material." Core drilling procedures are required to penetrate and sample refusal materials.

Prior to coring, casing may be set in the drilled hole through the overburden soils to keep the hole from caving and to prevent excessive water loss. The refusal materials are then cored according to ASTM D-2113 using a diamond bit fastened to the end of a hollow, double, or triple tube core barrel. This device is rotated at high speeds and the cuttings are brought to the surface by circulating water. Core samples of the material penetrated are protected and retained in the swivel-mounted inner tube. Upon completion of each drill run, the core is brought to the surface, recovery is measured, and the core is sequentially placed in boxes and transported to our laboratory for review and storage.

SAMPLING AND TESTING IN BOREHOLES

Several techniques are used to obtain samples and data in soils; however, the most common methods in this area are:

A) Standard Penetration Testing
B) Undisturbed Sampling
C) Dynamic Cone Penetration Testing
D) Hand-Held Static Cone Penetrometer
E) Water Level Readings.

These procedures are presented below. Any additional testing techniques employed during this exploration are contained in other sections of the Appendix.

Standard Penetration Testing: At regular intervals, the drilling tools are removed and soil samples are obtained with a standard 2-inch diameter split tube or "split spoon" sampler connected to a drill rod. The sampler is first seated 6 inches to penetrate any loose cuttings then driven an additional 12 inches with blows of a 140 pound safety hammer falling 30 inches. Generally, the number of hammer blows required to drive the sampler the final 12 inches is designated the "penetration resistance" or "N" value, defined in blows per foot (bpf). The split spoon sampler is designed to retain the soil penetrated so it may be returned

to the surface for observation. Representative portions of the soil samples obtained from each split spoon sample are placed in jars, sealed, and transported to the laboratory.

The standard penetration test, when properly evaluated, provides an indication of the soil strength and compressibility. The tests are conducted according to ASTM Standard D-1586. The depths and N-values of standard penetration tests are shown on the Boring Records. Split spoon samples are suitable for visual observation and classification tests, but generally are not sufficiently intact for quantitative laboratory testing.

Undisturbed Sampling: Relatively undisturbed samples are obtained by pushing 3 inch outside diameter (OD), 30 inch long steel tubes with hydraulic pressure supplied by the drill rig into the soil at the desired sampling levels (ASTM Standard D-1587). These tubes are also known as Shelby tubes. Each tube, together with the encased soil, is removed from the ground, sealed, and transported to the laboratory. Locations and depths of undisturbed samples are shown on the Boring Records.

Dynamic Cone Penetrometer: The dynamic cone is a hand-operated penetrometer used in hand auger borings and observation pits. This test is intended to provide data that can be correlated to the standard penetration test. A 1.5-inch OD cone is seated to penetrate any loose cuttings, and then driven for 3 intervals of 1.75 inch with blows from a 15-pound weight falling 20 inches. The average number of blows required to drive the cone over 1 increment is an index to soil strength and compressibility.

Water Level Readings: Water table readings are normally taken in the borings and are recorded on the Boring Records. In sandy soils, these readings indicate the approximate location of the hydrostatic water table at the time of the field exploration. In clayey soils, the rate of water seepage into the borings is low and it is generally not possible to establish the location of the hydrostatic water table through short-term water level readings. Also, fluctuation in the water table should be expected with variations in precipitation, surface run-off, evaporation, and other factors. For long-term monitoring of water levels, it is necessary to install piezometers.

The water level reported on the Boring Records is determined by field crews immediately after the drilling tools are removed, and again several hours after the borings are completed, if possible. The time lag is

intended to permit stabilization of the ground water table which may have been disrupted by the drilling operation.

Occasionally, the borings will cave in, preventing water level readings from being obtained or trapping drilling water above the cave-in zone. The cave-in depth is measured and recorded on the Boring Records.

BORING RECORDS

The subsurface conditions encountered during drilling are reported on a Boring Record. The record contains information concerning the boring method, samples attempted and recovered, indications of the presence of coarse gravel, cobbles, etc., and observations of ground water. It also contains the driller's and the geotechnical engineer's interpretation of soil conditions between samples. Therefore, these boring records contain both factual and interpretative information. A geotechnical engineer visually classifies the soil samples and prepares the Boring Records which are the basis for all evaluations and recommendations.

ELECTRICAL RESISTIVITY

Electrical resistivity is a non-destructive, non-intrusive method of searching for the presence of sinkholes. The process includes driving a series of electrical probes into the ground at set spacings and along a line. Electrical current is then pushed between two probes and the resistivity of the soil is measured at intermediate probes. The depth of the area studies increases as the distance between the electrical probes increases. As soil materials change in consistency, which may be a result of mineralogy, moisture content, or density, the electrical resistivity or conductivity changes. Therefore, if a sinkhole is present near the resistivity profile, a change in resistivity will show up due to the changed conditions in the sinkhole. This methodology assists in looking for sinkholes in an area such as this.

OMI uses a multiple probe resistivity meter that allows 56 probes to be placed in the ground and attached to the machine at one time. A computer systematically switches between the probes sending current between two probes and measuring the resistivity between two additional probes. The computer switches through the combinations of probes to collect approximately 750 separate readings during each setup. Mathematical modeling techniques are then used to evaluate the data and the resulting resistivity is plotted using a graphical contouring program.

LABORATORY TEST PROCEDURES

OMI, Inc., generally follows laboratory testing procedures as outlined by the American Society for Testing and Materials (ASTM), the U. S. Army Corps of Engineers, and other applicable procedures. All work is initiated and supervised by qualified engineers. Laboratory tests are performed by technicians trained to perform the work according to the appropriate procedures. The equipment is well maintained and inspected and calibrated annually or as specified by ASTM.

A description of the procedures used during this exploration or study are included in this Appendix.

SOIL CLASSIFICATION

Classification of soils provides a record and general guide to the engineering properties of the soils encountered during this study. Samples obtained during the field testing (drilling) operations are visually examined and classified by the geotechnical engineer. OMI, Inc., generally follows ASTM procedure No. D-2488 "Visual-Manual Procedure for Classifying Soils." Soil consistency and relative density is based on the number of blows from the standard penetration test. Representative or special samples are then selected for laboratory testing. Soil Boring Records are developed which present the data from the field testing as well as the soil description, water level information, and other data.

MOISTURE CONTENT

Moisture content values, when used in conjunction with other data, can be a useful and inexpensive tool to the engineer as an indicator of the engineering characteristics and parameters of the soil when compared to other data. Moisture content is performed by weighing a moist sample, drying, then re-weighing the dry sample. The moisture content is expressed as a percent of the dry weight of the soil. ASTM Method D-2216 is used to determine the moisture content of soil.

ATTERBERG LIMITS

Atterberg limits include the liquid limit (LL), plastic limit (PL), and shrinkage limit (SL) tests. These tests are performed to aid in the classification of soils and to determine the plasticity and volume change characteristics of the soil. The liquid limit is the minimum moisture content at which the soil will flow as a heavy viscous fluid. The plastic limit is the minimum moisture content at which the soil behaves as a plastic material. The shrinkage limit is the moisture content below which no further volume change will occur with continued drying. The plasticity index (PI) is the difference between the liquid limit and the plastic limit. The PI is the range of moisture at which the soil remains plastic. Many engineering characteristics have been correlated to the Atterberg limits. These are ASTM procedures D-4318, D-4943, and D-427.

STANDARD PROCTOR COMPACTION TEST

This test is used to establish a curve that predicts the effect of moisture and compactive effort on the dry density of the soil sample. It is useful as a comparative value in monitoring contractors' efforts during fill placement and compaction during construction. Also, correlations of engineering parameters such as strength, compressibility, and permeability are related to the percent compaction and soil type.

A representative sample of the proposed fill material (soil or stone) is collected. The sample is divided into four or more samples. Each sample is then brought to a different moisture content about 2% apart. Each sample is then placed in a standard 4-inch diameter mold in 3 equal layers with each layer being compacted with 25 blows from a 5.5-pound hammer falling 12 inches. The sample is trimmed to a known volume of 1/30 cubic foot then weighed. The moisture content of the sample is determined and the dry density is calculated. A graph of dry density (pcf) versus moisture content is developed. The maximum density and its corresponding moisture content known as the optimum moisture content are derived from the curve. A graph of the moisture-density relationship is given in the Appendix. ASTM D-698 describes the procedure.

UNCONFINED COMPRESSION TESTS - ROCK CORES

The strength of rock is important in many engineering applications. This strength is usually desired and reported as the unconfined or simple shear strength. Selected samples of rock cores are cut using a diamond saw. The cores are usually cut to a length equal to about twice the core diameter. The capped length and diameter of each core is measured and recorded. The cores are then loaded to failure in a compression machine. The unconfined compressive strength is calculated by dividing the cross-sectional area of the core

into the maximum load required to crush the sample. If the length to diameter ratio is less than 2.0, then the maximum strength is adjusted mathematically. The results are reported in psi. This procedure is similar to ASTM D-2938.

CONSOLIDATION TESTING

The consolidation test provides data for estimating the settlement and time rate of settlement of the soil in response to the applied loads. Representative soil samples are collected from undisturbed samples, trimmed into a disk about 2.5 inches in diameter and 1 inch thick, then placed in the consolidometer. The disk is confined in a brass ring and sandwiched by porous stones on the top and bottom. The sample ring and stones are placed in a testing device, inundated, then loaded in increments. The sample height is measured as each load caused it to compress. The resulting loads and deformations are reduced to a graph which is presented in the Appendix. These results may be presented in load versus percent strain or load versus void ration. This procedure is described in ASTM D-2435.

SECTION 03 30 00 — CAST-IN-PLACE CONCRETE

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work: Provide all labor, materials, equipment and services required for complete installation of all cast-in-place concrete work indicated on Drawings and specified herein.

1.3 Quality Assurance:

A. Codes and Standards: ACI 301 "Specifications for Structural Concrete Buildings," ACI 318, "Building Code Requirements for Reinforced Concrete;" comply with applicable provision except as otherwise indicated.

B. Concrete Testing Service: Engage a testing laboratory acceptable to Architect to perform material evaluation tests and to design concrete mixes.

C. Quality Control: Perform Sampling and testing during concrete placement, as follows:

1. Slump: ASTM C 143, one test for each load at point of discharge.
2. Compressive Strength: ASTM C 39, one set for each 50 cu. yds., or fraction thereof for each class of concrete. One specimen at 7 days, two specimens at 28 days, and one retained for later testing if required. When the total quantity of a given class of concrete is less than 50 cu. yds., strength tests may be waived by Architect if field experience indicates evidence of satisfactory strength.

1.4 Submittals:

A. Design Mixes: For each concrete mix, include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

B. Submit reinforcement shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars and arrangement of concrete reinforcement. Include special reinforcement required and openings through concrete structures.

1.5 Project Conditions:

A. Protection of Footings Against Freezing: Cover completed work at footing level with sufficient temporary or permanent cover as required to protect footings and adjacent subgrade against possibility of freezing.

B. Protect adjacent finish materials against splatter during concrete placement.

1.6 Delivery, Storage and Handling:

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 — PRODUCTS

2.1 Form Materials:

A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal framed plywood faced or other acceptable panel type surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on Drawings. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection. Use plywood conforming with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill oiled and edge sealed, with each piece bearing legible inspection trademark.

B. Forms for Unexposed Finish Concrete: Form concrete surfaces that will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

C. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

D. Form Ties: Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal.

2.2 Reinforcing Materials:

A. Reinforcing Bars (ReBar): ASTM A 615, Grade 60, deformed.

B. Steel Wire: ASTM A 82, plain, cold-drawn steel.

C. Welded Wire Fabric (WWF): ANSI/ASTM A 185, welded steel wire fabric.

D. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendations, unless otherwise acceptable.

2.3 Concrete Materials:

A. Portland Cement: ASTM C 150, Type I, unless otherwise acceptable to Architect. Use one brand of cement throughout project, unless otherwise acceptable to Architect.

B. Fly Ash: ASTM C 618, Type C or Type F.

C. Aggregates:

1. Coarse Aggregates: ASTM C 33, coarse aggregates; washed and graded natural gravel or crushed stone graded from 3/8" to 3/4" with all particles clean, hard and durable while being free of dust, salt and other foreign matter.
   a) For exterior exposed surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.

D. Water: Clean, drinkable.

2.4 Admixtures:

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

B. Air-Entraining Admixture: ASTM C 260.

C. Water Reducing Admixture: ASTM C 494, Type A.

D. Water-Reducing, Non-Corrosive, Non-Chloride Accelerator: The admixture shall conform to ASTM C 494, Type C or E, and not contain more chloride ions than are present in municipal drinking water.
   1. Available Products: Subject to compliance with requirements, products may be incorporated in the work include, but are not limited to, the following:
      a) Accelguard 80; Euclid Chemical Co.

E. Water-Reducing, Retarding Admixture: ASTM C 494, Type D, and containing not more than 0.05 percent chloride ions.

F. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions are not permitted.

2.5 Related Materials:

A. Expansion Joint Fillers: Premoulded asphalt ASTM D 994 for exterior work, asphalt impregnated fiberboard ASTM D 1751 for interior work. Depths and thicknesses as indicated on the Drawings.

B. Crushed Stone Fill Under Slabs on Grade: Crushed stone or gravel graded from 3/8" to 3/4" or 3/4" to 1".

C. Metal Screed Joints: Equal to Key-Loc Joint System as manufactured by Form-A-Key Products Division, 225 Eiler Ave., P.O. Box 14144, Louisville, KY 40214, Telephone (502)361-1396.
   1. Screed joint shall be constructed from 24 gauge galvanized steel with dowel knockouts on six inch centers and shaped to form a constant tongue and groove key between adjacent concrete floor slab sections.
   2. Joint forms shall be secured in place with 13 gauge HRPO steel stakes installed at 2 foot intervals.
   3. Provide "Snap-In" Joint Splice at joint butts.
   4. Provide stake clip when it is necessary to pour on the stake side first.
   5. Provide Key-Loc Joint manufactured in 10' lengths, for slab depths required. Joints are available for slab depths of 4", 5", 6", 8", 10" and 12". Stakes are pointed and have ratchet tops. Standard lengths are 12", 15", 18" 21" and 24". Provide 15" stakes for 4" slab depths and 18" stakes for 5" and 6" slab depths.

D. Non-Shrink Grout: CRD-C 621, factory pre-mixed non-metallic grout equal to "Five Star Grout" as manufactured by U.S. Grout Corp. or approved equal.

2.6 Curing Materials:

A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

B. Moisture Retaining Cover: One of the following complying with ASTM C 171:
   1. Waterproof paper
   2. Polyethylene film
   3. Polyethylene coated burlap

C. Liquid Membrane-Forming Curing Compound: Liquid type membrane-forming curing compound complying with ASTM C 309, Type I, Class A unless other type acceptable to Architect. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. ft./gal. Subject to compliance with requirements, provide one of the following:
   1. "Masterseal," Mastic Builders
   2. "Clear Seal," A. C. Horn
   3. "Spartan-Cote," The Burke Co.
   4. "Kure-N-Seal," Sonneborn-Contech
   5. "L & M Cure," L & M Construction Chemicals

D. Use of liquid membrane-forming curing compound is strictly prohibited over concrete slabs scheduled to receive resilient flooring.

2.7 Vapor Retarders:

A. Manufacturers:
   1. Stego Wrap (15-mil) Vapor Barrier by Stego Industries LLC, San Juan Capistrano, CA, Tel.: (877) 464-7834, Website: www.stegoindustries.com.
   2. Raven Industries VaporBlock 15.
   3. W.R. Meadows Premoulded Membrane with Plasmatic Core.
   4. Zero-Perm by Alumiseal.

B. Vapor Barrier must meet or exceed the following properties:
   1. WVTR less than or equal to 0.006 gr/ft^2/hr as tested by ASTM E 96.
   2. ASTM E 1745 Class A (Plastics).

C. Accessories:
   1. Vapor Retarding Seam Tape:
      a) Tape must meet or exceed the following properties:
         (1) Water Vapor Transmission Rate: ASTM E 96, 0.3 perms or lower.
   2. Vapor Proofing Mastic:
      a) Mastic must meet or exceed the following properties:
         (1) Water Vapor Transmission Rate: ASTM E 96, 0.3 perms or lower.
   3. Pipe Boots: Construct pipe boots from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer's instructions.

2.8 Proportioning and Design of Mixes:

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed design mixes. The testing facility shall not be the same as used for quality control testing unless otherwise acceptable to Architect.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

C. Footings and Foundation Walls: Proportion normal-weight concrete mix as follows:
   1. Compressive Strength (28 Days): 3000 psi (20.7 Mpa).
   2. Slump: 4 inches (+/- 1").

D. Slab-on-Grade: Proportion normal-weight concrete mix as follows:
   1. Compressive Strength (28 Days): 3000 psi (20.7 Mpa).
   2. Minimum Cementitious Materials Content: 470 lb./cu. yd. (279 kg/cu. m.).
   3. Slump: 4 inches (+/- 1").

E. Walls and Columns: Proportion normal weight concrete mix as follows:
   1. Compressive Strength (28 days): 3000 psi (20.7 Mpa).

F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   1. Fly Ash: 25 percent.

G. Maximum Water-Cementitious Materials Ratio: 0.50 for concrete required to have low water permeability. 0.45 for concrete exposed to deicers or subject to freezing and thawing while moist.

H. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 1.5 percent, unless otherwise indicated:
   1. 5.5 percent for 1-1/2-inch- (38-mm-) nominal maximum aggregate size.

2. 6 percent for 1-inch- (25-mm-) nominal maximum aggregate size.
3. 6 percent for 3/4-inch- (19-mm-) nominal maximum aggregate size.

I. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.

2.9 Fabricating Reinforcement: Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.10 Concrete Mixing:

A. Ready-Mixed Concrete: Measure, batch, mix and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes: when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 — EXECUTION

3.1 Forms:

A. Construct so that concrete members and structures are of correct size, shape, alignment, elevation and position.
B. Clean and adjust forms prior to concrete placement. Apply form release agents or wet forms, as required to eliminate mortar leaks.
C. Provide construction joint forms where concrete placement terminates at the end of a day or because of other reasons.
D. Provide bulkheads, with horizontal keyways and reinforcing steel penetrating bulkheads, where concrete placement stops at end of day or for other reasons.
E. Where soil conditions are such that concrete cannot be placed without forms, and where other conditions cause trenches to be opened wider than footing or slab widths, erect forms for footing or slab.
F. Install items furnished by others for installation in concrete. Use templates to locate anchor bolts and other critical items.
G. Prepare insides of forms so that concrete will have a smooth, uniform finish free of surface defects.
H. Coat forms before reinforcement steel is placed. Where mill-oiled forming material is used, follow manufacturer's instructions for recoating. Where forming material is not mill-oiled, coat forms before each use.
I. Before reusing forms, thoroughly clean them and remove projecting nails or similar devices.

3.2 Building Slab Drainage Course:

A. General: Drainage course consists of placement of drainage fill material, in layers of indicated thickness, conforming to indicated cross section and thickness. Maintain optimum moisture content for compacting material during placement operations.
B. Placing: Place drainage fill material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and during placement operations.
C. When a compacted drainage course is shown to be 6" thick or less, place material in a single layer.

3.3 Vapor Barrier Installation:

A. Preparation: Ensure that subsoil is approved by Architect.
   1. Level and tamp or roll aggregate, sand or tamped earth base.
B. Installation: Installation shall be in accordance with manufacturer's instructions and ASTM E 1643-98.
   1. Unroll vapor barrier with the longest dimension parallel with the direction of the pour.
   2. Lap vapor barrier over footings and seal to foundation walls.
   3. Overlap joints 6 inches and seal with manufacturer's tape.
   4. Seal all penetrations (including pipes) per manufacturer's instructions.
   5. No penetration of vapor barrier is allowed except for reinforcing steel and permanent utilities.
   6. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all four sides with tape.

3.4 Placing Reinforcement:
A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers as required.
D. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set tie wires so ends are directed into concrete, not toward exposed concrete surfaces.
E. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.
F. Protect reinforcing by thickness of concrete indicated. Where not indicated, thickness of concrete over reinforcing shall be as follows:
   1. Where concrete is deposited against the ground without use of forms - 3 inches.
   2. Where concrete is exposed to weather or to ground, but placed in forms - 2 inches for bars larger than No. 5 and 1-1/2 inches for No. 5 bars or smaller.
   3. In beams, girders, and columns not exposed to the ground or to the weather - 1-1/2 inches.
   4. Variation from clear cover and depth of members shall conform to Section 7.5 of ACI-83.

3.5 Joints:
A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.

2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch (12 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.
1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.6 Concrete Placement:

A. Preplacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

B. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

C. Comply with ACI, placing concrete in a continuous operation within planned joints or sections. Do not begin placement until work of other trades affecting concrete is complete.
D. Consolidate placed concrete using mechanical vibrating equipment with hand rodding and tamping, so that concrete is worked around reinforcement and other embedded items and into forms.
E. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placement and curing.
   1. In cold weather comply with ACI 306.
   2. In hot weather comply with ACI 305.
F. Cold Weather Placing: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.
   1. When air temperature has fallen to or is expected to fall below 40 deg. F., uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F., and not more than 80 deg. F. at point of placement.
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Only the specified non-corrosive, non-chloride accelerator shall be used. Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions are not permitted.
G. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
   1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg. F. Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.
   2. Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.

3.7 Monolithic Slab Finishes:
A. Float Finish:
   1. Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.
   2. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
B. Trowel Finish:
   1. Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, paint or other thin film finish coating system.

2. After floating, begin first trowel finish operation using a power driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance. Grind smooth surface defects that would telegraph through applied floor covering system.

C. Non-Slip Broom Finish:
   1. Apply non-slip broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.
   2. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

D. Finish surfaces to the following tolerances according to ASTM E 1155/E for randomly trafficked floor surface: specified overall values for flatness, F(F) 25; and levelness, (F)L 20; with minimum local values of flatness, F(F) 17; and levelness F(L) 15.

3.8 Grouting: All column base plates and other locations noted on the structural drawings shall be grouted with specified non-shrink grout. All exposed grout shall be the specified non-metallic type.

3.9 Concrete Curing and Protection:

A. General:
   1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
   2. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
   3. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

B. Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture retaining cover curing, and by combinations thereof, as herein specified.
   1. Provide moisture curing by following methods:
      a) Keep concrete surface continuously wet by covering with water.
      b) Continuous water-fog spray.
      c) Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.
   2. Provide moisture-cover curing as follows:
      a) Cover concrete surface with moisture retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by water proof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   3. Provide curing and sealing compound to interior slabs left exposed; and to exterior slabs, walks, and curbs, as follows:
      a) Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3

hours after initial application. Maintain continuity of coating and repair damage during curing period.

4. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, flooring (such as resilient flooring) and other coatings and finish materials, unless otherwise acceptable to Architect.

C. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

D. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of appropriate curing method.

E. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture retaining cover, unless otherwise directed.

F. Sealer and Dustproofer: Apply a second coat of specified curing and sealing compound only to surfaces given a first coat.

3.10 Removal of Forms:

A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F. (10 C.) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, joints, slabs and other structural elements, may not be removed in less than 14 days and until concrete has attained design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

3.11 Re-Use of Forms:

A. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

3.12 Miscellaneous Concrete Items:

A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.13 Concrete Surface Repairs:

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect.

B. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete, but in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.

C. For exposed-to-view surfaces, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

D. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

E. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

F. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.

G. Repair finished unformed surfaces that contain defects that affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop outs, honeycombs, rock pockets and other objectionable conditions.

H. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.

I. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Architect.

J. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

K. Repair isolated random cracks and single holes not over 1" in diameter by dry pack method. Groove top clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry pack, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound

has dried. Compact dry pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

L. Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.

M. Repair methods not specified above may be used, subject to acceptance of Architect.

END OF SECTION 03 30 00

SECTION 04 20 00 — UNIT MASONRY

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work: Provide all labor, materials, equipment and services required for complete installation of all unit masonry indicated on Drawings and specified herein.

1.3 Quality Assurance:

A. Single Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.

B. Single Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

C. Field Constructed Mock-Ups: Prior to installation of masonry work, erect sample wall panels to further verify selections made for color and textural characteristics, under sample submittals of masonry units and mortar, and to represent completed masonry work for qualities of appearance, materials and construction; build mock-ups to comply with the following requirements:

1. Build 8'-0" long by 4'-0" high mock-up for typical exterior face brick wall.
2. Where masonry is to match existing, erect panels parallel to existing surface.
3. Retain mock-ups during construction as standard for judging completed masonry work. When directed, demolish mock-ups and remove from site.

D. Fire Performance Characteristics: Where indicated, provide materials and construction that are identical to those of assemblies whose fire endurance has been determined by testing in compliance with ASTM E 119 by a recognized testing and inspecting organization or by another means as acceptable to authority having jurisdiction.

1.4 Submittals:

A. Submit samples of face brick to Architect for approval. Do not order face brick without written approval from Architect.

B. Colored masonry mortar samples showing full extent of colors available.

1.5 Delivery, Storage, and Handling:

A. Deliver masonry materials to project in undamaged condition.

B. Store and handle masonry units to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion or other causes.

C. Store cementitious materials off the ground, under cover and in dry location.

D. Store aggregates where grading and other required characteristics can be maintained.

E. Store masonry accessories including metal items to prevent deterioration by corrosion and accumulation of dirt.

1.6 Project Conditions:

A. Protection of Work: During erection, cover top of walls with heavy waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.
B. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
C. Do not apply uniform floor or roof loading for at least 12 hours after building masonry walls or columns.
D. Do not apply concentrated loads for at least 3 days after building masonry walls or columns.
E. Staining: Prevent grout or mortar or soil from staining the face of masonry to be left exposed or painted. Remove immediately grout or mortar in contact with such masonry.
F. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.
G. Protect sills, ledges and projections from droppings of mortar.

1.7 Cold Weather Protection:

A. Do not lay masonry units that are wet or frozen.
B. Remove any ice or snow formed on masonry bed by carefully applying heat until top surface is dry to the touch.
C. Remove all masonry determined to be frozen or damaged by freezing conditions.
D. Do not lay masonry when the temperature of the outside air is below 40 degrees unless suitable means as approved by the Architect are provided to heat materials, protect work from cold and frost and ensure that mortar will harden without freezing. No antifreeze ingredient shall be used in the mortar.
E. Protect completed masonry work at end of each day's work by covering with a weather-resistive membrane.

PART 2 — PRODUCTS

2.1 Face Brick and Brick Pavers:

A. Quality Standard: ASTM C 216, Grade SW, Type FBS.
B. Size: Modular, 2-1/4" x 3-3/4" x 7-5/8".

VE Item Revision:

C. Manufacturer: Allowance: Include in the Bid an Allowance of $400.00/M, plus sales tax, for the purchase of face brick as selected by the Architect.

2.2 Mortar Materials:

A. Portland Cement: Shall be an approved masonry cement conforming to ASTM C 91, Type "S" for below grade applications and above grade load bearing masonry walls; Type "N" for above grade non-load bearing masonry walls.
B. Sand: ASTM C 144, clear, well graded and free of organic and other deleterious substances.
C. Water: Clean, free of deleterious materials which would impair strength or bond.

2.3 Masonry Accessories:

A. Continuous Wire Reinforcing: Provide welded wire units prefabricated in straight lengths of not less than 10', with matching corner and tee units. Fabricate from cold-

drawn steel wire complying ASTM A 82, with deformed continuous side rods and plain cross-rods, and a unit width of 1-1/2" to 2" less than thickness of wall or partition. Units shall be truss type fabricated with single pair of 9 ga. side rods and 9 ga. continuous diagonal cross-rods spaced not more than 16" o.c.

B. Masonry Anchors (Brick to Metal Back Panels): Galvanized 12 gauge anchor plate and 3/16" diameter tie equal to Type III Anchors as manufactured by Wire-Bond or approved equal.
C. Vinyl Sheet Masonry Flashing: Flexible sheet flashing especially formulated from virgin polyvinyl chloride with plasticizers and other modifiers to remain flexible and waterproof in concealed masonry applications, black in color and 56 mils in thickness.
D. Mortar Netting: Provide trapezoidal-shaped recycled polyester/polyethylene mesh as manufactured by Mortar Net, 541 South Lake St., Gary, IN 46403, Tel. (800) 664-6638, Fax. (219) 939-3877. The mortar netting shall be designed to maintain airflow and drainage while suspending mortar droppings at unequal heights. Provide one or more thickness as required to fill cavity width.
E. Weep Holes: Provide 3/8" outside diameter translucent plastic tube weep holes equal to Dur-O-Wal DA1005. Set in the head (vertical) joint on top of the thru-wall flashing at weep joint spacing required where indicated on the Drawings.
F. Pattern Bond: Lay concrete block in running bond.

2.4 PVC Control Joints: 6-7/8" wide, high grade poly-vinyl chloride compound conforming to ASTM D 2287 type PVC 654-4 with a durometer hardness of 90 when tested in conformance with ASTM D-2240 and equal to No. AA2003 as manufactured by AA Wire Products Co.

2.5 Masonry Cleaner: Job-mixed detergent solution of trisodium phosphate (1/2 cup dry measure) and laundry detergent (1/2 cup dry measure) dissolved in one gallon of water.

PART 3 — EXECUTION

3.1 Installation, General:
A. Thickness: Build masonry construction to the full thickness shown, except, build single-wythe walls (if any) to the actual thickness of the masonry units, using units of nominal thickness shown or specified.
B. Cut masonry units with motor-driven saw designed to cut masonry with clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining work neatly. Use full units without cutting wherever possible.
C. Layout walls in advance for accurate spacing of surface bond patterns, with uniform joint widths and to properly locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-half size units at corners, jambs and wherever possible at other locations.
D. Lay-up walls plumb and true and with courses level, accurately spaced and coordinated with other work.
E. Fill space between hollow metal frames and masonry solidly with mortar.

3.2 Mortar Bedding and Jointing:
A. Use Type S mortar for below grade applications and above grade loadbearing masonry walls and Type N for above grade non-load bearing masonry walls.

B. Measure and batch materials either by volume or weight, such that the required proportions for mortar can be accurately controlled and maintained. Measurement of sand exclusively by shovel will not be permitted.
C. Mix mortars with the maximum amount of water consistent with workability to provide maximum tensile bond strength within the capacity of the mortar.
D. Mix mortar ingredients for a minimum of 5 minutes in a mechanical batch mixer. Use water clean and free of deleterious materials that would impair the work. Do not use mortar that has begun to set, or if more than 2-1/2 hours has elapsed since initial mixing. Retemper mortar during 2-1/2 hour period as required to restore workability.
E. Lay brick and other solid masonry units with completely filled bed, head and collar joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints.
F. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells; also bed webs in mortar in starting course on footings and foundation wall and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or to be filled with concrete or grout.
G. Joints: Maintain joint widths shown, except for minor variations required to maintain bond alignment. If not otherwise indicated, lay walls with 3/8" joints. Cut joints flush for masonry walls that are to be concealed or to be covered by other material. Tool exposed joints slightly concave. Rake out mortar in preparation for application of caulking or sealants where shown.
H. Remove masonry units disturbed after laying, clean and relay in fresh mortar.

3.3 Cavity Walls:
A. Keep cavity clean of mortar droppings and other materials during construction. Strike joints facing cavity, flush.
B. Provide weep holes in exterior wythe of cavity, composite and veneer walls located immediately above ledges and flashing, spaced 2'-8" o.c., unless otherwise indicated.
C. Install masonry cavity wall insulation by cutting board accurately to fit between ties where necessary. Do not push masonry ties through insulation. Butt edges tightly together. Install insulation board as brickwork progresses, installing masonry ties so that legs hold the insulation firmly against the backup wall; the air space must be maintained between the brick and insulation.
D. Anchor masonry veneer to metal studs with metal ties embedded in masonry joints and screw fastened to metal studs through sheathing. Provide not less than 1" air space between masonry veneer. Screw anchors through to studs. Space veneer anchors as shown, or if not shown, space not more than 24" o.c. vertically and horizontally. Provide additional anchors within 1'-0" of openings and space not more than 3'-0" around perimeter.
E. Anchor masonry veneer to metal studs with metal ties embedded in masonry joints and screw fastened to metal studs through sheathing. Provide not less than 1" air space between masonry veneer and insulation. Screw anchors through to studs. Space veneer anchors as shown, or if not shown, space not more than 24" o.c. vertically and horizontally. Provide additional anchors within 1'-0" of openings and space not more than 3'-0" around perimeter.
F. Anchor brick veneer to structural steel members with two-piece metal anchors welded to steel structure and embedded in masonry joints at 24" o.c. vertically.
G. Mortar Netting: Install mortar netting in cavity walls in accordance with manufacturer's instructions immediately above flashing where weep holes are indicated on the Drawings.

3.4 Control Joints:

A. General: Provide vertical expansion, control and isolation joints in masonry where shown. Build-in related items as the masonry work progresses.

B. Build-in non-metallic joint fillers where indicated.

3.5 Flashing of Masonry Work:

A. Provide concealed flashings in masonry work at, or above, all shelf angles, lintels, ledges and other obstructions to the downward flow of water in the wall so as to divert such water to the exterior. Prepare masonry surfaces smooth and free from projections that could puncture flashing. Place through-wall flashing on bed of mortar. Seal penetrations in flashing with mastic before covering with mortar.

B. Extend flashings the full length of lintels and shelf angles and minimum of 4" into masonry each end. Extend flashing from a line 1/2" in from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4", and through the inner wythe to within 1/2" of the interior face of the wall in exposed work. Where interior surface of inner wythe is concealed by furring, carry flashing complete through the inner wythe and turn up approximately 2".

C. Provide weepholes in the head joints of the same course of masonry bedded in the flashing mortar.

D. Install reglets and nailers for flashing and other related work where shown to be built into masonry work.

3.6 Repair, Pointing and Cleaning:

A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge any voids or holes, except weepholes, and completely fill with mortar. Point-up all joints at corners, openings and adjacent work to provide a neat, uniform appearance, properly prepared for application of caulking or sealant compounds.

C. Clean exposed brick masonry surfaces by the bucket and brush hand cleaning method or by high pressure water method.

END OF SECTION 04 20 00

SECTION 05 12 10 — STRUCTURAL AND MISCELLANEOUS STEEL

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all labor, materials, equipment and services required for complete installation of all structural and miscellaneous steel indicated on Drawings and specified herein.
- B. Related Work Specified Elsewhere: Section 03 30 00 – Cast-In-Place Concrete, Section 04 20 00 – Unit Masonry, and Section 06 61 00 – Rough Carpentry.

1.3 Quality Assurance:
- A. Codes and Standards: Comply with provisions of following, except as otherwise indicated:
  1. AISC "Code of Standard Practice for Steel Buildings and Bridges".
  2. AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings", including the "Commentary" and Supplements thereto as issued.
  3. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
  4. AWS D1.1 "Structural Welding Code".
  5. ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".

1.4 Submittals:
- A. Product Data: Submit producer's or manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
  1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.
  2. High-strength bolts (each type), including nuts and washers.
  3. Structural steel primer paint.
  4. Shrinkage-resistant grout.
- B. Shop Drawings:
  1. Submit shop drawings including complete details and schedules for fabrication and assembly of structural steel member's procedures and diagrams.
  2. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length and type of each weld.
  3. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by others.

1.5 Delivery, Storage and Handling:
- A. Deliver materials to site at such intervals to insure uninterrupted programs of work.

B. 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.
C. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 — PRODUCTS

2.1 Metal Surfaces, General: For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.

2.2 Materials:
A. Structural Steel Shapes, Plates and Bars: ASTM A 36, except ASTM A992 Grade 50 for W-shapes.
B. Cold-Formed Steel Tubing: ASTM A 500, Grade C.
C. Anchor Bolts: ASTM A449 headed type unless otherwise indicated.
D. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:
   1. Quenched and tempered with medium-carbon steel bolts, nuts and washers, complying with ASTM A 325.
E. Electrodes for Welding: Comply with AWS Code.
F. Structural Steel Primer Paint: Fabricator's standard rust-inhibiting primer.
G. Non-Shrink Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sand, portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CRD-C621.

2.3 Fabrication:
A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.
B. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.
C. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.
D. Connections: Weld or bolt shop connections, as indicated.
E. Bolt field connections, except where welded connections or other connections are indicated.
   1. Provide high-strength threaded fasteners for principal bolted connections, except where unfinished bolts are indicated.
F. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on final shop drawings.
G. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work.

H. Cut, drill or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

2.4 Shop Painting:

A. General: Shop paint structural steel, except those members or portions of members to be embedded in concrete mortar. Paint embedded steel that is partially exposed on exposed portions and initial 2" of embedded areas only.
   1. Apply 2 coats of paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

B. Surface Preparation: After inspection and before shipping, clean steelwork to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows:
   1. SP-1 "Solvent Cleaning."
   2. SP-2 "Hand Tool Cleaning."
   3. SP-3 "Power Tool Cleaning."

C. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide a uniform dry film thickness of 1.5 mils. Use painting methods that result in full coverage of joints, corners, edges and exposed surfaces.

PART 3 — EXECUTION

3.1 Inspection: Erector must examine areas and conditions under which structural steel work is to be installed, and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Erector.

3.2 Erection:

A. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

B. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.

C. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.

D. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.
   1. Refer to Division 3 of these specifications for anchor bolt installation requirements in concrete, and Division 4 for masonry installation.

E. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surfaces of base and bearing plates.

F. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.

G. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.

H. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
   1. For proprietary grout materials, comply with manufacturer's instructions.
I. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
J. Level and plumb individual members of structure within specified AISC tolerances.
K. Splice members only where indicated and accepted on shop drawings.
L. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.
M. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
N. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
O. Gas Cutting: Do not use gas-cutting torches in field for correcting fabrication errors in structural framing. Cutting will be permitted only on secondary members that are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted.
P. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas with same material as used for shop painting.
Q. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

3.3 Field Quality Control:
A. The Owner may engage an independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports.
B. Shop Welding: Inspect and test during fabrication of structural steel assemblies, as follows:
   1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
   2. Perform visual inspection of all welds.
C. Field Bolted Connections: Inspect in accordance with AISC specifications.
D. Field Welding: Inspect and test during erection of structural steel as follows:
   1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
   2. Perform visual inspection of all welds.

END OF SECTION 05 12 10

SECTION 05 21 00 — STEEL JOIST FRAMING

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all labor, materials, equipment and services required for complete installation of steel joist framing indicated on Drawings and specified herein.
- B. Related Work Specified Elsewhere: Section 05 12 00 - Structural Steel Framing and Section 05 31 00 - Steel Decking.
- C. Refer to Division 3 Sections for installation of anchors set in concrete.
- D. Refer to Division 4 Sections for installation of anchors set in masonry.

1.3 Quality Assurance:
- A. Provide joists fabricated in compliance with the following, and as herein specified.
  1. SJI "Standard Specifications, Load Tables and Weight Tables for Steel Joists & Joist Girders" for:
     a) KCS-type, Open Web K-Series Steel Joists.
     b) Joist accessories.
- B. Qualification for Field Welding: Qualify welding processes and welding operators in accordance with the American Welding Society (AWS) "Structural Welding Code - Steel", AWS D1.1.
  1. Joists welded in place are subject to inspection and testing. Expense of removing and replacing any portion of steel joists for testing purposes will be born by Owner if welds are found to be satisfactory. Remove and replace work found to be defective and provide new acceptable work.

1.4 Submittals:
- A. Product Data: Submit manufacturer's specifications and installation instructions for each type of joist and accessories. Include manufacturer's certification that joists comply with SJI "Specifications".
- B. Shop Drawings: Submit detailed drawings showing layout of joist units, special connections, jointing and accessories. Include mark, number, type, location and spacing of joists and bridging.

1.5 Delivery, Storage and Handling: Deliver, store and handle steel joists as recommended in SJI "Specifications". Handle and store joists in a manner to avoid deforming members and to avoid excessive stresses.

PART 2 — PRODUCTS

2.1 Materials:
- A. Steel: Comply with SJI "Specifications" for chord and web sections.

B. Steel Bearing Plates: ASTM A36.
C. Unfinished Threaded Fasteners: ASTM A 307, Grade A, regular hexagon type, low carbon steel.
D. High-Strength Threaded Fasteners: ASTM A325 or A490 heavy hexagon structural bolts with nuts and hardened washers.
E. Steel Prime Paint: Comply with SJI "Specifications", except asphalt type paint not permitted.

2.2 Fabrication:
A. General: Fabricate steel joists in accordance with SJI "Specification".
B. Holes in Chord Members: Provide holes in chord members where shown for securing other work to steel joists; however, deduct area of holes from the area of chord when calculating strength of member.
C. Extended Ends: Provide extended ends (“R” type) on joists where shown, complying with manufacturer's standards and requirements of applicable SJI "Specifications" and load tables.
D. Ceiling Extensions: Provide ceiling extensions in areas having ceilings attached directly to joist bottom chord. Provide either an extended bottom chord element or a separate unit, to suit manufacturer's standards, of sufficient strength to support ceiling construction. Extend ends to within 1/2" of finished wall surface unless otherwise indicated.
E. Top Chord Extension: Provide top chord extensions ("S" type) on joists where indicated, complying with SJI "Specifications" and load tables.
F. Bridging: Provide horizontal or diagonal type bridging for "open web" joists, complying with SJI "Specifications".
1. Provide bridging anchors for ends of bridging lines terminating at walls or beams.
G. End Anchorage: Provide end anchorages to secure joists to adjacent construction, complying with SJI "Specifications", unless otherwise indicated.
H. Header Units: Provide header units to support tail joists at openings in floor or roof system not framed with steel shapes.
I. Shop Painting: Remove loose scale, heavy rust and other foreign materials from fabricated joists and accessories before application of shop paint.
J. Apply one shop coat of primer paint to steel joists and accessories by spray, dipping, or other method to provide a continuous dry paint film thickness of not less than 0.50 mil.
K. Camber joists and joist girders according to SJI’s “Specification”, unless noted otherwise.
J.L. Equip bearing ends of joists with manufacturer’s standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per foot.

PART 3 — EXECUTION

3.1 Inspection: Erector must examine areas and conditions under which steel joists are to be installed and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Erector.

3.2 Erection:

A. Place and secure steel joists in accordance with SJI "Specifications", final shop drawings and as herein specified.
B. Anchors: Furnish anchor bolts and other devices to be built into concrete and masonry construction. Furnish templates for accurate location of anchors in other work.
    1. Furnish unfinished threaded fasteners for anchor bolts, unless high strength bolts indicated.
C. Placing Joists: Do not start placement of steel joists until supporting work is in place and secured. Place joists on supporting work, adjust and align in accurate locations and spacing before permanently fastening.
    1. Provide temporary bridging, connections and anchors to ensure lateral stability during construction.
D. Bridging: Install bridging simultaneously with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams.
E. Fastening Joists:
    1. Field weld joists to supporting steel framework in accordance with SJI "Specifications" for type of joists used. Coordinate welding sequence and procedure with placing of joists.
    2. Secure joists resting on masonry or concrete bearing surfaces by welding to steel anchor plates in accordance with SJI "Specifications" for type of steel joist used.
    3. Bolt joists to supporting steel framework in accordance with SJI "Specification" for type of joists used.
        a) Provide unfinished threaded fasteners for bolted connections, unless otherwise indicated.
        b) Provide unfinished threaded fasteners for bolted connections except where high-strength bolts or welded connections are shown.
        c) Provide high-strength threaded fasteners for bolted connections of steel joists to steel columns, and at other locations where shown, installed in accordance with AISC "Specifications for Structural Joints Using ASTM A325 or A490 Bolts".
F. Touch-Up Painting: After joist installation, paint field bolt heads and nuts, and welded areas, abraded or rust surfaces on joists and steel supporting members. Wire brush surfaces and clean with solvent before painting. Use same type of paint as used for shop painting.

END OF SECTION 05 21 00

SECTION 05 31 00 — STEEL DECKING

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all labor, materials, equipment and services required for complete installation of steel decking indicated on Drawings and specified herein.
- B. Related Work Specified Elsewhere: Section 05 21 00 – Steel Joist Framing.

1.3 Quality Assurance:
- A. Comply with provisions of the following codes and standards, except as otherwise shown or specified. AISI "Specification for the Design of Cold-Formed Steel Structural Members."
- B. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure."
- C. SDI "Steel Roof Deck Design Manual."

1.4 Submittals:
- A. Product Data: Submit manufacturer's specifications and installation instructions for each type of decking and accessories. Include manufacturer's certification as may be required to show compliance with these specifications.
- B. Shop Drawings: Submit detailed drawings showing layout and types of deck panels, anchorage details, and conditions requiring closure panels, supplementary framing, sump pans, cant strips, cut openings, special jointing or other accessories.

1.5 Manufacturer: Subject to compliance with requirements, provide composite roof deck products of one of the following:
- A. Bowman/E.G. Smith, Div. Cyclops Corp.
- B. Epic Metals Corp.
- C. Mac-Fab Products, Inc.
- D. Roll Form Products, Inc.
- E. United Steel Deck, Inc.
- F. Vulcraft/Div. Nucor Corp.
- G. Wheeling Corrugating Co.
- H. Consolidated Systems, Inc.

PART 2 — PRODUCTS

2.1 Roof Decking: ASTM A 653, Grade 33, 22 gauge galvanized steel, G60 zinc coating, wide-rib (Type 'B'), 1-1/2" nominal depth roof deck, unless noted otherwise on drawings.

2.2 Floor Decking: ASTM A 611, Grade C minimum, 24 gauge galvanized steel, G60 zinc coating, Type ‘C’, 1” deep, unless noted otherwise on drawings.

2.3 Sheet Metal Accessories: ASTM A 526, commercial quality, galvanized, closures, closure angles, cover plates, etc.

PART 3 — EXECUTION

3.1 Installation:

A. General: Install deck units and accessories in accordance with manufacturer's recommendations and final shop drawings, and as specified herein.

B. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.

C. Place deck units in straight alignment for entire length of run.

D. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.

E. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.

F. Fastening Deck Units:

1. Fasten deck units to steel supporting members by welding in accordance with manufacturer's recommendations.
2. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.
3. Use welding washers even if not required by deck manufacturer.
4. Mechanically fasten side laps of adjacent deck units between supports using self-tapping No. 10 or larger machine screws at spacing indicated on drawings.

G. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking, as shown.

H. Hanger Slots or Clips: Provide manufacturer's standard hanger attachment devices.

I. Touch-Up Painting: After decking installation, wire brush, clean and paint scarred areas, welds and rust spots on top and bottom surfaces of decking units and supporting steel members.

1. Touch-up galvanized surfaces in accordance with manufacturer's instructions.

END OF SECTION 05 31 00

SECTION 06 10 00 — ROUGH CARPENTRY

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work: Provide all labor, materials, equipment and services required for complete installation of all rough carpentry work indicated on Drawings and specified herein.

1.3 References:
- A. Lumber Standards: Comply with PS 20 and with applicable rules of the respective grading and inspecting agencies for species and products indicated.
- B. Plywood Product Standards: Comply with PS 1 (ANSI A 199.1), or for products not manufactured under PS 1 provisions, with applicable APA Performance Standard for type of panel indicated.

1.4 Product Handling: Keep materials dry at all times. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and plywood, and provide air circulation within stacks.

1.5 Job Conditions: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other work.

PART 2 — PRODUCTS

2.1 Lumber, General:
- A. Factory-mark each piece of lumber with type, grade, mill and grading agency, except omit marking from surfaces to be exposed with transparent finish or without finish.
- B. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.
- C. Provide dressed lumber, S4S, unless otherwise indicated.
- D. Provide seasoned lumber with 15% maximum moisture content at time of dressing.

2.2 Studs (2"-4" Thick, 2"-6" Wide, 10' and Shorter): No. 2 Spruce-Pine-Fir or Western Spruce.

2.3 Treated Lumber:
- A. Preservative Treatment: Where lumber or plywood is indicated as "Trt-Wd" or "Treated", or is specified herein to be treated, comply with applicable requirements of AWPA Standards C2 (Lumber) and C9 (Plywood) and of AWPB Standards listed below. Mark each treated item with the AWPB Quality Mark Requirements.
- B. Pressure-treat above-ground items with water-borne preservatives complying with AWPB LP-2. After treatment, kiln-dry to a maximum moisture content of 15%. Treat indicated items and the following: Wood cants, nailers, curbs, blocking, stripping, and

similar members in connection with roofing, flashing, vapor barriers and waterproofing. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

2.4 Plywood Roof Sheathing: Exposure 1 sheathing.
- A. Span Rating: Not less than 48/24.
- B. Nominal Thickness: Not less than 3/4 inch.

2.5 Miscellaneous Materials:
- A. Fasteners and Anchorages: Provide size, type, material, and finish as indicated and as recommended by applicable standards, complying with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommending nails. Where rough carpentry work is exposed to weather, in ground contact, or in a high relative humidity, provide fasteners and anchorages with a hot-dip zinc coating (ASTM A 153).

PART 3 — EXECUTION

3.1 General:
- A. Discard units of material with defects that might impair quality of work, and units that are too small to use in fabricating work with minimum joints or optimum joint arrangement.
- B. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.
- C. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards.
- D. Use common wire nails, except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.
- E. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

3.2 Installation of Framing and Wood Blocking:
- A. Provide blocking members of sizes and on spacings shown, and frame openings as shown, or if not shown, comply with recommendations of "Manual of House Framing" of National Forest Products Association.
- B. Anchor and nail as shown, and comply with "Recommended Nailing Schedule" of "Manual of House Framing" and other recommendations of N.F.P.A.
- C. Securely attach carpentry work to substrates and supporting members using fasteners of size that will not penetrate members where opposite side will be exposed to view or receive finish materials. Install fasteners without splitting wood; fasten panel products to allow for expansion at joints unless otherwise indicated.

3.3 Installation of Plywood:

A. General: Comply with applicable recommendations contained in Form No. # 304 "APA Design/Construction Guide - Residential and Commercial", for types of plywood products and applications indicated.
B. Nail plywood or composition sheathing 6" o.c. at edges of panels, and 12" o.c. at intermediate supports. Leave space between panels as recommended by APA.

END OF SECTION 06 10 00

SECTION 06 20 00 — FINISH CARPENTRY

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all labor, materials, equipment and services required for complete installation of all finish carpentry indicated on Drawings and specified herein.
- B. Related Work Specified Elsewhere: Section 06 10 00 – Rough Carpentry and Section 09 91 00 - Painting.

1.3 Product Delivery, Storage and Handling:
- A. Protect finish carpentry materials during transit, delivery, storage and handling to prevent damage, soiling and deterioration.
- B. Do not deliver finish carpentry materials until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, finish carpentry materials must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

1.4 Quality Assurance:
- A. Softwood Lumber Standards: Comply with PS 20 and with applicable grading rules of the respective grading and inspecting agency for the species and product indicated.
- B. Plywood Standard: Comply with PS 1.
- C. Hardwood Lumber Standard: Comply with National Hardwood Lumber Association (NHLA) rules.
- D. Hardwood Plywood Standard: Comply with PS 51.
- E. Woodworking Standard: Architectural Woodwork Institute (AWI) "Quality Standards".

PART 2 — PRODUCTS

2.1 Interior Finish Carpentry:
- A. Standing and Running Trim (Painted): FAS Clear Poplar or approved equal manufactured to sizes and patterns (profiles) shown from First Grade lumber and complying with referenced woodworking standard.
  1. Moldings designated with an "AH" prefix (such as AH-366) are available from American Hardwoods, Inc., 402 Celtic Dr., Madison, AL 35758, (256) 772-0061 or (800) 836-8717.
  2. Moldings that are not designated with a prefix and number on the Drawings shall be obtained from stock or milled sources manufactured to sizes, type and patterns (profiles) shown.
- B. MDO Plywood: 3/4" thick factory primed Medium Density Overlay (MDO) Plywood Siding as manufactured by Campion, Georgia-Pacific or approved equal.

2.2 Fasteners and Anchorages:
- A. Provide nails, screws and other anchoring devices of the proper type, size, material and finish for application indicated to provide secure attachment, concealed where possible, and complying with applicable Federal specifications.
- B. Where finish carpentry is exposed on exterior or in areas of high relative humidity, provide fasteners and anchorages with a hot-dipped zinc coating (ASTM A 153).

2.3 Fabrication:
- A. Wood Moisture Content: Comply with requirements of specified inspection agencies and manufacturer's recommendations for moisture content of finish carpentry in relation to relative humidity conditions existing during time of fabrication and in installation areas. Provide finish carpentry with moisture content that is compatible with Project requirements.
- B. Fabricate finish carpentry to dimensions, profiles and details indicated. Ease edges to radius indicated for the following:
  1. Lumber less than 1 inch in nominal thickness: 1/16-inch.
  2. Lumber 1 inch or more in nominal thickness: 1/8-inch.

PART 3 — EXECUTION

3.1 Examination:
- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting installation and performance of finish carpentry. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 Preparation:
- A. Clean substrates of projections and substances detrimental to application.
- B. Condition finish carpentry to average prevailing humidity conditions in installation areas before installation for a minimum of 24 hours unless longer conditioning recommended by manufacturer.
- C. Backprime lumber for painted finish exposed on the exterior. Comply with requirements for surface preparation and application in Section "Painting."
- D. Do not use finish carpentry materials that are unsound, warped, bowed, twisted, improperly treated or finished, not adequately seasoned, or too small to fabricate with proper jointing arrangements.
- E. Do not use manufactured units with defective surfaces, sizes, or patterns. Architect to approve material prior to finishing of material.
- F. Install finish carpentry plumb, level, true, and aligned with adjacent materials. Use concealed shims where required for alignment.
- G. Where finish carpentry is not tight to substrate within 1/16" due to substrate that is bowed, caulk and fill gaps to receive same finish material (stained or painted) as trim. Complete this work prior to any finish work, including painting, wallcovering and carpeting.
- H. Scribe and cut finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
- I. Install to tolerance of 1/8 inch in 8 feet for plumb and level. Install adjoining finish carpentry with 1/16-inch maximum offset for flush installation and 1/8-inch maximum offset for reveal installation.

J. Coordinate finish carpentry with materials and systems that may be in or adjacent to standing and running trim and rails. Provide cutouts for mechanical and electrical items that penetrate exposed surfaces of trim and rails.
K. Finish in accordance with specified requirements.
L. Refer to Section 09 90 00 - Painting for final finishing of finish carpentry.

3.3 Adjusting: Repair damaged or defective finish carpentry where possible to eliminate functional or visual defects. Where not possible to repair, replace finish carpentry. Adjust joinery for uniform appearance.

3.4 Cleaning: Clean finish carpentry on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.5 Protection: Provide final protection and maintain conditions that ensure finish carpentry is without damage or deterioration at time of Substantial Completion.

END OF SECTION 06 20 00

SECTION 06 41 16 — PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETRY

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:

A. Provide all labor, materials, equipment and services required for complete installation of all plastic-laminate-clad architectural cabinetry indicated on Drawings and specified herein.

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

1. Division 6 Section "Rough Carpentry" for furring, blocking, and other carpentry work that is not exposed to view.
2. Division 8 Section "Flush Wood Doors" for doors specified by reference to architectural woodwork standards.

1.3 Submittals:

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of product and process specified in this section and incorporated into items of plastic-laminate-clad architectural cabinetry during fabrication, finishing, and installation.

C. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components. Shop Drawing submittals shall follow the same numbering sequence as the Architectural Drawings.

D. Plastic laminate samples for verification purposes.

E. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.

F. Product samples, three each, of each type item to be stained.

1.4 Quality Assurance:

A. Manufacturer Qualifications: Firm experienced in successfully producing plastic-laminate-clad architectural cabinetry similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.

B. Single-Source Manufacturing and Installation Responsibility: Engage a qualified Manufacturer to assume undivided responsibility for woodwork specified in this section, including fabrication, finishing, and installation.

C. AWI Quality Standard: Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI) except as otherwise indicated.

D. Plastic-laminate-clad architectural cabinetry fabricators requesting approval shall submit evidence of at least 5 years experience and installations for similar type of project. Fabricators shall submit a written request with a detailed list of any deviations from the Contract Documents for approval. Samples may be impounded by Owner and retained until completion of job for verification and compliance with Specifications.

1.5 Delivery, Storage and Handling:

A. Protect woodwork during transit, delivery, storage and handling to prevent damage, soilage and deterioration.

B. Do not deliver woodwork until painting, wet work, grinding and similar operations which could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas meeting requirements specified in "Project Conditions."

1.6 Project Conditions:

A. Environmental Conditions: Obtain and comply with Woodwork Manufacturer's and Installer's coordinated advice for optimum temperature and humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained and stabilized so that woodwork is within plus or minus 1.0 percent of optimum moisture content from date of installation through remainder of construction period.

B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing woodwork; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with manufacture of woodwork without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

PART 2 — PRODUCTS

2.1 High Pressure Decorative Laminate Manufacturers: Subject to compliance with requirements, provide high pressure decorative laminates indicated on Finish Schedule in Contract Documents by the following:

A. Formica Corp.

B. Nevamar Corp.

C. Wilsonart

Selections will be made from manufacturer's full product line, including solids, woodgrains and patterns.

2.2 Materials:

A. General: Provide materials that comply with requirements of the AWI woodworking standard for each type of woodwork and quality grade indicated and, where the following products are part of woodwork, with requirements of the referenced product standards, that apply to product characteristics indicated:

1. Hardboard: ANSI/AHA A135.4
2. High Pressure Laminate: NEMA LD 3.
3. Medium Density Fiberboard: ANSI A208.2.

4. Particleboard: ANSI A208.1.
5. Softwood Plywood: PS 1.

2.3 Fabrication, General:

A. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber in relation to relative humidity conditions existing during time of fabrication and in installation areas.
B. Fabricate woodwork to dimensions, profiles, and details indicated.
C. Complete fabrication, including assembly, finishing, and hardware application, before shipment to project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
D. Factory-cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges of cutouts with a water-resistant coating.
E. Open-faced cabinets and cabinets with glass doors shall have laminate finish to match exterior face of cabinet on interior faces of cabinets and shelves.
F. Overhead cabinets shall have laminate finish to match exterior face of cabinet on underside of overhead cabinets.
G. Edges shall match exterior cabinet face laminate, including edge laminates that are not "the casework manufacturer's standard edge options." Edge laminate selections shall be made from the plastic laminate manufacturer's full range of options.
H. Toe kicks shall have laminate finish to match exterior face of cabinet.

2.4 Plastic-Laminate-Clad Cabinets (Plastic-Covered Millwork):

A. Quality Standard: Comply with AWI Section 400 and its Division 400B "Laminate Clad Cabinets".
B. Grade: Custom.
C. AWI Type of Cabinet Construction: Flush overlay.
D. Laminate Cladding: High pressure decorative laminate complying with the following requirements:
   1. Match color, pattern, and finish indicated on Finish Schedule in Contract Documents.
   2. Plastic laminate selections shall be made from the plastic laminate manufacturer's full range of options.
E. Laminate Grade for Exposed Surfaces: Provide laminate cladding complying with the following requirements for type of surface and grade.
   1. Horizontal Surfaces: GP-50 (0.050-inch nominal thickness).
   2. Vertical Surfaces: GP-28 (0.028-inch nominal thickness).
   3. Semiexposed Surfaces: High pressure laminate, CL-20.
   4. Tempered Hardboard Panels: Woodwork manufacturer's standard low pressure laminate.

2.5 Cabinet Hardware and Accessory Materials:

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
B. Hinges: Blum Model 170 Concealed Hinges for 170° opening and flush overlay application. Hinges shall be self-closing.

C. Pulls: Stanley 4484 US26D.
D. Drawer Slides: Blum BS 430E Full Extension Drawer Runners, 100 lb. capacity, white or almond epoxy coated finish as selected by Architect.
E. Shelf Supports: Blum 34.0040 Shelf Supports, nylon with steel pin, clear finish as selected by Architect.
F. Pencil Drawers (See interior elevations for locations): Provide OFS, PD-1, Slim Line Drawer, Black, available from PSI, 113 N. Court St., Florence, AL 35630, Tel. (256)764-8061.
G. Cable Grommets (See interior elevations for locations): Nominal 2-1/2" diameter plastic cable hole cover with breakaway tab in black color.
H. Keyboard Drawers (See interior elevations for locations): Provide HON, 4028P, 30" wide pull out tray drawer, Black Metal, available from PSI, 113 N. Court St., Florence, AL 35630, Tel. (256)764-8061.
I. Wire Managers (See interior elevations for locations): Doug Mockett WM-2A Black or approved equal.
J. False Front Drawer Trays (See interior elevations for locations): Rev-A-Shelf No. 6581-1404-41-4, 14-1/4" false front drawer trays with self-holding concealed hinges.
K. Hanging File Frames: Universal UNV-17000 Letter-Size Hanging Folder Frames or approved equal.
L. Support Brackets: Shall be as manufactured by Rangine Corporation, 114 Union Street, Millis, Massachusetts 02054, Tel. (800) 826-6006, Fax. (508) 376-8079, Website www.rakks.com or approved equal.
    1. Sill Brackets: Rakks 3.5" x 3.5" x 4" x 6", structural aluminum angle, Color: Mill (unfinished).
    2. Countertop Support Brackets: Rakks EH-1818, 6063 T-6 "T" shaped extruded aluminum countertop support bracket, Color: Mill.
    3. Flush-Mounted Countertop Support Brackets: Rakks EH1209-FM, 6063 T-6 "T" shaped extruded aluminum countertop support bracket, Color: Mill.

2.6 Fasteners and Anchors:
A. Screws: Select material, type, size, and finish required for each use. Comply with FS FF-S-111 for applicable requirements.
B. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.
C. Anchors: Select material, type, size, and finish required by each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

PART 3 — EXECUTION

3.1 Preparation:
A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.
B. Before installing plastic-laminate-clad architectural cabinetry, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.2 Installation:

A. Quality Standard: Install woodwork to comply with AWI Section 1700 for same grade specified in Part 2 of this section for type of woodwork involved.

B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 8'-0" for plumb and level (including tops) and with no variations in flushness of adjoining surfaces.

C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation.

END OF SECTION 06 41 16

SECTION 06 61 13 — CULTURED MARBLE FABRICATIONS

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work: Provide all labor, materials, equipment and services required for complete installation of all cultured marble fabrications indicated on Drawings and specified herein.

1.3 Submittals:
- A. Samples: Submit manufacturer's complete color and pattern selections for Architect's approval.

PART 2 — PRODUCTS

2.1 Cultured Marble Window Stools: Shall be 3/4" thick calcium carbonate-polyester resin composition with beveled top and side edging.

2.2 Adhesive: Shall be as recommended by manufacturer.

PART 3 — EXECUTION

3.1 Fabrication: To the greatest extent possible, cutting and edge finishing shall be done in the Fabricator's shop using tools, equipment and methods recommended by the manufacturer.

3.2 Installation:
- A. Install window stools and countertops using adhesives or fasteners recommended by the manufacturer.
- B. All joints shall be plumb and true, all surfaces flush at joints.
- C. All joints shall be filled with sealant and rubbed smooth.
- D. Clean and protect finished surfaces in accordance with manufacturer's recommendations and instructions.

END OF SECTION 06 61 13

SECTION 07 21 00 — THERMAL INSULATION

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work: Provide all labor, materials, equipment and services required for complete installation of all thermal insulation indicated on Drawings and specified herein.

1.3 Quality Assurance:

A. Thermal Resistivity: Where thermal resistivity properties or insulation materials are designated by R-values they represent the rate of heat flow through a homogenous material exactly 1" thick, measured by test method included in referenced material standard or otherwise indicated. They are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.

1.4 Submittals: Submit manufacturer's product literature and installation instructions for each type of insulation and vapor retarder material required.

1.5 Delivery, Storage and Handling:

A. General Protection: Protect insulation from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

B. Protection for Plastic Insulation:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver plastic insulating materials to project site ahead of installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of work.

PART 2 — PRODUCTS

2.1 Perimeter Insulation (Under slabs on grade): 1" thick extruded polystyrene boards equal to Owens Corning Foamular 250 or approved equal in widths as indicated on the Drawings.

2.2 Batt Insulation (R-15): 3 1/2" fiberglass vinyl faced batts as manufactured by Owens-Corning, Manville or approved equal.

2.3 Batt Insulation (R-19): 6" fiberglass Kraft faced batts as manufactured by Owens-Corning, Manville or approved equal.

2.4 Sound Control Blankets: 3-1/2" un-faced fiberglass batts as manufactured by Johns-Manville or approved equal.

PART 3 — EXECUTION

3.1 Installation:

A. General:

1. Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with work.
2. Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement.
3. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.

B. Installation of Wall Insulation:

1. Batt Insulation (Metal Stud Walls): Install between metal studs by lapping flanges in accordance with manufacturer's recommendations.

C. Installation of Sound Control Blankets: Install in accordance with manufacturer's recommendations, completely filling the wall cavity with blankets in widths proper for stud spacing.

D. Perimeter Insulation: Protect insulation on vertical and horizontal surfaces from damage during backfilling and concrete work. Install in longest possible lengths, butting joints tightly.

3.2 Protection:

A. General: Protect installed insulation and vapor retarders from harmful weather exposures and from possible physical abuses, where possible by non-delayed installation of concealing work, or where that is not possible, by temporary covering or enclosure.

END OF SECTION 07 21 00

SECTION 07 84 00 — FIRESTOPPING

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all labor, materials, equipment and services required for complete installation of firestopping indicated on Drawings and specified herein.
- B. Sections Includes:
  1. Through-penetration firestopping in fire rated construction.
- C. Related Items:
  1. Fire rated masonry walls: Refer to Section 04 20 00.
  2. Fire rated drywall partitions: Refer to Section 09 21 16.

1.3 References:
- A. Underwriters Laboratories:
  1. Fire Resistance Directory.
     - a) Through-penetration firestop devices (XHCR).
     - b) Fire resistance ratings (BXUV).
     - c) Through-penetration firestop systems (XHEZ).
     - d) Fill, void, or cavity material (XHHW).
- B. American Society for Testing and Materials Standards:
  1. ASTM E 814 - 88: Standard Test Method for Fire Tests of Through-Penetration Firestops.

1.4 Definitions:
- A. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in reference documents.
- B. Barriers: Time rated fire walls, smoke barrier walls, time rated ceiling/floor assemblies and structural floors.
- C. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gasses and smoke.
- D. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.
- E. Construction Gaps: Gaps between adjacent sections of walls, exterior walls, at wall tops between top of wall and ceiling, and structural floors or roof decks; and gaps between adjacent sections of structural floors.
- F. System: Specific products and applications, classified and numbered by Underwriters Laboratories, Inc. to close specific barrier penetrations.
- G. Sleeve: Metal fabrication or pipe section extending through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

1.5 System Description:

A. Design Requirements:
   1. Fire-rated construction: Maintain barrier and structural floor fire resistance ratings including resistance to cold smoke at all penetrations, connections with other surfaces or types of construction, at separations required to permit building movement and sound or vibration absorption, and at other construction gaps.
   2. Smoke barrier construction: Maintain barrier and structural floor resistance to cold smoke at all penetrations, connections with other surfaces and types of construction and at all separations required to permit building movement and sound or vibration absorption, and other construction gaps.

1.6 Submittals:
A. Submit in accordance with Section 01 33 00, unless otherwise indicated.
B. Product Data: Manufacturer's specifications and technical data including the following:
   1. Detailed specification of construction and fabrication.
   2. Manufacturer's installation instructions.
C. Shop Drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements:
   1. Details of each proposed assembly identifying intended products and applicable UL System number, or UL classified devices.
   2. Manufacturer or manufacturers representative shall provide qualified engineering judgments and drawings relating to non-standard applications as needed.

1.7 Quality Assurance:
A. Installer's Qualifications: Firm experienced in installation or application of systems similar in complexity to those required for this project, plus the following:
   1. Acceptable to or licensed by manufacturer, state or local authority where applicable.
   2. At least 2 years experience with systems.
   3. Successfully completed at least 5 comparable scale projects using this system.
B. Local and State Regulatory Requirements: Submit forms or acceptance for proposed assemblies not conforming to specific UL Fire System numbers, or UL classified devices.
C. Materials shall have been tested to provide fire rating at least equal to that of the construction.

1.8 Delivery, Storage and Handling:
A. Packing and Shipping:
   1. Deliver products in original unopened packaging with legible manufacturer's identification.
   2. Coordinate delivery with scheduled installation date; allow minimum storage at site.
B. Storage and Protection: Store materials in a clean, dry, ventilated location. Protect from soiling abuse, moisture and freezing when required. Follow manufacturer's instructions.

1.9 Project Conditions:
A. Existing Conditions:
   1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

2. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

B. Environmental Requirements:
1. Furnish adequate ventilation if using solvent.
2. Furnish forced air ventilation during installation if required by manufacturer.
3. Keep flammable materials away from sparks or flame.
4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.
5. Comply with manufacturing recommendations for temperature and humidity conditions before, during and after installation of firestopping.

1.10 Guarantee:

A. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, co-adhesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be one year from date of substantial completion.

PART 2 — PRODUCTS

2.1 Through-Penetration Firestopping of Fire-Rated Construction:

A. Systems or devices listed in the U.L. Fire Resistance Directory under categories XHCR and XHEZ may be used, providing that it conforms to the construction type, penetrant type, annular space requirements and fire rating involved in each separate instance, and that the system be symmetrical for wall applications. Systems or devices must be asbestos-free.
1. Additional requirements: Withstand the passage of cold smoke either as an inherent property of the system, or by the use of a separate product included as a part of the U.L. system or device, and designed to perform this function.
2. Acceptable manufacturers and products.
a) Those listed in the U.L. Fire Resistance directory for the U.L. System involved.
3. All firestopping products must be from a single manufacturer. All trades shall use products from the same manufacturer.

B. Firestopping at Fire-Rated Masonry Construction: Shall be accomplished in accordance with UL System #95 using Fire Barrier FS-195 Wrap/Strip and Fire Barrier CP-25 Caulk as manufactured by 3M or approved equal.

C. Firestopping at Fire-Rated Drywall Construction: Shall be accomplished in accordance with UL System #147 (B) using Fire Barrier FS-195 Wrap/Strip and Fire Barrier CP 25 Caulk as manufactured by 3M or approved equal.

2.2 Accessories:

A. Fill, Void or Cavity Materials: As classified under category XHHW in the U.L. Fire Resistance Directory.

B. Forming Materials: As classified under category XHKU in the U.L. Fire Resistance Directory.

PART 3 — EXECUTION

3.1 Examination:

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
   1. Verify barrier penetrations are properly sized and in suitable condition for application of materials.
   2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 Preparation:

A. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose materials, rust, other substances that may affect proper fitting, adhesion, or the required fire resistance.

3.3 Installation:

A. Install penetration seal materials in accordance with printed instructions of the U.L. Fire Resistance Directory and in accordance with manufacturer's instructions.
B. Seal holes or voids made by penetrations to ensure an effective smoke barrier.
C. Protect materials from damage on surfaces subject to traffic.
D. Where large openings are created in walls or floors to permit installation of pipes, ducts, cable tray, bus duct or other items, close unused portions of opening with firestopping material tested for the application.

3.4 Field Quality Control:

A. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.
B. Keep areas of work accessible until inspection by applicable code authorities.
C. Perform under this section patching and repairing of firestopping caused by cutting or penetration by other trades.

3.5 Adjusting and Cleaning:

A. Clean up spills of liquid components.
B. Neatly cut and trim materials as required.
C. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

END OF SECTION 07 84 00

SECTION 07 92 00 — JOINT SEALANTS

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work: Provide all labor, materials, equipment and services required for complete installation of all joint sealants indicated on Drawings and specified herein.

1.3 Quality Assurance:

A. General Performance: Except as otherwise indicated, joint sealers are required to establish and maintain airtight and waterproof continuous seals on a permanent basis, within recognized limitations of wear and aging as indicated for each application. Failure of installed sealers to comply with this requirement will be recognized as failure of materials and workmanship.

1.4 Submittals: Submit sealant color cards for selection by Architect.

PART 2 — PRODUCTS

2.1 Caulking: Shall be as manufactured by Dap or Pecora and shall be equal to Pecora "AC-20 Acrylic Latex Caulk."

2.2 Sealants: Shall be as manufactured by Tremco, Dap, or Pecora and shall be equal to Tremco "Mono" 1-Part Acrylic Terpolymer. Color as selected by Architect from manufacturer's standard colors.

2.3 Backer Rods: Shall be an extruded, closed cell polyethylene foam.

PART 3 — EXECUTION

3.1 Sealant and Caulking Locations:

A. Caulking: Install at interior hollow metal frames, aluminum windows, wood windows and other voids as necessary to ensure uniform surface finish.

B. Sealants: Perimeter of door, window and glazing frames and other openings in exterior walls. Apply solid bead under all aluminum thresholds.

3.2 Joint Preparation:

A. Clean joint surfaces immediately before installation of sealant or caulking compound. Remove dirt, insecure coatings, moisture and other substances that could interfere with bond sealant or caulking compound. Etch concrete and masonry joint surfaces as recommended by sealant manufacturer. Roughen vitreous and glazed joint surfaces as recommended by sealant manufacturer.

B. Prime or seal joint surfaces where indicated, and where recommended by sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.

3.3 Installation:

A. Set joint filler units at proper depth or position in joint to coordinate with other work, including installation of bond breakers, backer rods and sealants. Do not leave voids or gaps between ends of joint filler units.

B. Install sealant backer rod for liquid elastomeric sealants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for application indicated.

C. Employ only proven installation techniques, which will ensure that sealants are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally to a lightly concave surface, slightly below adjoining surfaces. Where horizontal surface and vertical surface, fill joint to form a slight cove, so that joint will not trap moisture or dirt.

D. Install sealant to depths as shown, or if not shown, as recommended by sealant manufacturer.

E. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.

3.4 Cure and Protection: Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability. Advise Contractor of procedures required for cure and protection of joint sealers during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at time of substantial completion.

END OF SECTION 07 92 00

SECTION 08 11 13 — HOLLOW METAL DOORS AND FRAMES

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work: Provide all labor, materials, equipment and services required for complete installation of hollow metal doors and frames indicated on Drawings and specified herein.

1.3 Submittals: Submit shop drawings indicating location and size of each door and frame and including manufacturer's standard details.

1.4 Quality Assurance:

A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications: Standard Steel Doors and Frames" (SDI-100) and as herein specified.

B. Manufacturer: Provide standard hollow metal doors and frames by a single firm specializing in production of this type of work. Provide hollow metal doors and frames by one of the following:

1. Ceco Corp.
2. Republic Builders Prod. Corp.
3. SteelCraft Mfg. Co.

Ceco product numbers are used for reference only.

PART 2 — PRODUCTS

2.1 Insulated Metal Doors:

A. Ceco "Full Flush Imperial" or equal.

B. Doors shall be Grade II, heavy-duty, Model 1, full flush design, minimum 0.0516 inch (1.3 mm) thick galvanized steel sheet faces.

C. Fabricated of 18 gauge steel face sheets and 16 gauge flush top and bottom channels.

1. Provide A60 galvanized face sheets and channels. Provide silicone sealant at top channel of the galvanized door.

D. Core shall be completely filled with rigid urethane formed in place and chemically bonded to all interior door surfaces.

E. Doors shall be fabricated with sill clearances to allow for thresholds as specified where thresholds are indicated.

F. Shop paint exposed surfaces using manufacturer's standard baked-on rust inhibitive primer.

G. Close top and bottom edges of exterior doors as integral part of door construction or by addition of inverted steel channels.

2.2 Welded Metal Frames:

A. Exterior frames shall be fabricated from 16-gage galvanized steel.

B. Fabricated of 16 gauge sheet steel and of dimensions and shapes indicated on the Drawings.
C. Joints shall be mitered at intersection of head and jambs and shall be continuously factory arc-welded for full depth and width of frame with all welds ground smooth.
D. Furnish with appropriate anchors required for wall construction in which the frames are to be installed.
E. Door frames shall be punched to receive rubber or vinyl silencers. Provide 2 silencers on lock side of single doors.
F. Shop paint exposed surfaces using manufacturer's standard baked-on rust inhibitive primer.
G. Prep frames at strike for future installation of electronic strike.

2.3 Hardware Preparation: Prepare hollow metal units to receive mortised and concealed finish hardware, including cutouts, reinforcing, drilling, and tapping, complying with ANSI A 115, "Specifications for Door and Frame and Preparation for Hardware".

PART 3 — EXECUTION

3.1 Inspection: Installer must examine substrate and conditions under which steel doors and frames are to be installed and must notify Contractor in writing of any conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 Installation:
A. General: Install standard hollow metal doors, frames and accessories in accordance with final shop drawings and manufacturer's data, and as herein specified.
B. Placing Frames:
1. Comply with provision of SDI-105 "Recommended Erection Instructions for Steel Frames", unless otherwise indicated.
2. Place frames prior to construction of enclosing walls and ceiling. Set frames accurately in position, plumbed, aligned and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
3. In masonry construction, locate 3 wall anchors per jamb at hinge and strike levels. Building-in of anchors and grouting of frames is specified in Division 4.
4. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
C. Door Installation: Fit hollow metal doors accurately in frames; within clearances specified in SDI-100.

3.3 Adjust and Clean:
A. Prime Coat Touch-up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air drying primer.
B. Final Adjustments: Check and readjust operating finish hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

END OF SECTION 08 11 13

SECTION 08 14 16 — FLUSH WOOD DOORS

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work: Provide all labor, materials, equipment and services required for complete installation of all flush wood doors indicated on Drawings and specified herein.

1.3 Submittals:

A. Product Data: Door manufacturer's technical data for each type of door, including details of core and edge construction, trim for openings and louvers, and factory-finishing specifications, if required.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate fire ratings for fire doors.

1.4 Quality Assurance:

A. NWWDA Quality Standard: I.S.1-A "Architectural Wood Flush Doors," of National Wood Window and Door Association (NWWDA).

B. AWI Quality Standard: "Architectural Woodwork Quality Standards Illustrated," including Section 1300 "Architectural Flush Doors," of Architectural Woodwork Institute (AWI) for grade of door, core construction, finish and other requirements exceeding those of NWWDA quality standard.

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

D. Manufacturer: Obtain doors from a single manufacturer.

1.5 Delivery, Storage, and Handling:

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 Project Conditions:

A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.7 Warranty:

A. General: Warranties shall be in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.

B. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 75-mm) span.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
2. Warranty shall be in effect during the following period of time from date of Substantial Completion:
   a) Solid-Core Interior Doors: Two years.

PART 2 — PRODUCTS

2.1 Manufacturer: Subject to compliance with requirements, provide doors of one of the following:

A. Algoma Hardwoods, Inc.
B. Eggers Industries, Architectural Door Division
C. Ipik Door Co., Inc.
D. Weyerhaeuser Company.
Weyerhaeuser product numbers are used only for reference to quality and standards required.

2.2 Interior Flush Solid Core Wood Doors: Shall be Marshfield Door Systems DPC-1 Solid Particle Board Core Door or approved equal in sizes and thicknesses indicated on the Drawings which meet or exceed NWWDA Industry Standards I.S. 1 Series and Architectural Woodwork Institute for Type SLC-5. Face doors with premium grade, rotary cut, select white birch. Embed red dowel in door edge. Trim light openings with W-2 wood moulding (glazing by others).

2.3 Fabrication:

A. Fabricate doors in sizes indicated for Project-site fitting.

B. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:

1. Comply with clearance requirements of referenced quality standard for fitting.

C. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

D. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.

1. Light Openings: Trim openings with moldings of material and profile indicated. Architect to approve paint / stain color and coverage of same prior to installation of glass. Caulk / sealant is to match paint / stain; "clear" will not be accepted.
2. Louvers: Factory install louvers in prepared openings.

PART 3 — EXECUTION

3.1 Examination:

A. Examine doors and installed door frames before hanging doors.
   1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation:

A. Hardware: For installation, see Division 8 Section "Door Hardware."
B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.
   1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold.
   2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
D. Field-Finished Doors: Refer to the following for finishing requirements:
   1. Division 9 Section "Painting."

3.3 Adjusting:

A. Operation: Rehang or replace doors that do not swing or operate freely.
B. Protection and Completed Work: Advise Contractor of proper procedures required for protection of installed wood doors from damage or deterioration until acceptance of work.

END OF SECTION 08 14 16

SECTION 08 33 23 — OVERHEAD COILING DOORS

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work: Provide all labor, materials, equipment and services required for complete installation of overhead coiling doors indicated on Drawings and specified herein.

1.3 Submittals: Submit manufacturer's product data shop drawings, roughing-in diagrams and installation instructions for overhead coiling doors specified. Include operating and maintenance instructions.

1.4 Delivery, Storage, and Handling:
- A. General: Comply with Division 1 Product Requirements.
- B. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- D. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

1.5 Warranty:
- A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard two-year warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under contract documents.

1.6 Manufacturer: Subject to compliance with requirements, provide products of one of the following:
- A. The Cookson Co.
- B. Cornell Iron Works, Inc.
- C. Kinnear
- D. North American Door, Division of Jim Walters
- E. Overhead Door Corp.
- F. Raynor Door
- G. Wilson Corp.

Cornell specifications given for reference and standards only.

PART 2 — PRODUCTS

2.1 Overhead Coiling Doors: Shall be Model ESD20 as manufactured by Cornell Iron Works, Inc., Crestwood Industrial Park, Mountaintop, PA 18707. Telephone: (800) 233-8366, Fax: (800) 526-0841 or prior approved equal.

A. Locations: Doors 134B, 134C, 136C, 136D, 136E, 136F, 137B

B. Curtain:

1. Slat Material: No. 6F
   a) Galvanized Steel/Galvanized Steel: 24/24 gauge, Grade 40, ASTM A 653 galvanized steel zinc coating.
2. Insulation: 7/8 inch (22 mm) foamed-in-place, closed cell urethane.
3. Total Slat Thickness: 15/16 inch (24 mm).
4. Slats have a Flame Spread Index of 0 and a Smoke Developed Index of 10 as tested per ASTM E84.
5. Slat has an R-value of 8.0 and an STC rating of 26.

C. Bottom Bar: Reinforced extruded aluminum interior face with full depth insulation and exterior skin slat to match curtain material and gauge.

D. Fabricate interlocking sections with high strength nylon endlocks on alternate slats each secured with two 1/4" (6.35 mm) rivets. Provide windlocks as required to meet specified wind load.

E. Slat Finish:

1. Exterior Slat Finish: GalvaNex™ Coating System and phosphate treatment followed by baked-on polyester powder coat, color as selected by Architect from manufacturer's standard color range, minimum 32 colors; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
2. Interior Slat Finish: GalvaNex™ Coating System and phosphate treatment followed by baked-on polyester powder coat, color as selected by Architect from manufacturer's standard color range, minimum 32 colors; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.

F. Curtain Configuration: Standard.

G. Bottom Bar Finish:

1. Exterior Face: Match slats.
2. Interior Face: Powder coat to match slats.

H. Bottom Bar Configuration: Standard.

I. Guides: Fabricate with minimum 3/16 inch (4.76 mm) structural steel angles. Provide windlock bars of same material when windlocks are required to meet specified wind load. Top of inner and outer guide angles to be flared outwards to form bellmouth for smooth entry of curtain into guides. Provide removable guide stoppers to prevent over travel of curtain and bottom bar.

1. Top 16-1/2" (419.10 mm) of coil side guide angles to be removable for ease of curtain installation and as needed for future curtain service.
2. Finish: Phosphate treatment followed by baked-on polyester powder coat, color as selected by Architect from manufacturer's standard color range, minimum 32 colors; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
3. Configuration: Standard.

J. Counterbalance Shaft Assembly:

1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width.
2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs (110 N). Provide wheel for applying and adjusting spring torque.

K. Brackets: Fabricate from minimum 3/16 inch (5 mm) steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.
   1. Finish: Phosphate treatment followed by baked-on polyester powder coat, color as selected by Architect from manufacturer's standard color range; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.

L. Hood: 24 gauge galvanized steel with reinforced top and bottom edges. Provide minimum 1/4 inch (6.35 mm) steel intermediate support brackets as required to prevent excessive sag.
   1. Finish: GalvaNex™mark Coating System and phosphate treatment followed by baked-on polyester powder coat, color as selected by Architect from manufacturer's standard color range, minimum 32 colors; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.

M. Weatherstripping:
   1. Bottom Bar: Replaceable, bulb-style, compressible EDPM gasket extending into guides.
   2. Guides: Replaceable vinyl strip on guides sealing against fascia side of curtain.
   3. Lintel Seal: Nylon brush seal fitted at door header to impede air flow.
   4. Hood: Neoprene/rayon baffle to impede air flow above coil.

N. Locking:
   1. Manual Chain Hoist: Padlockable chain keeper on guide.

O. Operation:
   1. Manual Chain Hoist: Provide chain hoist operator with endless steel chain, chain pocket wheel and guard, geared reduction unit, and chain keeper secured to guide.

P. Door Operator: Cornell Model SG Electric Motor Operator.
   1. Industrial Duty:
      a) Continuous duty, UL listed, total enclosed fan cooled gear head operator.
      b) 1/2 to 7-1/2 hp, as recommended by door manufacturer for size and type of door.
      c) 120 Volts, 1 Phase.
      d) Operator shall be provided with factory pre-wired motor control terminals, maintenance free solenoid actuated brake, emergency manual chain hoist provided up to 2 HP and control station(s).
      e) Motor shall be high starting torque, industrial type, with overload protection.
      f) Primary speed reduction shall be heavy-duty gears running in grease or oil bath with mechanical braking to hold the door in any position.
      g) The emergency manual chain hoist assembly is automatically disengaged when motor is energized. A disconnect chain shall not be required to engage or release the manual chain hoist.
      h) Operator drive and door driven sprockets shall be provided with minimum #50 roller chain.
      i) Operator shall be capable of driving the door at a speed of 8 to 9 inches per second (20 to 23 cm/sec).
      j) Fully adjustable, driven linear screw type cam limit switch mechanism shall synchronize the operator with the door. The motor shall be removable without affecting the limit switch settings.
      k) The electrical contractor shall mount the control station(s) and supply the appropriate disconnect switch, all conduit and wiring per the overhead door wiring instructions.
   2. Control Station: Surface mounted, "Open/Close/Stop" push buttons; NEMA 1.

3. Entrapment Protection: Provide the following primary entrapment protection device to enable momentary contact close operation.
   a) Provide a 2-wire, E.L.R. electric sensing/weather edge seal extending full width of door bottom bar. Contact before door fully closes shall cause the door to immediately stop downward travel and reverse direction to the fully opened position. Provide a retracting safety cord and reel connection to control circuit.
4. Warranty: 2 years.

PART 3 — EXECUTION

3.1 Examination:
   A. Site Verification of Conditions: Verify through direct observation and field measurement that site conditions are acceptable for installation of doors, operators, controls and accessories. Ensure that openings square, flush and plumb.
   B. Do not proceed with installation of doors, operators, controls and accessories until unacceptable conditions are corrected.

3.2 Installation:
   A. General: Install door, guide and operating equipment complete with all necessary accessories and hardware according to shop drawings, manufacturer's instructions.
   B. Upon completion of installation, including work by other trades, lubricate, test and adjust doors to operate easily, free from warp, twist or distortion and fitting weathertight for entire perimeter.

3.3 Cleaning:
   A. Remove temporary coverings and protection of adjacent work areas. Repair or replace installed products damaged prior to or during installation.
   B. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove and legally dispose of construction debris from project site.

END OF SECTION 08 33 23

SECTION 08 41 13 — ALUMINUM–FRAMED ENTRANCES AND STOREFRONTS

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all labor, materials, equipment and services required for complete installation of aluminum-framed entrances and storefronts indicated on Drawings and specified herein.
- B. Related Work Specified Elsewhere: Section 07 92 00 - Joint Sealers, Section 08 71 00 - Door Hardware, and Section 08 81 00 – Glass Glazing.

1.3 Submittals: Furnish complete shop drawings to the Architect for approval.

1.4 Manufacturer: Provide products by one of the following or an approved equal.
- A. Kawneer
- B. Amarlite
- C. PPG

Kawneer product numbers are used for reference only.

PART 2 — PRODUCTS

2.1 Frames: Aluminum door and glazing frames shall be 2" x 4-1/2" OR 4-1/2” x 4-1/2” flush-glazed sections and equal to Kawneer "TriFab II 451 VG" Storefront Framing.

2.2 Aluminum/Glass Doors: 1-3/4” depth with snap-in type glazing stops without exposed screws and equal to Kawneer Medium Stile “350” with square glass stops for 1” glazing.

2.3 Hardware:
- A. Concealed Overhead Closers: Rixson 91 Series single-acting manual concealed overhead closer ("Husky").
- B. Offset Pivots: Kawneer standard aluminum top and bottom pivots. Finish shall be baked epoxy to match door finish. Omit bottom pivots at floor closers.
- C. Intermediate Offset Pivots: Kawneer aluminum intermediate offset pivot fully mortised into the door and frame and having 3/4" offset from the door face. Finish shall be baked epoxy to match the door finish. Provide two (2) intermediate offset pivots at all 8'-0" high doors.
- D. Thresholds: Standard 1/2" x 4" extruded mill finish aluminum threshold for offset pivot and overhead closer.
- E. Weatherstripping: Manufacturer's complete weatherstripping and sill strips.
- F. Locking Cylinders: Furnished under Section 08 71 00 – Door Hardware.

G. Pulls (101A): Kawneer "Architects Classic" Style CO-12 Pulls, US32D Dull Stainless Steel finish.
H. Push Bars (101A): Kawneer "Architects Classic" Style CP-II, US32D Dull Stainless Steel Finish.

2.4 Finish:
A. All exposed surfaces of aluminum door and framing members shall be free of scratches and other serious surface blemishes.
B. Aluminum moldings shall be given a caustic etch followed by an anodic oxide treatment to obtain an Architectural Class II clear anodic coating conforming to Aluminum Association Standard AA-M12 C22 A31. Color shall be selected by Architect.

PART 3 — EXECUTION

3.1 Installation:
A. Comply with manufacturer's instructions and recommendations for installation of aluminum-framed entrances and storefronts.
B. Set units plumb, level, and true to line, without warp or rack of framing members, doors, or panels. Anchor securely in place, separating aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
C. Drill and tap frames and doors and apply surface-mounted hardware items, complying with hardware manufacturer's instructions and template requirements. Use concealed fasteners whenever possible.
D. Set sill members and other members in bed of compound as shown, or with joint fillers or gaskets as shown to provide weathertight construction. Comply with requirements of Division 7 for compounds, fillers and gaskets.
E. Refer to "Glass Glazing" section of Division 8 for installation of glass and other panels shown to be glazed into doors and framing, and not preglazed by manufacturer.

3.2 Adjust and Clean:
A. Adjust operating hardware to function properly, without binding, and to provide tight fit at contact points and weatherstripping.
B. Clean completed system, inside and out, promptly after erection and installation of glass and sealants. Remove excess glazing and sealant compounds, dirt, and other substances from aluminum surfaces.
C. Remove protective coating when completion of construction activities no longer requires its retention.
D. Institute protective measures and other precautions required to assure that aluminum-framed entrances and storefronts will be without damage or deterioration, other than normal weathering, at time of acceptance.

END OF SECTION 08 41 13

SECTION 08 42 13 — ALUMINUM FRAMES

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all labor, materials, equipment and services required for complete installation of aluminum-framed entrances and storefronts indicated on Drawings and specified herein.
- B. Related Work Specified Elsewhere: Section 07 92 00 - Joint Sealers and Section 08 81 00 - Glass Glazing.

1.3 Submittals: Furnish complete shop drawings to the Architect for approval.

1.4 Manufacturer: Provide products by one of the following or an approved equal.
- A. Kawneer
- B. Amarlite
- C. PPG

Kawneer product numbers are used for reference only.

PART 2 — PRODUCTS

2.1 Window Frames: Window glazing frames shall be 1-3/4" x 4-1/2" flush glazed framing sections capable of glazing 1" insulated glass and equal to Kawneer "Tri-Fab II 450."

2.2 Finish:
- A. All exposed surfaces of aluminum framing members shall be free of scratches and other serious surface blemishes.
- B. Aluminum moldings shall be given a caustic etch followed by an anodic oxide treatment to obtain an Architectural Class I Color Anodic Coating conforming with Aluminum Association Standard AAM12C22A42/44. Color shall be selected by Architect.

PART 3 — EXECUTION

3.1 Installation:
- A. Comply with manufacturer's instructions and recommendations for installation of aluminum frames.
- B. Set units plumb, level, and true to line, without warp or rack of framing members or panels. Anchor securely in place, separating aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

C. Drill and tap frames and apply surface-mounted hardware items, complying with hardware manufacturer's instructions and template requirements. Use concealed fasteners whenever possible.
D. Set sill members and other members in bed of compound as shown, or with joint fillers or gaskets as shown to provide weathertight construction. Comply with requirements of Division 7 for compounds, fillers and gaskets.
E. Refer to "Glass Glazing" section of Division 8 for installation of glass and other panels shown to be glazed into doors and framing, and not preglazed by manufacturer.

3.2 Adjust and Clean:
A. Adjust operating hardware to function properly, without binding, and to provide tight fit at contact points and weatherstripping.
B. Clean completed system, inside and out, promptly after erection and installation of glass and sealants. Remove excess glazing and sealant compounds, dirt, and other substances from aluminum surfaces.
C. Remove protective coating when completion of construction activities no longer requires its retention.
D. Institute protective measures and other precautions required to assure that aluminum frames will be without damage or deterioration, other than normal weathering, at time of acceptance.

END OF SECTION 08 41 13

SECTION 08 71 00 — DOOR HARDWARE

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work: Provide all labor, materials, equipment and services required for complete installation of all door hardware indicated on Drawings and specified herein.

1.3 Guarantee: Hardware furnished under this section shall be guaranteed for a period of seven (7) years against defects in workmanship and material.

1.4 Submittals:
- A. Schedule and Samples: Submit a complete schedule of hardware equipment indicating type, number, location and finish of each item.
- B. Template Hardware: Furnish templates of hardware to manufacturers of equipment requiring use of such templates.
- C. Instructions: Provide manufacturer's installation instructions for each type of hardware.

1.5 Packaging: Each individual piece of hardware shall be packed with screws and fasteners to ensure proper installation. Application templates shall be included. Items shall be identified with reference to hardware schedule and Architect's door designation.

1.6 Manufacturers: Products of the following manufacturers or others will be accepted, if equal in all respects to design, function and quality:
- A. Hinges: Hager, Stanley, McKinney or prior approved equal.
- B. Locks and Latches: Corbin Russwin or approved equal.
- C. Panic Devices: Corbin Russwin or approved equal.
- D. Closers: Yale, Corbin Russwin or approved equal.
- E. Miscellaneous: Hager, Ives, Rockwood or prior approved equal.

PART 2 — PRODUCTS

2.1 Materials and Finish:
- A. Butts:
  1. Hager or approved equal by Stanley or McKinney.
  2. Types, sizes and finish as shown under the Hardware sets.
- B. Locks and Latches: Corbin Russwin Cylindrical Lockset CL3000 Series locksets. with NZD trim, 626 Finish.
- C. Closers:
  1. Yale or prior approved equal.
  2. Closers to be 2700 Series. Finish to match balance of hardware. Furnish parallel arms where required. All closers to have sex nuts and bolts (SNB). Furnish to match the balance of hardware.

D. Panic Devices:
   1. Corbin Russwin or prior approved equal.
   2. Panic Devices to be Corbin Russwin ED5200 Series with Newport Trim 630.
E. Kickplates:
   1. Hager or approved equal by Mckinney, Ives, Hager or prior approved equal.
   2. Kickplates to be 8" x 2" less width of door, .050 thick US32D finish.
F. Stops: Ives or approved equal by Hager or Rockwood.
G. Miscellaneous Items: US26D
   NOTE: Hardware designs specified above are for bidding basis and shall be verified on approved schedule.

2.2 Keying:
A. All locks will be masterkeyed to a new Corbin Russwin Masterkey system. All locks shall be keyed differently except in the keyed alike groups as directed.
B. Furnish two (2) keys for each differently keyed lock. Six (6) keys for each keyed alike set and four (4) master keys.
C. Locks and cylinders must be by same manufacturer.

2.3 Hardware Sets: Hardware for doors shall be as listed in the following hardware sets. Hardware scheduled is for each door or pair of doors listed in the set. Hardware for doors not listed shall match other hardware as closely as possible in suitable function and quality.

HARDWARE SETS

Hardware Set #1

Door: 101A

Each to Have:
1 pair Master Keyed Cylinders
1 each Floor Stop FS444 US26D
Balance of hardware to be furnished by Aluminum Door Supplier

Hardware Set #2

Doors: 134A, 134D

Each to Have:
3 each Hinges BB1191 4 ½ x 4 ½ US32D NRP
1 each Panic Device ED5200 M54 x N955 630
1 each Masterkeyed Cylinder
1 each Closer 2701 689
1 each Kick Plate 190S 8” x 2” LWD US32D
1 each Floor Stop FS444 US26D
1 each Threshold 425 x length required
1 each Sweep 200NA x length required
1 set Head and Jamb Weatherstripping 160VA x length required

Hardware Set #3

Doors: 135A, 137A

Each to Have:
3 each Hinges BB1191 4 ½ x 4 ½ US32D NRP
1 each Lockset CL3551 NZD 626
1 each Closer 2701 689
1 each Kick Plate 190S 8” x 2” LWD US32D
1 each Floor Stop FS444 US26D
1 each Threshold 425 x length required
1 each Sweep 200NA x length required
1 set Head and Jamb Weatherstripping 160VA x length required
1 each Latchguard LP-111 630

Hardware Set #4

Door 112A, 129A

Each to Have:

3	each	Hinges BB1279 4 ½ x 4 ½ US26D
1	each	Panic Device ED5200 M54 x N955 630
1	each	Masterkeyed Cylinder
1	each	Magnetic Lock M370
1	each	Digital Keypad DK-12
1	each	Power Supply BPS-24-1
1	each	Closer 2701 689
1	each	Kick Plate 190S 8” x 2” LWD US32D
1	each	Floor Stop FS436 US26D

Hardware Set #5

Doors: 105A, 106A, 107A, 108A, 115A, 120A, 122A, 125A, 126A, 127A, 128A, 130A, 132A, 133A, 136A, 136B

Each to Have:

3	each	Hinges BB1279 4 ½ x 4 ½ US26D
1	each	Lockset CL3551 NZD 626
1	each	Closer 2701 689
1	each	Kickplate 190S 8” x 2” LWD US32D
1	each	Floor Stop FS436 US26D / Wall Stop WS407CCV US32D
3	each	Silencers

Hardware Set #6

Doors: 102A, 113A, 123A

Each to Have:

3	each	Hinges BB1279 4 ½ x 4 ½ US26D
1	each	Lockset CL3557 NZD 626
1	each	Closer 2701 689
1	each	Kickplate 190S 8” x 2” LWD US32D
1	each	Floor Stop FS436 US26D / Wall Stop WS407CCV US32D
3	each	Silencers

Hardware Set #7

Door: 131

Each to Have:

3	each	Hinges BB1279 4 ½ x 4 ½ US26D
1	each	Lockset CL3557 NZD 626
1	each	Floor Stop FS436 US26D / Wall Stop WS407CCV US32D
3	each	Silencers

Hardware Set #8

Doors: 116A, 117A

Each to Have:

3	each	Hinges BB1279 4 ½ x 4 ½ US26D
1	each	Lockset CL3551 NZD 626
2	each	Deadbolts DL3013 626
1	each	Closer 2701 689
1	each	Floor Stop FS436 US26D
3	each	Silencers

Hardware Set #9

Doors: 104A, 111A

Each to Have:

3	each	Hinges BB1279 4 ½ x 4 ½ US26D
1	each	Privacy CL3520 NZD 626
1	each	Closer 2701 689
1	each	Kickplate 190S 8” x 2” LWD US32D
1	each	Floor Stop FS436 US26D / Wall Stop WS407CCV US32D
3	each	Silencers

Hardware Set #10

Door: 121A

Each to Have:

3	each	Hinges BB1279 4 ½ x 4 ½ US26D
1	each	Privacy CL3520 NZD 626
1	each	Floor Stop FS436 US26D / Wall Stop WS407CCV US32D
3	each	Silencers

Hardware Set #11

Door 110A, 114A, 119A

3	each	Hinges BB1279 4 ½ x 4 ½ US26D
1	each	Passage CL3520 NZD 626
1	each	Closer 2701 689
1	each	Kickplate 190S 8” x 2” LWD US32D
1	each	Floor Stop FS436 US26D / Wall Stop WS407CCV US32D
3	each	Silencers

PART 3 — EXECUTION

3.1 Installation:

A. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by Architect.

B. 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 that are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in Division 9 sections. Do not install surface-mounted items until finishes have been completed on the substrate.

C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

3.2 Adjust and Clean:

A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly as intended for the application made.

B. Final Adjustment: Wherever 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 all hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

C. Instruct Owner's personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

END OF SECTION 08 71 00

SECTION 08 81 00 — GLASS GLAZING

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all labor, materials, equipment and services required for complete installation of all glass glazing work indicated on Drawings and specified herein.
- B. Related Work Specified Elsewhere: Section 07 92 00 - Joint Sealants, Section 08 11 13 – Hollow Metal Doors and Frames, Section 08 14 16 – Flush Wood Doors, Section 08 41 13 – Aluminum-Framed Entrances and Storefronts and Section 08 42 13 Aluminum Frames.

1.3 References:
- A. American Society for Testing and Materials (ASTM):
  1. ASTM E2074-00: Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.
  2. ASTM E2010-01: Standard Test Method for Positive Pressure Fire Tests of Window Assemblies.
- B. American National Standards Institute (ANSI):
  1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings
- C. Consumer Product Safety Commission (CPSC):
  1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials
- D. Glass Association of North America (GANA):
  1. GANA – Glazing Manual.
  2. FGMA – Sealant Manual.
- E. National Fire Protection Association (NFPA):
  1. NFPA 80: Fire Doors and Windows.
  2. NFPA 252 – Fire Tests of Door Assemblies.
  3. NFPA 257 – Fire Tests of Window Assemblies.
- F. Underwriters Laboratories, Inc. (UL):
  1. UL 9 – Fire Tests of Window Assemblies.
  2. UL 10B – Fire Tests of Door Assemblies.
  3. UL 10C – Positive Pressure Fire Tests of Door Assemblies.

1.4 Quality Assurance:
- A. Glazing Standards: FGMA Glazing Manual and Sealant Manual.
- B. Fire Protective Rated Glass: Each lite shall bear permanent, nonremovable label of UL certifying it for use in tested and rated fire protective assemblies.
- C. Fire Protective Glazing Products for Door Assemblies: Products identical to those tested per ASTM E 152, labeled and listed by UL or WHI or other certification agency acceptable to authorities having jurisdiction.

1.5 Delivery, Storage, and Handling:
- A. Deliver materials to specified destination in manufacturer's or distributor's packaging, undamaged, complete with installation instructions.
- B. Store off ground, under cover, protected from weather and construction activities.

PART 2 — PRODUCTS

2.1 Low-E Tempered Insulating Glass: 1" thick tempered Low-E insulating glass with 1/4" clear glass exterior, 1/2" airspace, and 1/4" clear interior and a low-E coating on interior side of interior lite equal to PPG "Solarban 60".

2.2 Tempered Plate Glass: 1/4" heat tempered plate or float glass equal to PPG "Herculite Clear Glass" where noted on the Drawings.

2.3 Fire-Rated Glazing Materials:
- A. Supplier: FireLite®NT as supplied by Technical Glass Products, Kirkland, Washington, voice 1-800-426-0279, fax 1-800-451-9857, e-mail sales@fireglass.com, web site www.fireglass.com.
- B. Properties:
  1. Thickness: As determined by manufacturer for glass sizes indicated.
  2. Film: 3M Scotchshield Ultra Film.
  3. Weight: 2.4 lbs./sq. ft.
  4. Approximate Visible Transmission: 88 percent.
  5. Approximate Visible Reflection: 9 percent.
  6. Hardness (Vicker's Scale): 700.
  7. Fire-Rating: 20 minutes to 3 hours for doors; 20 minutes to 90 minutes for other applications.
  8. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).
  9. Positive Pressure Test: UL 10C, UBC 7-2 and 7-4; passes.
  10. Surface Finish: Premium (polished) [Standard (unpolished)] [Obscure (patterned)].
- C. Maximum sheet sizes based on surface finish:
  1. Premium: 48 inches by 96 inches.
  2. Standard: 48 inches by 96 inches.
  3. Obscure: 36 inches by 96 inches.
- D. Labeling: Permanently label each piece of FireLite®NT with the FireLite® logo, UL logo and fire rating in sizes up to 3,325 sq. in., and with the FireLite label only for sizes that exceed the listing (as approved by the local authority having jurisdiction).
- E. Fire Rating: Fire rating listed and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with ASTM E2074-00 and ASTM E2010-01, NFPA 257, and UL 9, UL 10B and UL 10C.
- F. Glazing Compound for Fire-Rated Glazing Materials:
  1. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent. Glass panels that exceed 1,393 sq. inches for 90-minute ratings must be glazed with fire-rated glazing tape supplied by manufacturer.
  2. Glazing Compound: DAP 33 putty.
  3. Silicone Sealant: One-part neutral curing silicone, medium modulus sealant, Type S; Grade NS; Class 25 with additional movement capability of 50 percent in both

extension and compression (total 100 percent); Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable. Available Products:
   a) Dow Corning 795 - Dow Corning Corp.
   b) Silglaze-II 2800 - General Electric Co.
   c) Spectrem 2 - Tremco Inc.
4. Setting Blocks: Neoprene, EPDM, or silicone; tested for compatibility with glazing compound; of 70 to 90 Shore A hardness.
5. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

PART 3 — EXECUTION

3.1 Examination:
A. Examine framing glazing, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness and offsets at corners.
   2. Presence and function of weep system.
   3. Minimum required face or edge clearances.
   4. Effective sealing between joints of glass-framing members.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Preparation: Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 Glazing, General:
A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
G. Provide spacers for glass lites where the length plus width is larger than 50 inches (1270 mm) as follows:
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch (3 mm) minimum bite of spaces on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
I. Set glass lites in each series with uniform pattern, draw, bow and similar characteristics.
J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 Tape Glazing:

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.
D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
E. Do not remove release paper from tape until just before each glazing unit is installed.
F. Apply heel bead of elastomeric sealant.
G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 Gasket Glazing (Dry):

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.
B. Insert soft compression gasket between glass and frame, or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
D. Install gaskets so they protrude past face of glazing stops.

3.6 Installation, Fire-Glazing:

A. Glaze vertically into labeled fire-rated metal frames or partition walls with same fire rating as glass and push against tape for full contact at perimeter of pane or unit.
B. Place glazing tape on free perimeter of glazing in same manner described above.
C. Install removable stop and secure without displacement of tape.

D. Use specified glazing compound, without adulteration; bed glazing material in glazing compound; entirely fill all recess and spaces. Provide visible glazing compound with smooth and straight edges.
E. Install in vision panels in fire-rated doors to requirements of NFPA 80.
F. Install so that appropriate UL markings remain permanently visible.
G. Fire-Glazing Schedule: As follows on next page.

Rating	Assembly	Max. Exposed Area (Sq. In.)	Max. Width Of Exposed Glazing (In.)	**O R**	Max. Height Of Exposed Glazing (In.)	Stop Height
20 min.	Doors					
	HMS or wood*	3,204	36		89	5/8"
	Fireframes D.S.	3,204	36		89	3/4"
	Other than doors					
	HMS or wood	3,325	95		95	5/8"
	Fireframes D.S.	3,325	95		95	3/4"
45 min.	Doors					
	HMS or wood	3,204	36		89	5/8"
	Fireframes D.S.	3,204	36		89	3/4"
	Other than doors					
	HMS or wood	3,325	95		95	5/8"
	Fireframes D.S.	3,325	95		95	3/4"
60 min.	Doors (non-temp rise)	3,204	36		89	5/8"
	HMS or wood	3,204	36		89	3/4"
	Fireframes D.S.	100	12		33	5/8"
	Doors (temp rise)					
	Other than doors	3,325	95		95	5/8"
	HMS or wood	3,325	95		95	3/4"
	Fireframes D.S.					
90 min.	Doors (non-temp rise)	2,034	36		56 ½"	3/4"
		100	12		33	1/2"
	Doors (temp rise)					
	Other than doors	2,627	56 ½"		56 ½"	5/8"
	HMS	2,627	56 ½"		56 ½"	3/4"
	Fireframes D.S.					
3 hours	Doors	100	12		33	1/2"

* HMS indicates hollow metal steel framing. Fireframes D.S. indicates Designer Series narrow profile framing by Forster. For wood frames, check with manufacturer for maximum tested glass sizes.

3.7 Protection and Cleaning:
A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating

substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION 08 81 00

SECTION 09 21 16 — GYPSUM BOARD ASSEMBLIES

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all labor, materials, equipment and services required for complete installation of all gypsum board assemblies indicated on Drawings and specified herein.
- B. This Section includes the following types of gypsum board construction:
  1. Gypsum board screw attached to steel framing and furring members.
  2. Gypsum board screw attached to wood framing and furring members.
  3. Finishing of gypsum board.
- C. Related Work Specified Elsewhere: Section 06 61 00 – Rough Carpentry, Section 09 22 16 – Non-Structural Metal Framing and Section 09 91 00 - Painting.

1.3 Quality Assurance:
- A. Gypsum Board Standard: GA-216 by Gypsum Association.
- B. Fire-Resistance Ratings: Where indicated, provide materials and construction which are identical to those assemblies whose fire resistance rating has been determined per ASTM E 119 by a testing and inspecting organization acceptable to authorities having jurisdiction.

1.4 Delivery, Storage, and Handling:
- A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.
- C. Handle gypsum boards to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.

1.5 Project Conditions:
- A. Environmental Conditions, General: Establish and maintain environmental conditions for application and finishing gypsum board to comply with ASTM C 840 and with gypsum board manufacturer's recommendations.
- B. Minimum Room Temperatures: For non-adhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board maintain not less than 50 deg F (10 deg C) for 48 hours prior to application and continuously thereafter until drying is complete.
- C. Ventilate building spaces to remove water not required for drying joint treatment materials. Avoid drafts during dry, hot weather to prevent materials from drying too rapidly.

PART 2 — PRODUCTS

2.1 Manufacturer: Subject compliance with requirements, provide products of one of the following:
- A. Gypsum Boards and Related Products:
  1. Georgia-Pacific Corp.
  2. Gold Bond Building Products Div., National Gypsum Co.
  3. United States Gypsum Co.

2.2 Gypsum Board:
- A. General: Provide gypsum board of types indicated in maximum lengths available to minimize end-to-end joints.
  1. Thickness: Provide gypsum board in thicknesses indicated, or if not otherwise indicated, in 5/8 inch thicknesses to comply with ASTM C 840 for application system and support spacing indicated.
- B. Gypsum Wallboard: ASTM C 36, and as follows:
  1. Type: Type X, unless otherwise indicated.
  2. Edges: Tapered.
  3. Thickness: 5/8 inch, unless otherwise indicated.
- C. Gypsum Wallboard (installed in all "WET AREAS" where moisture conditions will occur): ASTM C 1396, and as follows:
  1. Type: Type X, moisture and mold-resistant.
  2. Edges: Tapered.
  3. Thickness: 5/8 inch.

2.3 Trim Accessories:
- A. Cornerbead and Edge Trim for Interior Installation: Provide corner beads, edge trim and control joints which comply with ASTM C 1047 with formed sheet steel zinc-coated by hot-dip process.
- B. Edge trim shapes shall be "LC" Bead, unless otherwise indicated.

2.4 Gypsum Board Joint Treatment Materials:
- A. General: Provide materials complying with ASTM C 475, ASTM C 840, and recommendations of manufacturer of both gypsum board and joint treatment materials for the application indicated.
- B. Joint Tape: Paper reinforcing tape, unless otherwise indicated.
- C. Joint Compounds: Factory-premixed all-purpose vinyl-based joint compound.

2.5 Miscellaneous Materials:
- A. General: Provide auxiliary materials for gypsum drywall construction which comply with referenced standards and the recommendations of the manufacturer of the gypsum board.
- B. Gypsum Board Screws: ASTM C 1002.

PART 3 — EXECUTION

3.1 Examination:
- A. Examine substrates to which drywall construction attaches or abuts, preset hollow metal frames, cast-in-anchors, and structural framing, with Installer present, for

compliance with requirements for installation tolerances and other conditions affecting performance of drywall construction. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 Application and Finishing of Gypsum Board, General:

A. Gypsum Board Application and Finishing Standard: Install and finish gypsum board to comply with ASTM C 840.
B. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 24 inches in alternate courses of board.
C. Install ceiling boards across framing in the manner which minimizes the number of end-butt joints, and which avoids end joints in the central area of each ceiling. Stagger end joints at least 24 inches.
D. Install wall/partition boards in manner which minimizes the number of end-butt joints or avoids them entirely where possible. At high walls, install boards horizontally with end joints staggered over studs.
E. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16 inch open space between boards. Do not force into place.
F. Locate either edge or end joints over supports, except in horizontal applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field-cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.
G. Attach gypsum board to steel studs so that leading edge or end of each board is attached to open (unsupported) edge of stud flange first.
H. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.
I. Space fasteners in gypsum boards in accordance with referenced gypsum board application and finishing standard and manufacturer's recommendations.

3.3 Methods of Gypsum Board Application:

A. Single-Layer Application: Install gypsum wallboard as follows:
   1. On ceilings apply gypsum board prior to wall/ partition board application to the greatest extent possible.
   2. On partitions/walls apply gypsum board vertically (parallel to framing), unless otherwise indicated, and provide sheet lengths which will minimize end joints.
   3. On partitions/walls 8'-1" or less in height apply gypsum board horizontally (perpendicular to framing); use maximum length sheets possible to minimize end joints.
   4. On furring members apply gypsum board vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
B. Single-Layer Fastening Methods: Apply gypsum boards to supports as follows:
   1. Fasten with screws.

3.4 Installation of Drywall Trim Accessories:

A. General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges to comply with manufacturer's recommendations.
B. Install corner beads at external corners.

C. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed. Provide type with face flange to receive joint compound.
   1. Install "LC" bead where drywall construction is tightly abutted to other construction and back flange can be attached to framing or supporting substrate.

3.5 Finishing Gypsum Board Assemblies:
A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
   1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated.
   2. Level 3: Embed tape and apply separate first and fill coats of joint compound to tape, fasteners, and trim flanges at all fire rated assemblies.
   3. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges.

3.6 Field Quality Control:
A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
   1. Notify Architect days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
   2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
      a) Installation of 80 percent of lighting fixtures, powered for operation.
      b) Installation, insulation, and leak and pressure testing of water piping systems.
      c) Installation of air-duct systems.
      d) Installation of air devices.
      e) Installation of mechanical system control-air tubing.
      f) Installation of ceiling support framing.

3.7 Cleaning and Protection:
A. Promptly remove any residual joint compound from adjacent surfaces.
B. Provide final protection and maintain conditions, in a manner suitable to Installer, which ensures gypsum drywall construction being without damage or deterioration at time of Substantial Completion.

END OF SECTION 09 21 16

SECTION 09 22 16 — NON-STRUCTURAL METAL FRAMING

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all labor, materials, equipment and services required for complete installation of all non-structural metal framing indicated on Drawings and specified herein.
- B. This Section includes non-load-bearing steel framing members for the following applications:
  1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
- C. Related Sections include the following:
  1. Division 07 Section "Thermal Insulation" for insulation installed with Z-shaped furring members.
  2. Division 09 Section "Gypsum Board Assemblies" for non-load-bearing metal wall framing, gypsum panels, and other components of wall assemblies.

1.3 Submittals:
- A. Product Data: For each type of product indicated.

1.4 Quality Assurance:
- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 — PRODUCTS

2.1 Non-Load-Bearing Steel Framing, General:
- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
  1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
  2. Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized, unless otherwise indicated.

2.2 Steel Framing for Framed Assemblies:
- A. Steel Studs and Runners: ASTM C 645.
  1. Minimum Base-Metal Thickness:
     a) 0.0312 inch (0.79 mm), 20 gauge, unless otherwise indicated.

2. Depth:
   a) 3-5/8 inches (92.1 mm), unless otherwise indicated on the Drawings.
   b) 6 inches (152.4 mm), where indicated on the Drawings.

B. Cold-Rolled Channel Bridging: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.
   1. Depth: 1-1/2 inches (38.1 mm).
   2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38.1 by 38.1 mm), 0.068-inch- (1.73-mm-) thick, galvanized steel.

C. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
   1. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
   2. Depth: 7/8 inch (22.2 mm).

2.3 Auxiliary Materials:

A. General: Provide auxiliary materials that comply with referenced installation standards.
   1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 — EXECUTION

3.1 Examination:

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Preparation:

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
   1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 Installation, General:

A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.

B. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
   1. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
   2. Install bracing at terminations in assemblies.
   3. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 Installing Framed Assemblies:

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.

1. Space studs as follows:
   a) Single-Layer Application: 16 inches (406 mm) o.c., unless otherwise indicated.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
   1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
   2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
      a) Install two studs at each jamb, unless otherwise indicated.
      b) Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
      c) Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
   3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
   4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
   5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

D. Direct Furring:
   1. Screw to wood framing.
   2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 09 22 16

SECTION 09 30 00 — TILING

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section. Reference also the Finish Plan; Finish Schedule, Legend, and Notes; Interior Elevations; and Millwork Details.

1.2 Description of Work:
- A. Provide all labor, materials, equipment and services required for complete installation of all tiling indicated on Drawings and specified herein.

1.3 References:
- A. ANSI A108 Series/A118 Series - American National Standards for Installation of Ceramic Tile.
- B. ANSI A137.1 - American National Standard Specifications for Ceramic Tile.
- C. TCNA (HB) - Handbook for Ceramic Tile Installation; Tile Council of North America.
- D. ISO 13007 - International Standards Organization; classification for Grout and Adhesives.

1.4 Quality Assurance:
- A. Source of Materials: Provide materials obtained from one source for each type and color of tile, grout, and setting materials.
- B. Specify porcelain tile and glass tile manufacturer to product order out of same run with same caliper.
- C. To ensure warranty requirements and compatibility of products; provide all tile grout, setting materials, additives, accessories, and factory-prepared dry-set mortars from the same manufacturer and completion of the work is within the manufacturer's expiration date for products, if any.
- D. Installer Qualifications:
  1. Installer is member of the National Tile Contractors Association.
  2. Installer's supervisor for the Project holds the International Masonry Institute's Foreman Certification.
  3. Installer employs Ceramic Tile Education Foundation Certified Installers.

1.5 Submittals:
- A. Product Data: Submit manufacturer's technical information and installation instructions for materials required, except bulk materials.
- B. Samples: Submit manufacturer's samples for each type of tile and marble threshold showing full range of colors, texture and pattern available for each type specified. Include samples of grout and accessories involving color selection.

1.6 Delivery, Storage and Handling:
- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Prevent damage or contamination to materials by water, freezing, foreign matter or other causes.

B. Do not use frozen materials unless specifically allowed by manufacturer.
C. Deliver and store materials on site at least 24 hours before work begins.
D. Provide heated and dry storage facilities on site.

1.7 Environmental Requirements:
A. Comply with requirements of referenced standards and recommendations of material manufacturers for environmental conditions before, during, and after installation.
B. For interior applications:
1. Do not begin installation until building is completely enclosed and maintaining temperature and humidity conditions consistent with "after occupancy" conditions for a minimum of two (2) weeks.
2. Maintain continuous and uniform building temperatures of not less than 10°C (50°F) during installation.
3. Ventilate spaces receiving tile in accordance with material manufacturer's instructions.

PART 2 — PRODUCTS

2.1 Manufacturer: Subject to compliance with requirements, provide products of one of the following manufacturers:
A. Specialty Tile Products, Inc.
B. DalTile Co.
C. American Olean Tile Co.

2.2 Porcelain Ceramic Tile Type 1: Tile type shall be Decorum Porcelain Ceramic Tile as manufactured by American Olean Tile Co. or prior approved equal.
A. Floor Tile:
1. Color: Match existing.
2. Nominal Facial Dimensions: 12" x 12" as selected by Architect.
3. Nominal Thickness: 3/8".
4. Face: Unpolished.
5. Grout Joint: 1/8".

2.3 Marble Thresholds: Shall be Alabama Ceramic "A" marble or equal with honed finish. Thresholds shall be width, thickness and depths as indicated on the drawings.

2.4 Setting Materials:
A. Thin-Set Mortar: Dry-set portland cement mortar, ANSI A118.1, factory sanded, equal to L & M Surco Thin-Set Mortar as manufactured by L & M Surco Manufacturing Co.

2.5 Grouting Materials:
A. Grout Source: Only commercial sanded portland cement type quality grout, equal to Laticrete "Permacolor" or "Permacolor 2" and Laticrete "1500 Sanded Grout," is to be used. Grout is to be purchased directly from the approved grout manufacturer or commercial tile and grout distributor. Consumer grade grout products available at retail outlets are not equivalent and shall not be used.
1. Floor Grout: Laticrete, 45 Raven. Verify color with Architect.
2. Wall Grout: Laticrete, 23 Antique White. Verify color with Architect.

B. Grout Mixing: Strictly follow all of the grout manufacturer's instructions for mixing and installing grout, including:
   1. Mixing "whole bag batches," not partial bags.
   2. Water additive proportions and water type.
   3. Mixing method (including manual, where specified by grout manufacturer).
   4. Mixing consistency.

C. Finished Grout Colors: Grout colors, including dark colors or "Black," shall match the manufacturer's approved sample. It shall be the installing tile subcontractor's responsibility to match the specified grout color(s) in the installation. It shall be the General Contractor's responsibility to protect the grout in tiled areas during the remainder of construction from all forms of damage, including contamination, discoloration, staining and debris. (Tiling contractor shall provide and install the protective covering as per Paragraph 3.3.D of this Section.)

PART 3 — EXECUTION

3.1 Tile Installation Standards:

A. Comply with applicable requirements of the Tile Council of America for tile installed with portland cement mortar.

B. Comply with manufacturer's instructions for mixing and installation of proprietary materials.

C. Any deficiencies in the work are to be submitted in writing to the General Contractor as per Paragraph 2.2.A.

D. Tile contractor, by commencing work, assumes overall responsibility to assure that site conditions and all components and parts shown or required for the installation comply with contract documents and are compatible with each other and with the conditions and expected use. Commencement of work signifies acceptance of substrate and installation conditions.

3.2 Installation, General:

A. Pre-Installation Meeting:
   1. Two weeks (minimum) prior to the start of porcelain tile installation or delivery of same to the project site, schedule and conduct a meeting with the following persons: Architect, General Contractor's Project Manager and Job Superintendent, Owner's Representative(s), Porcelain Tile Contractor's Project Manager and Job Superintendent, and any other persons whom the Architect, General Contractor, Owner, or Porcelain Tile Contractor request to attend.
   2. Critical installation coordination issues (such as schedule, working points, field cuts, grout joints, code requirements, transitions, drain cut outs, equipment cut outs, edges at door and window openings, etc.) shall be reviewed.
   3. "Job standards" for finished product and installation items (such as cuts at drains, grout mixes and colors, sealants, etc.) shall be reviewed.
   4. Other coordination and scheduling items shall be discussed as required or requested by participants.

B. Install tile using method indicated in strict compliance with manufacturer's printed instructions. Extend tile work into toe spaces, door reveals, and into closets and similar openings.

C. Strictly comply with all manufacturer's recommended instructions, including maximum recommended times for "no traffic allowed." The General Contractor and Subcontractor

are to allow for manufacturers' recommended schedules in the scheduling of the work. At the time materials are ordered, the tiling subcontractor shall provide a written statement to the General Contractor, and a copy to the Architect, of the estimated time frames for the tiling installation of each area and the additional "no traffic allowed" time required for each area. The General Contractor shall strictly enforce the "no traffic allowed" time frames with other trades and shall protect tiled areas from accidental access by anyone during those times.

D. Extend tile work into recesses and under or behind equipment and fixtures, to form a complete covering without interruptions, except as otherwise shown. Terminate work neatly at obstructions, edges and corners without disrupting pattern or joint alignments.

E. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures and other penetrations so that plates, collars, and covers overlap tile.

F. Setting Methods:
   1. Floor Tile (Thin-Set): Reference to TCA Method F113-09, Latex-Portland Cement Mortar.
   2. Wall Base (Thin-Set): Reference to TCA Method W202-09, Dry-Set Mortar or Latex-Portland Cement Mortar.
   3. Marble Thresholds: Install in same type setting bed as field tile.

G. Jointing Pattern: Unless otherwise shown, lay tile in grid pattern. Align joints where adjoining tiles on floor, base, walls, and trim are same size. Layout tile work and center tile field in both directions in each space or on each wall area as indicated on the Drawings. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise shown. Utilize joint widths as recommended by tile manufacturer for each tile type, unless specifically noted otherwise.

H. Document compliance with each respective manufacturer's required and recommended installation methods and processes as required for proof of same in the event of a potential warranty claim. Provide a copy to the Architect of all documentation.

3.3 Cleaning Protection:

A. Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

B. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but not sooner than 14 days after installation. Protect metal surfaces, cast iron and vitreous plumbing fixtures from effects of acid cleaning. Flush surfaces with clean water before and after cleaning.

C. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, or otherwise defective tile work.

D. Protection: When recommended by tile manufacturer, tiling contractor shall apply a protective coat of neutral protective cleaner to completed tile floors. Tiling contractor shall provide and install Kraft paper or other heavy covering over installed tile work for protection during construction period to prevent damage and wear. All protection materials shall be heavy, breathable paper and shall allow for moisture to escape from the protected tile areas. It shall be the General Contractor's responsibility to protect the tiled areas and rooms with tile work during the construction period from damage and wear. The General Contractor shall ensure that all protective coverings remain intact and as the tiling contractor installed them until the General Contractor advises the tiling contractor that the protective coverings are to be removed for final inspection.

E. Before final inspection, tiling contractor shall remove protective coverings and rinse neutral cleaner from tiled surfaces.
F. All repair or "punch list" work is to be performed by the installing tile subcontractor.

END OF SECTION 09 30 00

SECTION 09 51 00 — ACOUSTICAL CEILINGS

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work: Provide all labor, materials, equipment and services required for complete installation of all acoustical ceilings and related items indicated on Drawings and specified herein.

1.3 Quality Assurance:

A. Fire Performance Characteristics: Provide acoustical ceiling components that are identical to those tested for the following fire performance characteristics, according to ASTM test method indicated, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction. Identify acoustical ceiling components with appropriate marking of applicable testing and inspecting agency.

1. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 for Class A products.
   a) Flame Spread: 25 or less.
   b) Smoke Developed: 50 or less.
2. Fire Resistance Ratings: As indicated by reference to design designation in UL "Fire Resistance Directory" or "FM Approval Guide", for floor, roof or beam assemblies in which acoustical ceilings function as a fire protective membrane; tested per ASTM E 119. Provide protection materials for lighting fixtures and air ducts to comply with requirements indicated for rated assembly.

B. Coordination of Work: Coordinate layout and installation of acoustical ceiling units and suspension system components with other work supported by or penetrating through ceilings, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition system (if any).

1.4 Submittals:

A. Product Data: Manufacturer's product specifications and installation instructions for each acoustical ceiling material required, and for each suspension system, including certified laboratory test reports and other data as required to show compliance with these specifications.

B. Samples:

1. Acoustical Panels: Set of 6" x 4" square samples for each acoustical unit required, showing full range of exposed color and texture to be expected in completed work.
2. Suspension System: Set of 12" long samples of each exposed runner and molding.

1.5 Delivery, Storage and Handling:

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination or other causes.

B. Before installation acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
C. Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way.

1.6 Project Conditions:
A. Space Enclosure: Do not install interior acoustical ceilings until space is enclosed and weatherproof, wet-work in space is complete, and nominally dry, work above ceilings is complete, and ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

1.7 Maintenance Stock: At time of completing installation, deliver stock of maintenance material to Owner. Furnish full size units matching units installed, packaged with protective covering for storage, and identified with appropriate labels. Furnish amount equal to 2% of acoustical units installed.

PART 2 — PRODUCTS

2.1 Metal Suspension Systems:
A. General:
1. Standard for Metal Suspension Systems: Provide metal suspension systems of type, structural classification and finish indicated which comply with applicable ASTM C 635 requirements.
2. Attachment Devices: Size for 5 times design load indicated in ASTM C 635, Table 1, Direct Hung.
3. Hanger Wire: Galvanized carbon steel wire, ASTM A 641, soft temper, prestretched, Class 1 coating, sized so that stress at 3-times hanger design load (ASTM C 635, Table 1, Direct Hung), will be less than yield stress of wire, but provide not less than 12 gauge.
4. Edge Moldings and Trim: Metal of types and profiles indicated or, if not indicated, provide manufacturer's standard molding for edges and penetrations of ceiling which fits with type of edge detail and suspension system indicated.
5. Available Manufacturers: Subject to compliance with requirements, provide Armstrong, hot-dipped galvanized in the sizes and styles compatible with specified acoustical panels with a 30-year HumiGuard Plus warranty or approved equal.
6. Available manufacturers: Subject to compliance with requirements, manufacturers offering suspension systems which may be incorporated in the work include, but are not limited to, the following:
a) Donn Corporation
b) National Rolling Mills, Inc.
c) Roper Eastern
d) CertainTeed
7. Type of Suspension Systems: Direct-Hung.
B. Non-Fire-Rated Single Web Steel Suspension System:
1. Structural Classification: Intermediate-Duty System.
2. Finish: Painted, white.

2.2 Acoustical Panels:
A. General:

1. Standard for Acoustical Ceiling Units: Provide manufacturer's standard units of configuration indicated which are prepared for mounting method designated and which comply with ASTM E 1264 requirements, including those indicated by reference to type, form, pattern, grade (ASTM C 423 for NRC), light reflectance coefficient (LR), edge detail, and joint detail (if any).
2. Sound Transmission Performance: Provide acoustical ceiling units with ratings for ceiling attenuation class (CAC) of range indicated as determined according to ASTM E 1414 with ceilings continuous at partitions and supported by a metal suspension system of type appropriate for ceiling unit of configuration indicated (concealed for tile, exposed for panels).

B. Type 1 Acoustical Panels: Shall be 2' x 2' x 3/4" nondirectional wet formed mineral fiber acoustical panels which meet ASTM E 1264, Class A, Type III, Form 2 for standard washable finish (CVA), NRC shall be .70, CAC shall be 40 and shall have .85 light reflectance. Provide the following or a prior approved equal:
   1. Armstrong World Industries, Inc., 1713 Fine-Fissured, Square Lay-in, with 15/16" grid, 30-year Humi-Guard Plus warranty.

C. Type 2 Acoustical Panels: Acoustical Panels: Shall be 2' x 2' x 3/4" nondirectional wet formed mineral fiber acoustical panels which meet ASTM E 1264, Class A, Type III, Form 2 for standard washable finish (CVA), NRC shall be .70, CAC shall be 40 and shall have .85 light reflectance. Provide the following or a prior approved equal:
   1. Armstrong World Industries, Inc., 1717 Fine-Fissured, Angled Tegular Edge, with 15/16" grid, 30-year Humi-Guard Plus warranty.

D. Type 3 Acoustical Panels: Shall be # 607, 2' x 2' x 5/8" with square edge non-directional composition mineral fiber acoustical panels which meet ASTM E1264, Class A, Type X, NRC shall be .55, CAC shall be 38 and the light reflectance classification shall be .82. Provide 15/16" grid. Color: White tile and grid. Product shall comply with 30-year HumiGuard Plus warranty. Provide products as manufactured by Armstrong World Industries, or prior approved equal.

E. Substitutions must be approved by the Architect prior to the Bid. Burden of proof for equality of products rests solely with the Contractor.

PART 3 — EXECUTION

3.1 Preparation:

A. Coordination: Furnish layouts for inserts, clips, or other supports required to be installed by other trades for support of acoustical ceilings.

B. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Unless otherwise noted, avoid use of less-than-half width units at borders, and comply with reflected ceiling plans.

3.2 Installation:

A. General: Install materials in accordance with manufacturer's printed instructions, and to comply with governing regulations, fire-resistance rating requirement as indicated, and industry standards applicable to work.

B. Install suspension systems to comply with ASTM C 636, with hangers supported only from building structural members. Locate hangers not less than 6" from each end and spaced 4'-0" along each carrying channel or direct-hung runner, unless otherwise indicated, leveling to tolerance of 1/8" in 12'-0".

C. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye-screws, or other devices which are secure and appropriate for substrate, and which will not deteriorate or fail with age or elevated temperatures.
D. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal force by bracing, countersplaying or other equally effective means.
E. Install edge moldings of type indicated at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units. Screw-attach moldings to substrate at intervals not over 16" o.c. and not more than 3" from ends, leveling with ceiling suspension system to tolerance of 1/8" in 12'-0". Miter corners accurately and connect securely.
F. Install acoustical panels in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations.
G. Provide two (2) wire hangers located diagonally at each lay-in light fixture indicated on the Drawings.

3.3 Adjust and Clean:
A. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage.
B. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 00

SECTION 09 65 19 — RESILIENT TILE FLOORING AND BASE

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all labor, materials, equipment and services required for complete installation of all resilient tile flooring and accessories indicated on Drawings and specified herein.
- B. Reference in particular the Floor Plan and Room Finish Schedule.

1.3 Submittals:
- A. Submit current samples of resilient tile flooring and base to the Architect for approval and color selection. All colors will be selected from manufacturer's standard colors.
- B. Submit 36" x 36" mock-up sample of solid vinyl tile pattern selected for Architect's approval prior to ordering product.

1.4 Project Conditions:
- A. Maintain minimum temperature of 65 degrees F. (18 degrees C.) in spaces to receive resilient tile flooring for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. Store resilient tile flooring materials in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 55 degrees F. (13 degrees C.) in areas where work is completed.
- B. Install resilient tile flooring and accessories after other finishing operations, including painting, have been completed. Do not install resilient tile flooring over concrete slabs until the latter have been cured and are sufficiently dry to achieve bond with adhesive as determined by resilient tile flooring manufacturer's recommended bond and moisture test.

1.5 Maintenance Stock: At time of completing installation, deliver stock of maintenance material to Owner. Furnish full size tile matching tile installed, packaged with protective covering for storage, and identified with appropriate labels. Furnish not less than one box for each 50 boxes or fraction thereof, for each type, color, pattern and size installed.

PART 2 — PRODUCTS

2.1 Vinyl Composition Tile (VCT):
- A. Shall be first line quality vinyl-composition tile as manufactured by Armstrong, Mannington, Azrock, or prior approved equal, and shall be equal to Armstrong, Excelon "Imperial Series."
  1. Color: Maximum of one (1) color will be selected by Architect.
- B. All composition tile shall be uniform in thickness and size, cut accurately with square true edges. All tile shall be 12" x 12" x 1/8".

2.2 Solid Vinyl Tile (SVT):

A. Shall be first line quality solid vinyl tile as manufactured by Tandus-Centiva, by Tarkett or prior approved equal.

B. Contractor is to allow Three Dollars and 60/100 ($3.60) per square foot for material only. This allowance does not include installation materials or accessories, floor prep, labor, freight, sales taxes, or Contractor's overhead and profit.

C. The Architect will select a solid vinyl tile and installation method and submit the manufacturer's product information on a Finish Schedule Legend to be submitted to the Contractor. If the actual cost of the solid vinyl tile selected varies from this Allowance, an adjustment shall be made in the Contract Price accordingly.

1. Color: Maximum of three (3) colors will be selected by Architect.

2.3 Resilient Base:

A. Shall be set-on type equal to "Flex-Cove Set-On Type" Rubber Cove Base as manufactured by Flexco, Inc. Products may be selected from Johnsonite or VPI as well as Flexco. A maximum of six (6) colors will be selected by the Architect.

B. Material shall be 1/8" gauge, 4" high and furnished in continuous rolls. Thinner gauge of resilient base will not be accepted.

C. Furnish necessary end stops, inside and outside corners where applicable.

2.4 Accessories:

A. Adhesives (Cements): Waterproof, stabilized type as recommended by flooring manufacturer to suit material and substrate conditions.

B. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.

C. Leveling and Patching Compounds: Latex types as recommended by flooring manufacturer.

PART 3 — EXECUTION

3.1 Inspection:

A. Require Installer to inspect subfloor surfaces to determine that they are satisfactory. A satisfactory subfloor surface is defined as one that is smooth and free from cracks, holes, ridges, coatings preventing adhesive bond, and other defects impairing performance or appearance.

B. Perform bond and moisture tests on concrete subfloors to determine if surfaces are sufficiently cured and dry as well as to ascertain presence of curing compounds.

C. Do not allow resilient tile flooring work to proceed until subfloor surfaces are satisfactory.

3.2 Preparation:

A. Prepare subfloor surfaces as follows:

1. Use leveling and patching compounds as recommended by resilient flooring manufacturer for filling small cracks, holes and depressions in subfloors.

2. Remove coatings from subfloor surfaces that would prevent adhesive bond, including curing compounds incompatible with resilient tile flooring adhesives, paint, oils, waxes and sealers.

B. Broom clean or vacuum surfaces to be covered, and inspect subfloor.

C. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

3.3 Installation, General:

A. Where movable partitions are shown, install resilient tile flooring before partitions are erected.
B. Install resilient tile flooring using method indicated in strict compliance with manufacturer's printed instructions. Extend resilient flooring into toe spaces, door reveals, and into closets and similar openings.
C. Scribe, cut, and fit resilient tile flooring and base to permanent fixtures, built-in furniture and cabinets, pipes, outlets and permanent columns, walls and partitions.
D. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marking on subfloor. Use chalk or other non-permanent marking device.
E. Install resilient tile flooring on covers for telephone and electrical ducts, and similar items occurring within finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on these covers. Tightly cement edges to perimeter of floor around covers and to covers.
F. Tightly cement resilient tile flooring to subbase without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections. Hand roll resilient tile flooring at perimeter of each covered area to assure adhesion.

3.4 Installation of Tile Floors:

A. Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite edges of room area is of equal width, unless noted otherwise. Adjust as necessary to avoid use of cut widths less than 1/2 tile at room perimeters. Lay tile square to room axis, unless otherwise shown.
B. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged if so numbered. Cut tile neatly around all fixtures. Broken, cracked, chipped, or deformed tiles are not acceptable.
C. Adhere tile flooring to substrates using full spread of adhesive applied in compliance with flooring manufacturer's directions.
D. Install solid vinyl tile floors in patterns as indicated on the Room Finish Schedule and as required in this Specification.

3.5 Cleaning and Protection:

A. Perform following operations immediately upon completion of resilient flooring:
    1. Sweep or vacuum floor thoroughly.
    2. Do not wash floor until time period recommended by resilient tile flooring manufacturer has elapsed to allow resilient flooring to become well-sealed in adhesive.
    3. Damp-mop floor being careful to remove black marks and excessive soil.
    4. Remove any excess adhesive or other surface blemishes, using appropriate cleaner recommended by resilient tile flooring manufacturers.
B. Protect flooring against damage during construction period to comply with resilient tile flooring manufacturer's directions.
C. Protect resilient tile flooring against damage from rolling loads for initial period following installation by covering with plywood or hardboard. Use dollies to move stationary equipment or furnishings across floors.

D. Clean resilient tile flooring not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Clean resilient flooring by method recommended by resilient tile flooring manufacturer.
E. Apply protective floor polish to resilient tile flooring surfaces free from soil, excess adhesive or surface blemishes. Use commercially available metal cross-linked acrylic product acceptable to resilient flooring manufacturer.
F. Apply protective sealer and finisher to SVT resilient flooring surfaces free from soil, excess adhesive, or surface blemishes. Use commercially available S.C. Johnson products: "Taski, R50 Neutral Cleaner," "Professional Over and Under Sealer," and "Taski, Wiwax Finisher" as recommended by flooring manufacturer.

END OF SECTION 09 65 19

SECTION 09 68 13 — TEXTILE COMPOSITE FLOORING

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work: Provide all labor, materials, equipment and services required for complete installation of all textile composite flooring modules and accessories indicated on Drawings and specified herein.

1.3 Related Sections:
- A. Other Division 9 sections for floor finishes related to this section but not the work of this section.
- B. Division 3 Concrete - not included work this section.
- C. Division 7 Thermal and Moisture Protection - not included work this section.

1.4 Quality Assurance and Regulatory Requirements:
- A. Qualifications of flooring installation contractor: All work shall be done by installation firms specializing in commercial flooring and carpet installation. It is required, that the firm or individual shall be a member of the Floor Covering Installation Contractors Association (FCICA) and/or certified by the Certified Floorcovering Installers Association (CFI). Flooring contractor to be specialty contractor normally engaged in this type of work and shall have three (3) years minimum documented experience in commercial installation of similar flooring materials and participation in manufacturer's environmental program including responsible flooring removal, recycling, and installation.
- B. Flooring contractor will be responsible for the proper product installation, including floor preparation in all the areas indicated in the drawings to receive Kinetex modules. The installation standard will be as listed in The Carpet and Rug Institute's Standard for Installation of Commercial Carpet CRI-104, the standard that establishes the minimum installation procedures.
- C. Flooring contractor to provide owner a written warranty that guarantees the completed installation to be free from defects in materials and workmanship for a period of no less than two (2) years after job completion.
- D. Manufacturer qualifications: Manufacturing facility to ISO 14001 certified and have a minimum of 20 years experience in the manufacture of commercial flooring.
- E. Manufacturer to offer a reclamation program for the recycling of existing broadloom carpet, modular carpet tile and textile composite flooring.
- F. All warranties must be issued by the manufacturer as standard published warranties on all types of flooring modules within this document. Second source warranties that involve parties other than the textile composite flooring manufacturer are unacceptable. If the product fails to perform as warranted when installed according to the J+J Flooring Group's Kinetex installation instruction and maintained according to J+J Flooring Group's Kinetex maintenance instructions, the affected area will be repaired or

replaced at the expense of the manufacturer. J+J Flooring Group will provide standard published written performance warranties for the following:

1. Lifetime product performance. Excessive wear means no more than five (5%) percent loss of pile fiber weight.
2. Lifetime static protection, meaning built-in protection below 3.0 kv as tested under AATCC-134.
3. Lifetime Stain Removal
4. Lifetime Colorfastness (Light and Crocking)
5. Lifetime Edge Ravel
6. Lifetime Delamination
7. Lifetime Dimensional Stability

G. Manufacturer to provide field service experts to assist in project start-up as required by the job and will notify owner, architect, general contractor, or another designated contact if any installation instructions are not followed.

H. Provide flooring material to meet the following test performance criteria as tested by a recognized independent testing laboratory. Certified test reports shall be submitted by the manufacturer for each test method. Requirements listed below must be met by all products being submitted for approval:

1. Pill Test / DOC-FF-1-70 (ASTM D-2589) - Requirement: Pass
2. Flooring Radiant Panel / ASTM E-648 - Requirement: Class I (Above .45 w/cm)
3. CRI VOC Chamber Test/Indoor Air Quality test (CRI-IAQ) Green Label Plus™ Test.
4. Lightfastness: Rating of not less than 5 on International Grey Scale after 40 SFU's when tested in accordance with AATCC Test Method 16E.
5. Crockfastness: Minimum stain rating on International Grey Scale of not less than 5 wet or dry when tested in accordance with AATCC Test Method 165.
6. Atmospheric Fading: Burned Gas shall not be less than 5 on International Grey Scale after two cycles on each test as per AATCC Test Method 129 Ozone and AATCC Test Method 23.
7. Noise Reduction Coefficient (ASTM C 423-02): NRC Rating of 0.30
8. Impact Insulation Classification (ASTM E 492-09): IIC Rating of 64

1.5 Submittals:

A. Submit to Architect ten (10) days prior to Bid, two (2) 6.5" x 6.5" (minimum size) finished samples of the exact type of flooring proposed, including quality, pattern, color and backing.

B. Submit to Architect ten (10) days before Bid, any proposed substitutions for consideration. Submit at least three (3) references of installations using the same flooring technology, as described within this text. Include contact names and telephone numbers.

C. Submit manufacturer's warranties, installation instructions, and maintenance instructions before bid date.

D. Submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required flammability tests as well as other testing requirements as listed under 1.4.F.

1.6 Environmental/Field Conditions:

A. Deliver all materials to the installation site in the manufacturer's original packaging and in good condition. Packaging to contain manufacturer's name and marks, identification number, shipping and handling instructions and related information.

B. Delivered and stored materials must be available for inspection as required by the Architect, General Contractor and/or the manufacturer.
C. Sub-floor preparation shall meet all conditions as specified in manufacturer's textile composite flooring installation instructions.
D. All materials, including adhesives, are to be delivered to the site of installation at a minimum of 48 hours prior to the start of installation and stored in a clean and dry room that measures above 65°F and below 95°F and measures between 10% and 65% relative humidity (RH). To maintain temperature and relative humidity, permanent heating and air conditioning systems (HVAC) must be in operation. Place pallets of textile composite flooring modules on a flat surface (do not double stack pallets). After work is completed, the ambient room temperature should remain at 65°F and relative humidity between 10% and 65% for 48 hours. These materials and related adhesives shall be protected from the direct flow of heat from heating fixtures and appliances such as hot-air registers, radiators, or other. Site conditions shall include those specified in the flooring manufacturer's installation instructions and shall also include sufficient heat, light and power required for effective and efficient working condition.
E. Once the temperature and relative humidity in area for installation have been stabilized, loose lay the modules within the installation area and allow them to precondition for 48 hours prior to installation. Module installation shall not commence until painting and finishing work is complete and ceiling and overhead work is tested, approved and completed. Traffic shall be closed during the installation of the textile composite flooring products. Verify concrete slabs are dry per the standards for bond and moisture tests listed in the manufacturer's installation instructions.

1.7 Substitutions:
A. Pre-Bid submittals must conform to the Specifications in this document.
B. All test results to be in accordance with a certified independent testing laboratory.

1.8 Maintenance Stock: At the time as directed by the Owner, deliver stock of maintenance material to Owner. Furnish full size textile composite flooring tile matching textile composite flooring tile installed, packaged with protective covering for storage and identified with appropriate labels. Furnish not less than one box for each 20 boxes or fraction thereof, for each type, color, pattern and size of textile composite flooring tile installed.

PART 2 — PRODUCTS

2.1 Manufacturers:
A. Acceptable Manufacturer: Kinetex, a brand of J+J Flooring Group, P.O. Box 1287, Dalton, GA, 30722. (800) 241-4586. JJ-KINETEX.COM. Please contact Kari Davis, 205.500.9221, kari.davis@jjflooringgroup.com

2.2 Textile Composite Flooring Allowance:
A. Provide textile composite flooring allowances indicated herein for material only for purchase of textile composite flooring indicated on the Architectural Drawings to be selected by Owner. Allowances do not include for freight, taxes, installation or Contractor's overhead and profit. The Contractor shall allow and provide for all such costs in addition to the allowance figures required herein. If the actual cost of textile composite flooring selected should be more or less than the allowances given, there shall be a corresponding adjustment made in the Contract Price.

1. Textile Composite Flooring Allowance: $3.20/SF, no pattern repeat. All textile composite flooring is tile, and all patterns will be selected from the same manufacturer.

2.3 Textile Composite Flooring Materials:
- A. Approximately four (4) different Kinetex Flooring Modules (tiles):
  1. TCF-1 through TCF-4:
     a) Pattern: To be selected
     b) Color: To be selected
- B. Backing: Polyester Cushion Felt
- C. Dye Method: Solution Dyed
- D. Fiber Type: Polyester
- E. Total Weight (Nominal Average): 4.5 oz - 5.2 oz / square foot
- F. Pattern Repeat: N/A
- G. Soil Release: Yes
- H. Standard Size: 24" x 24" (approximate)
- I. Warranties: Lifetime Product Performance, Colorfastness to Light & Crocking, Stain Removal, Static Protection, Protection from Edge Ravel and Delamination; Lifetime Dimensional Stability.
- J. Testing Specifications - Pill Test: Yes
- K. Testing Specifications - Flooring Radiant Panel: Class 1
- L. Testing Specifications - Smoke Density: Less than 450 flaming (ASTM E 662)
- M. Testing Specifications - Static Test: Less than 3 kv (AATCC-134)
- N. Recycled content: Minimum of 50% recycled content
- O. NSF/ANSI 140 Platinum Certified
- P. Closed-loop recyclable

2.4 Adhesives: Kinetex® Adhesive, an aggressive, pressure-sensitive adhesive designed for the installation of Kinetex textile composite flooring modules is required.

2.5 Accessories:
- A. Kinetex requires protective transition 3/16-inch to other floor covering thickness. Provide transition/reducing strips tapered to meet abutting materials as indicated in the drawings.
- B. Provide resilient edge or transition to protect Kinetex edge as manufactured by Flexco or prior approved equal:
  1. TCF (Textile Composite Flooring) to vinyl tile edge protection, Flexco 168:
     a) Vinyl Transition Strip: Color to be selected
     b) Height: 1/4"

PART 3 — EXECUTION

3.1 Inspection:
- A. Examine and verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive installation of modules.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive installation of modules.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

D. Verify that concrete sub-floor surfaces are dry enough and ready for flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F 710; obtain instructions if test results are not within limits recommended by the manufacturer.
E. Verify that required floor-mounted utilities are in correct location.
F. The manufacturer shall require that textile composite flooring be inspected prior to installation for proper style, color and potential defects. No claims will be honored if the modules are installed with visible defects. Should there be a problem, call manufacturer's customer relations department.

3.2 Preparation:
A. Starting installation constitutes acceptance of sub-floor conditions.
B. Surface Preparation: Dust, dirt, debris and non-compatible adhesive must be removed before the installation begins. Surfaces must be smooth and level with all holes and cracks filled with Portland cement-based patch reinforced with polymers. Adhesive cannot be applied to any substrate where chemical or solvent-based cleaners have been used.
C. Concrete Moisture Testing and pH Testing: Substrate surfaces must be tested for moisture emission. It is the responsibility of the textile composite flooring subcontractor to perform moisture testing prior to starting the installation. ASTM-F 2170-2 relative humidity probe moisture testing is required. Acceptable relative humidity probe testing results are up to 95% RH. Alkalinity tests should also be performed per ASTM F 710. The maximum acceptable pH is 9.0. *Note: pH readings of 9.0 - 11.00, XL Brands DriSeal Concrete Moisture Sealer is required.*
D. New Concrete: New concrete must be fully cured and free of moisture (see ASTM F 710). New concrete requires a curing period of approximately 90 days.

3.3 Installation of Textile Composite Flooring:
A. Install flooring in strict accordance with the finish drawings and Manufacturer's installation instructions.
B. Full Spread Adhesive System: Manufacturer requires full spread use of adhesive for all flooring modules. The spread rate for adhesive is approximately 1080 square feet per four gallon pail and can be spread using a 1/16" x 1/32" x 1/32" U-notched trowel or applied using a 3/8" foam or nap roller. Allow to dry until transparent or adhesive does not transfer to finger when touched. Drying time will vary with temperature, humidity and air velocity, however modules must be installed within two hours after adhesive has dried. *Note: Inadequate amounts of adhesive can cause modules to shift and move and will not be covered by warranty. Manufacturer will not be responsible for the adhesive bond where other adhesives have been used.*
C. Module Placement: Arrows are printed on the module backing to show pile/machine direction. A tight installation without compression is mandatory for optimum performance and appearance of the modular installation. It is critical that each module uniformly touch each adjoining module without a gap. To ensure a clean tight fit, do not pull/tug or slide-in modules, but instead lay each module into its location against the adjoining module. Use your hands to press/form the module into place where the new module meets the previously installed module. Manufacturer requires quarter turn install method. *Note: To reposition a flooring module during installation, remove it by gently lifting all four sides of the module with a spatula or putty knife, rotating around each side of the module doing a little at a time. The very center of the module should be the last part of the module touching the floor upon removal. Do not stretch a module*

while it is in the adhesive in order to align next to an adjoin modular. An attempt to stretch will likely result in the module pulling back to its original position. Never attempt to remove a module all at once by pulling one or only two sides of the modular. Doing so may lead to distorting the module.

D. Pallet and Bundle Sequencing: It is very important to install flooring modules in the order they were manufactured; this is easily accomplished by selecting pallets in sequential order and following the numbers located on each bundle of modules. Typically, an installation will begin with the lowest bundle numbers and progress through the highest numbers until the project is complete. Installing modules by bundle sequence will assure the most even uniform look possible. (For layout and installation instructions refer to Manufacturer's Installation Instructions or CRI 104 standards.)

E. Completing Installation: To avoid dislodging modules, do not walk on or move furniture onto modules until the area is completely anchored. Roll entire area with 75-100 lb. roller in both directions (north-south and east-west) after completion of installation. It is also required that sheets of plywood or hardboard be laid over the new modular surface when transporting heavy furniture on carts or dollies. As a final step, vacuum the entire area with an upright vacuum.

3.4 Installation of Accessories:

A. Install accessories as required by Drawings and per manufacturer's specifications.

3.5 Cleaning and Protection:

A. Use a moist cloth when wet; if dry, use a solvent based product applied to a towel then worked onto the textile composite flooring module for removal of contaminants such as adhesive, paint, oil and grease. Follow manufacturer's maintenance guidelines.

B. Clean and vacuum surfaces.

END OF SECTION 09 68 00

SECTION 09 91 00 — PAINTING

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all labor, materials, equipment and services required for complete installation of all painting required on Drawings and specified herein.
- B. Related Work Specified Elsewhere: Joint sealers are included under other sections of the specifications.
- C. Work Not Included: Unless otherwise indicated, shop priming of ferrous metal items and fabricated components are included under their respective trades. Pre-finished items, such as acoustic material and the like, are not included. Unless otherwise indicated, painting not required on surfaces on concealed areas except for piping, equipment and other such items within the concealed spaces. Finished metals such as anodized aluminum, stainless steel, bronze, and similar parts of metals will not be painted. Do not paint any moving parts of operating units, or over any equipment identifications, performance rating, name or nomenclature plates or code required labels.

1.3 Submittals:
- A. Verify prior to preparation of color schedule that Architect has an up-to-date color deck of the approved paint manufacturer.
- B. Submit to Architect for approval three (3) samples of each different item to be stained.

1.4 Manufacturer: Provide products by one of the following or an approved equal:
- A. Pittsburgh
- B. Benjamin Moore
- C. Glidden/ICI
- D. Sherwin-Williams

Sherwin-Williams product numbers are given for standards (where applicable) except as noted otherwise.

1.5 Delivery and Storage: Deliver materials to job site in new, original, and unopened containers bearing manufacturer's name, trade name, and label analysis. Store all paint materials and equipment in an assigned area. Protect floor and wall surfaces against damage. Take necessary precaution to keep fire hazard to a minimum. Leave surface of storage space clean and in condition required for that space.

1.6 Job Conditions:
- A. Maintain constant minimum temperature of 60 degrees F at areas of installation for at least 72 hours before and 48 hours after application of materials.
- B. Illuminate areas of installation using building's permanent lighting system; temporary lighting alone will not be acceptable.

PART 2 — PRODUCTS

2.1 Exterior Paint Systems:

A. Ferrous Metals:
1. 1st Coat (Primer): S-W Galvite HS, B50WZ30.
2. 2nd Coat: S-W SWP Gloss House & Trim, A2 Series.
3. 3rd Coat: S-W SWP Gloss House & Trim, A2 Series.

B. Galvanized Metals:
1. 1st Coat (Primer): None Required. Solvent clean with VM&P Naphtha, 97-726.
2. 2nd Coat: S-W SWP Gloss House & Trim, A2 Series.
3. 3rd Coat: S-W SWP Gloss House & Trim, A2 Series.

C. Parking Lot Stripping:
1. 1st Coat: S-W Setfast Acrylic Water Borne Traffic Marking Paint.
2. 2nd Coat: S-W Setfast Acrylic Water Borne Traffic Marking Paint.
3. Color: White (International Blue at Handicap Spaces).

2.2 Interior Paint Systems:

A. Woodwork and Trim (Painted):
1. 1st Coat (Primer): S-W PrepRite Classic Primer, B28W101.
2. 2nd Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss Enamel, B31 Series.
3. 3rd Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss Enamel, B31 Series.

B. Woodwork and Trim (Stained):
1. 1st Coat: S-W Wood Classics Interior Oil Stain, A48 Series.
2. 2nd Coat: S-W Wood Classics Interior Oil Stain, A48 Series.
3. 2nd Coat: S-W Wood Classics Waterborne Polyurethane Varnish, Gloss A68V91.
4. 3rd Coat: S-W Wood Classics Waterborne Polyurethane Varnish, Gloss or Satin.

C. Concrete Block (Where Noted Enamel):
1. 1st Coat (Primer): S-W Loxon Block Surfacer, A24W200.
2. 2nd Coat: S-W ProMar 200 Latex Eg-Shel B20W200 Series.
3. 3rd Coat: S-W ProMar 200 Latex Eg-Shel B20W200 Series.

D. Concrete Block (Where Noted Epoxy):
1. 1st Coat (Primer): S-W Heavy Duty Block Filler, B42W46.
2. 2nd Coat: S-W Water Based Catalyzed Epoxy B70/B60V25.
3. 3rd Coat: S-W Water Based Catalyzed Epoxy B70/B60V25.

E. Ferrous Metals:
1. 1st Coat (Primer):
2. 2nd Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss Enamel, B31 Series.
3. 3rd Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss Enamel, B31 Series.

F. Galvanized Metals:
1. 1st Coat (Primer):
2. 2nd Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss Enamel, B31 Series.
3. 3rd Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss Enamel, B31 Series.

G. Gypsum Board (Where noted Flat Latex):
1. 1st Coat (Primer): S-W PrepRite Classic Latex Primer, B28W101.
2. 2nd Coat: S-W ProMar 200 Latex Flat Wall Paint, B30W200.
3. 3rd Coat: S-W ProMar 200 Latex Flat Wall Paint, B30W200.

H. Gypsum Board (Where noted Enamel):
1. 1st Coat (Primer): S-W PrepRite 200 Latex Primer, B28W200.

2. 2nd Coat: S-W ProMar 200 Latex Eg-Shel, B20W200 Series.
3. 3rd Coat: S-W ProMar 200 Latex Eg-Shel, B20W200 Series.

2.3 Interior Paint Systems, General:

A. Approximately eight (8) interior paint colors total will be selected.
B. Individual colors may be used on more than one interior surface material.
C. Color selections will be made from the manufacturer's full product line, including deep tone tint bases.
D. Stained finishes to match Architect's sample. Provide three (3) approved finish samples of each type of wood to be stained prior to commencement of work. Note that different wood species are used for different items; adjust stain formulas as required to provide a uniform color and intensity on all stained items.

PART 3 — EXECUTION

3.1 Painting, General:

A. Applicator must examine areas and conditions under which painting work is to be applied and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Applicator.
B. Starting of painting work will be construed as Applicator's acceptance of surfaces and conditions within any particular area.
C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of durable paint film.

3.2 Surface Preparation:

A. General:
   1. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.
   2. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures and similar items in place and not to be finish-painted or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.
   3. Clean surfaces to be painted before applying paint surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.
B. Wood:
   1. Clean wood surfaces to be painted of dirt, oil or other foreign substances with scrapers, mineral spirits and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.

2. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, paneling.
3. When transparent finish is required, use spar varnish for backpriming.
4. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or equivalent sealer immediately upon delivery to job.

C. Ferrous Metals: Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.

D. Galvanized Surfaces: Clean free of oil and surface contaminants with non-petroleum based solvent.

E. Cementitious Materials: Prepare cementitious surfaces of concrete block to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.

3.3 Application:

A. General:
1. Apply paint in accordance with manufacturer's directions. Allow a minimum of four (4) hours between coats. Use applicator and techniques best suited for substrate and type of material best applied.
2. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
3. Paint surfaces behind movable equipment and furniture same as similar exposed equipment. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.
4. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.
5. Paint backsides of access panels, and removable or hinged covers to match exposed surfaces.
6. Finish exterior doors on tops, bottoms and side edges same as exterior faces, unless otherwise indicated.
7. Sand lightly between each succeeding enamel or varnish coat.
8. Omit first coat (primer) on metal surfaces that have been shop-primed and touch-up painted, unless otherwise indicated.
9. Paint exterior face only of Fire Extinguisher Cabinets (FEC) to match adjacent wall. Submit 8-1/2" x 11" color sample for Architect's approval where adjacent wall finish is wallcovering or other non-painted finish.
10. Paint interior surfaces of gypsum board soffits, light boxes, and similar surfaces where fully or partially visible through light lenses, grilles or other materials. Color to be selected by Architect.

B. Scheduling Painting:
1. Apply first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
2. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky

under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer.

D. Prime Coats:
   1. Apply prime coat of material which is required to be painted or finished, and which has not been prime coated by others.
   2. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

E. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.

F. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, holes, or other surface imperfections. Provide satin finish for final coats, unless otherwise indicated.

G. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3.4 Clean-Up and Protection:

A. Clean-Up:
   1. During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each workday.
   2. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

B. Protection:
   1. Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting as acceptable to Architect.
   2. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
   3. At the completion of work of other trades, touch up and restore all damaged or defaced painted surfaces.

END OF SECTION 09 91 00

SECTION 10 14 00 — SIGNAGE

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work: Provide all labor, materials, equipment and services required for complete installation of signage indicated on Drawings and specified herein.

1.3 Submittals:

A. Samples: The Architect will select the interior signage to be purchased under the allowance specified herein. If so requested by the Architect, submit samples of each color and finish of exposed materials and accessories required for signage. Architect's review of samples will be for color and texture only.

B. Request for Interior Signage Schedule:

1. The Architect will provide a schedule of interior signage requirements for the Contractor's use in preparing shop drawings.
2. The Contractor shall submit a written request for the signage schedule to the Architect not less than ninety (90) business days prior to the preparation of shop drawings. The Architect will not be responsible for delays that may result if the Contractor does submit his request in a timely manner.

C. Shop Drawings: Submit shop drawings showing fabrication and erection of signage. Include plans, elevations, and large-scale details of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories, and installation details.

1. Provide message list and drawing for each sign required, including large-scale details of wording and lettering layout.
2. For signage supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.
3. Furnish full-size spacing templates for individually mounted letters and numbers.

1.4 Quality Assurance:

A. Signage Fabricator Qualifications: Firm experienced in producing signage similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.

B. Single-Source Responsibility: For each separate sign type required, obtain signage from one source of a single manufacturer.

C. Design Concept: The Drawings indicate sizes, profiles, and dimensional requirements of signage and are based on the specific types and models indicated. Sign units by other manufacturers may be considered provided deviations in dimensions and profiles do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

1.5 Project Conditions:
A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

1.6 Coordination:
A. For signage supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signage.
1. For signage supported by or anchored to permanent construction, furnish templates for installation of anchorage devices.

PART 2 — PRODUCTS

2.1 Interior Signage Allowance: Contractor is to allow the sum of Three Thousand and no/100 Dollars ($3,000.00) in the Base Bid for the purchase of Interior Signage as specified herein. This allowance does not include sales taxes, freight, Contractor's profit and overhead, or installation cost. The installation shall include approximately Thirty (30) signs. A schedule of signage requirements will be provided to the Contractor by the Architect, in accordance with Article 1.3 – Submittals.
A. Laminated, Etched Photopolymer: Raised graphics with Braille 1/32 inch (0.8 mm) above surface with contrasting colors as selected by Architect from manufacturer's full range and laminated to acrylic back.
B. Edge Condition: Square cut.
C. Corner Condition: Square.
D. Mounting: Framed.
1. Wall mounted with concealed anchors.
E. Color: As selected by Architect from manufacturer's full range.
F. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch (0.8 mm) above surface with contrasting colors.

2.2 Handicapped Parking Signage (Two (2) Req'd): 12" x 18" physically handicapped parking signage equal to Series 218-2 as manufactured by the Charleston Industries, Inc., One Industrial Park, P.O. Box 370, Charleston, MS 38921, Tel (800) 647-2384, Fax (601) 647-3604, or prior approved equal. Signage shall include symbol of access and lettering silk-screened on .125" aluminum blank and mounted on manufacturer's standard painted aluminum 2" square post with post cap. There shall be an additional signage mounted below the symbol of accessibility on one (1) of the signs where indicated on the Drawings which reads "VAN ACCESSIBLE."

PART 3 — EXECUTION

3.1 Examination:
A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
B. Verify that items provided under other sections of Work are sized and located to accommodate signage.

C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation:
A. General: Locate signage units and accessories where indicated, using mounting methods of type described and in compliance with the manufacturer's instructions.
1. Install signage level, plumb, and at the height indicated, with signage surfaces free from distortion or other defects in appearance.
2. Interior Wall Signage: Install signage on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.
B. Wall-Mounted Panel Signage: Attach panel signage to wall surfaces using the methods indicated below:
1. Vinyl-Tape Mounting: Mount signs 5'-0" above finished floor on door or wall, as indicated on signage schedule to be provided by Architect, unless otherwise indicated using double-sided vinyl foam tape equal to 3M 4416 foam tape. Do not use this method for vinyl-covered or rough surfaces.
2. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signage with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
3. Where panel signage are scheduled or indicated to be mounted on glass, provide matching plate on opposite side of glass to conceal mounting materials.
C. Handicapped Parking Signage: Install signage in locations indicated on Drawings with bottom of sign 60" above finish grade and post set in 6" diameter x 18" deep concrete.

3.3 Cleaning and Protection: After installation, clean soiled signage surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

END OF SECTION 10 14 00

SECTION 10 21 15 — PLASTIC TOILET COMPARTMENTS

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section. Specifically reference Interior Elevations and Finish Schedule Notes.

1.2 Description of Work: Provide all labor, materials, equipment and services required for complete installation of plastic toilet compartments indicated on Drawings and specified herein.

1.3 Quality Assurance:
- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible, to ensure proper fitting of work. However, allow for adjustments within specified tolerance wherever taking of field measurements before fabrication might delay work.
- B. Coordination: Furnish inserts and anchorages which must be built into other work for installation of toilet partitions and related work; coordinate delivery with other work to avoid delay.

1.4 Submittals:
- A. Product Data: Submit manufacturer's detailed technical data for materials, fabrication, and installation, including catalog cuts of anchors, hardware, fastenings and accessories.
- B. Shop Drawings: Submit shop drawings for fabrication and erection of toilet partition assemblies not fully described by product drawings, templates and instructions for installation of anchorage devices built into other work.

1.5 Manufacturer: Provide floor mounted/overhead braced toilet partitions as manufactured by one of the following:
- A. Accurate Partitions Corporation
- B. American Sanitary Partition Corporation
- C. Bradley Corporation; Mills Partitions
- D. General Partitions Mfg. Corp.
- E. Scranton Products
  Scranton Products specification numbers are used for reference only.

PART 2 — PRODUCTS

2.1 Materials:
- A. Toilet compartment shall be floor-mounted, overhead-braced, with non-corrosive doors, panels and pilasters similar and equal to Poly-Mar HD® or Poly-Granite HD® compartments as manufactured by Scranton Products, Scranton, PA, or an approved equal by specifier or design professional prior to bid date with hardware as specified herein. Product shall be equal to the "Metallic Color Collection" in the Hammered finish

as manufactured by Scranton, but shall be selected from manufacturer's full range of colors and textures.

B. Panels, doors and pilasters shall be fabricated from High Density Polyethylene (HDPE) containing minimum of 10% recycled material which is waterproof, non-absorbent and has a self-lubricating surface that resists marking with pens, pencils or other writing utensils. All panels, doors and pilasters to arrive at job-site with special protective plastic covering.

C. Construction:
   1. High Density Polyethylene (HDPE) of solid Poly-Mar HD® or Poly-Granite HD® virgin resin materials in colors that extend throughout the surface; the panels, doors, and pilasters shall have combined recycled and/or virgin material (HDPE).
   2. Doors, panels and pilasters shall be a minimum of 1" thick and all edges machined to a radius of .250" and all exposed surfaces to be free of saw marks.
   3. Texture: To be selected by Architect from manufacturer's full range of texture options, including Hammered, Grip Ex, and Contour.
   4. Colors: To be selected by Architect from manufacturer's full range of and patterns, including metallic and textures in combination.

D. Fabrication:
   1. Dividing panels shall be 55" high and mounted 14" above finished floor.
   2. Doors shall be 55" high and mounted 14" above the finished floor.
   3. Pilasters shall be 82" high, mounted with a continuous stainless steel wall bracket with one-way theft-proof, stainless steel sex bolts. At pilasters 12" or wider, provide 3-1/2" wide x 78" long aluminum stiffener.
   4. Urinal screen dividing panels shall be 55" high and mounted 14" above finish floor. The panels shall be supported by a full length continuous stainless steel wall bracket at the end and a 1-3/4" x 1-3/4" x 69" high aluminum post at panel end.
   5. Finish of doors, panels, and pilasters shall be similar and equal to Santana Products, Inc. Colors of doors, panels and pilasters to be selected from the full range of standard colors and textures.
   6. Aluminum edging strips to be fastened to the bottom edge of all doors and panels using vandal-proof "T" barb heat sinc.

2.2 Hardware:

A. Door hardware shall be as follows:
   1. Hinges shall be aluminum continuous hinges that extend full height of the doors.
   2. Each handicapped door to include: Two (2) door pulls and one (1) wall stop.
   3. Door strike and keeper shall be fabricated from heavy aluminum extrusion (6463-T5 Alloy) with clear anodized finish with wrap around flange surface mounted and thru-bolted to pilaster with star-head security pin, stainless steel barrel bolts. Size of strike shall be 6" in length.
   4. Door latch housing shall be fabricated from heavy aluminum extrusion (6463-T5 Alloy) with brightdipped anodized finish, surface mounted and thru-bolted to door with star-head security pin, stainless steel barrel bolts. Slide bolt and button shall be heavy aluminum with "Tuff-Coat Black" anodized finish.

B. Pilaster Sleeves: 3 inches high, 20 gage stainless steel, secured to pilaster with stainless steel tamper resistant Torx head sex bolt.

C. Wall Brackets: 54 inches long, continuous stainless steel, fastened to pilasters and panels with stainless steel tamper resistant Torx head sex bolts.

D. Headrail: Heavy-duty extruded aluminum, anti-grip design, clear anodized finish, fastened to headrail bracket with stainless steel tamper resistant Torx head sex bolt and at top of pilaster with stainless steel tamper resistant Torx head screws.
E. Headrail Brackets: 20 gage stainless steel, satin finish, secured to wall with stainless steel tamper resistant Torx head screws.

PART 3 — EXECUTION

3.1 Installation:
A. General: Erection of partitions, etc., shall be in accordance with the manufacturer's standard recommendations and the following:
B. All parts shall be erected in a substantial manner, straight, level, and plumb.
C. No evidence of drilling, cutting or patching shall be visible in the finished work.
D. Clearance at vertical edges of doors shall be uniform top to bottom and shall not exceed 1/4".

3.2 Adjust and Clean:
A. Hardware Adjustment: Adjust and lubricate hardware for proper operation. Set hinges on inswinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging to return to fully closed position.
B. Clean exposed surfaces of partition systems using materials and methods recommended by manufacturer, and provide protection as necessary to prevent damage during remainder of construction period.

END OF SECTION 10 21 15

SECTION 10 28 13 — TOILET ACCESSORIES

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work: Provide all labor, materials, equipment and services required for complete installation of all toilet accessories indicated on Drawings and specified herein.

1.3 Submittals:
- A. Product Data: For each type of product indicated. Include the following:
  1. Construction details and dimensions.
  2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
  3. Material and finish descriptions.
  4. Features that will be included for Project.
  5. Manufacturer's warranty.
- B. Maintenance Data: For toilet accessories to include in maintenance manuals.

1.4 Quality Assurance:
- A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

1.5 Coordination:
- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 — PRODUCTS

2.1 Manufacturer: Provide toilet accessories as manufactured by Bradley, Bobrick, ASI or approved equal. Bradley specification numbers are used for reference only.

2.2 Public-Use Washroom Accessories:
- A. Grab Bars (3 Req'd of Each Size): Bradley Model 812-001-36" long, Model 812-001-18" long and Bradley Model 812-001-42" long grab bars fabricated of type 304 satin finish stainless steel with concealed mounting flanges. Furnish 899-011 mounting kit for drywall/metal stud partitions with wood blocking. See floor plans and interior elevations for locations.
- B. Paper Towel Dispensers: Shall be furnished by Owner and installed by General Contractor. See interior elevations for locations.
  1. Quantity: 4

2. Locations: Toilet 104, Toilet 121, Men's Restroom 110

C. Soap Dispensers: Shall be furnished by Owner and installed by General Contractor. See interior elevations for locations.
   1. Quantity: 4
   2. Locations: Toilet 104, Toilet 121, Men's Restroom 110

D. Toilet Tissue Holders: Bradley Model 5224, dual roll surface mounted toilet tissue dispenser, shall be furnished and installed by General Contractor. See interior elevations for locations.
   1. Quantity: 4
   2. Locations: Toilet 104, Toilet 121, Men's Restroom 110

E. Channel-Framed Mirror: Bradley Model 781-1836 mirror with roll formed channel frame and theft-resistant mounting. Frame is one piece, roll-formed stainless steel with 90-degree mitered corners and bright annealed finish. Overall dimensions 18" x 36" H.
   1. Quantity: 2
   2. Locations: Toilet 104, Toilet 121

2.3 Custodial Accessories:

A. Utility Shelf (One (1) Req'd): Bradley Model 9983-30" surface mounted utility shelf fabricated of type 304 (18-8) stainless steel in satin finish with 16 gauge brackets and hooks. Drying rod of 1/4" stainless steel. Mop and broom holders to have spring operated rubber cams.

2.4 Fabrication:

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

PART 3 — EXECUTION

3.1 Installation:

A. Install accessories according to manufacturer's written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

3.2 Adjusting and Cleaning:

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 28 13

SECTION 10 44 00 — FIRE PROTECTION SPECIALTIES

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all labor, materials, equipment and services required for complete installation of all fire protection specialties and accessories indicated on Drawings and specified herein.
- B. Field painting of fire protection specialties shall be as specified in Section 09 91 00 - Painting.

1.3 Quality Assurance:
- A. Provide portable fire protection specialties and accessories by one manufacturer, unless otherwise acceptable to Architect.
- B. UL-Listed Products: Provide new portable fire extinguishers that are UL-listed and bear UL "Listing Mark" for type, rating, and classification of extinguisher indicated.

1.4 Submittals:
- A. Product Data: Submit manufacturer's technical data and installation instructions for all portable fire extinguishers required. For fire extinguisher cabinets include rough-in dimensions, and details showing mounting methods, relationships to surrounding construction, door hardware, cabinet type and materials, trim style and door construction, style and materials. Where color selection by Architect is required, include color charts showing full range of manufacturer's standard colors and designs available.

PART 2 — PRODUCTS

2.1 Fire Extinguishers and Cabinets:
- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
  1. J.L. Industries.
  2. Larsen's Mfg. Co.
  3. Muckle Manufacturing, Division.
  4. Profile International, Inc.

  Larsen specification numbers given for reference to standard only for fire extinguishers and cabinets.
- B. Fire Extinguishers (9 Req'd): Shall be Larsen MP10 or approved equal 10 lb. multi-purpose dry chemical fire extinguisher capable of extinguishing Class A, B and C fires.
- C. Cabinets (3 Req'd): Shall be Larsen FS 2409-R4 fire-rated or approved equal constructed of cold-rolled steel with a standard finish of white baked acrylic enamel, 26 1/8" x 11 5/8" x 4" rough opening. Door shall be solid panel with black horizontal letters.

D. Bracket (6 Req'd): Shall be Larson Optional Bracket #846

2.2 Fire Department Key Box (1 Req'd): Provide Knox-Box 3200 Series recessed mounted High Security Commercial Key Box with hinged door and UL Listed tamper switches as manufactured by Knox Company, 1601 W. Deer Valley Road, Phoenix, AZ 85027, Tel: (800) 552-5669, Fax: (623) 687-2299, Web: www.knoxbox.com.

A. Construction: Key box shall be constructed of 1/4" plate steel housing, 1/2" thick steel door with interior gasket seal. Box and lock shall be UL Listed. Lock shall have 1/8" dust cover with tamper seal mounting capability.
B. Exterior Dimensions: Recessed mounting, 7" h. x 7" w. x 3-1/4" d.
C. Lock: UL Listed, double-action rotating tumblers and hardened steel pins accessed by a biased cut key.
D. Finish:
   1. Pre-Treatment: Zinc-phosphate to Federal Standard TTC 490 Type II.
   2. Final Coating: Weather resistant interior and exterior TGIC polyester powder coat.
   3. Finish Color: Dark Bronze.
E. Recessed Mounting Kit: Knox-Box 3200 Series Recessed Mounting Kit (RMK). Kit shall be furnished with shell housing and mounting hardware to be cast-in-place in new concrete or in masonry construction.
   1. Dimensions: 6-1/8" h. x 6" w. x 5" d., including rebar.
   2. Mounting Height: 6'-0" a.f.f. to bottom of RMK shell.

PART 3 — EXECUTION

3.1 Examination:

A. Examine walls and partitions for suitable framing depth and blocking where recessed fire protection specialties will be installed.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation:

A. Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.
B. Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.
C. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.
D. Where exact location of surface-mounted cabinets and bracket-mounted fire extinguishers is not indicated, locate as directed by Architect.

3.3 Identification: Identify fire extinguisher in cabinet with black horizontal lettering spelling "FIRE EXTINGUISHER" on a decal applied to door following field painting of cabinet. Provide lettering on door as indicated, or if not indicated, as selected by Architect from manufacturer's standard letter sizes, styles, colors and layouts.

3.4 Adjusting and Cleaning:

A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.

B. Touch up marred finishes, or replace fire protection specialties that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection specialties manufacturer.
C. Replace fire protection specialties that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 00

SECTION 10 75 00 — FLAGPOLE

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work: Provide all labor, materials, equipment and services required for complete installation of flagpole indicated on Drawings and specified herein.

1.3 Submittals:
- A. Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data and installation instructions for flagpole required.
- C. Shop drawings of flagpole and base, showing general layout, jointing, grounding method, and anchoring and supporting systems.
  1. Include details of foundation system for ground-set poles.

1.4 Quality Assurance:
- A. Manufacturing Standards: Provide flagpole as a complete unit produced by a single manufacturer, including fittings, accessories, bases, and anchorage devices.
- B. Design Criteria: Provide flagpole and installation constructed to withstand a 90-mph wind velocity minimum when flying flag of appropriate size. Use heavy pipe sizes if required for flagpole type and height shown.
- C. Pole Construction: Construct pole and ship to site in one piece if possible. If more than one piece is necessary provide snug-fitting, precision joints with self-aligning, internal splicing sleeve arrangement for weather-tight, hairline field joints.

1.5 Delivery, Storage, and Handling:
- A. General: Spiral wrap flagpole with heavy Kraft paper or other weather-tight wrapping and prepare for shipment in hard fiber tube or other protective container.
- B. Deliver flagpole and accessories completely identified for installation procedure. Handle and store flagpole to prevent damage or soiling.

PART 2 — PRODUCTS

2.1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- A. Aabec Pole Div., Morgan-Francis Co.
- B. American Flagpole Div. of Kearney-National, Inc.
- C. Baartol Co., Inc.
- D. Concord Industries, Inc.
- E. EMC Div., Eder Manufacturing Corp.
- F. Eder Flag Manufacturing Co., Inc.
- G. John Ewing and Co., Inc.

H. Pole-Tech, Inc.

2.2 Aluminum Flagpole: Fabricate from seamless extruded tubing complying with ASTM B 241, alloy 6063-T6, having a minimum wall thickness of 3/16 inch (0.1875 inch), tensile strength not less than 30,000 psi, and a yield point of 25,000 psi. Heat-treat and age-harden after fabrication. Provide cone-tapered aluminum flagpole.

A. Dimensions:
   1. Overall Length: 33'-0"
   2. Exposed Height: 30'-0"
   3. Butt Diameter: 5"
   4. Top Diameter: 3"
   5. Wall Thickness: .188"

B. Flag: 6' x 10' Nylon.

2.3 Flagpole Mounting:

A. Provide manufacturer's standard base system for the type of flagpole installation required.

B. Foundation Tube: For ground-set flagpoles, provide 16-gage minimum galvanized corrugated steel tube, or 12-gage rolled steel tube, sized to suit flagpole and installation. Furnish complete with welded steel bottom base and support plate, lightning ground spike, and steel centering wedges, all welded construction. Provide loose hardwood wedges at top for plumbing pole after erection. Galvanize steel parts after assembly, including foundation tube.

C. Provide manufacturer's standard flash collar, finish to match flagpole.

2.4 Shaft Finish:

A. General: Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Aluminum: Finish designations prefixed by "AA" conform to the Aluminum Association system for designating aluminum finishes. Provide fine, directional, satin (AA-M32), anodized finish.

2.5 Fittings:

A. Finial Ball: Manufacturer's standard flush-seam ball, size to match pole butt diameter. Finish shall be gold anodized.

PART 3 — EXECUTION

3.1 Preparation for Ground-Set Poles:

A. Excavation: Excavate for foundation concrete to neat clean lines in undisturbed soil. Provide forms where required due to unstable soil conditions. Remove wood, loose soil, rubbish, and other foreign matter from excavation; and moisten earth before placing concrete. Backfill open excavation after concreting with original excavated material.

B. Concrete: Provide concrete composed of portland cement, coarse and fine aggregate, and water mixed in proportions to attain 28-day compressive strength of not less than 3000 psi, complying with ASTM C 94.

C. Place concrete immediately after mixing. Compact concrete in place by use of vibrators. Moist-cure exposed concrete for not less than 7 days, or use a nonstaining curing compound in cold weather.
D. Finish trowel exposed concrete surfaces to smooth, dense surface. Provide positive slope for water runoff to base perimeter.

3.2 Flagpole Installation:
A. General: Prepare and install flagpole where shown and in compliance with accepted shop drawings and manufacturer's instructions.
B. Provide positive lightning ground for flagpole installation.
C. Paint below-grade portions of ground-set flagpole with heavy coat of bituminous paint.

END OF SECTION 10 75 00

SECTION 13 34 21 — METAL BUILDING SYSTEMS

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:

A. The building shall include all primary and secondary structural framing members, connection bolts, covering, flashing, closures, sealer, insulation and other miscellaneous items as shown or called for in the Drawings or Specifications.

B. The building manufacturer shall provide erection, installation and assembly drawings including anchor bolt setting plan, roof plan, elevation, cross section, etc., as required to assemble all parts, components and accessories furnished by the building manufacturer. Drawings shall indicate the piece marks of all parts to be erected or assembled for easy field identification.

C. The building manufacturer shall furnish structural steel, primary and secondary member design and drawings. Design drawings shall bear the name, seal, registration number and State of Alabama registry of a licensed professional engineer. Design load requirements shall be in compliance with International Building Code and in accordance with the latest edition of AISC, "Specifications for the Design, Fabrication and Erection of Steel Buildings" for structural steel; AISI, "Specifications for the Design of Cold-Formed Steel Structural Members" for lightgage cold-formed structural members; and "Recommended Design Practices Manual" of the Metal Building Manufacturers Association (MBMA). In addition to the requirements of the agencies listed above, the following additional requirements must be met:

1. Building shall be designed to withstand a minimum horizontal projection for any structural member. The design live load shall not be reduced for members supporting more than 200 SF of tributary loaded area.
2. Building shall be designed to withstand a minimum collateral load of 10 PSF.

D. Related Sections: The following sections contain requirements that relate to this section:

1. Concrete floor and foundations and installation of anchor bolts are specified in Division 3 Section "Concrete Work."
2. Brick masonry exterior walls are specified in Division 4 Section "Unit Masonry."
3. Sealants and caulking are specified in Division 7 Section "Joint Sealers."

1.3 System Performance Requirements:

A. General: Engineer, design, fabricate and erect the pre-engineered metal building system to withstand loads from winds, gravity, structural movement including movement thermally induced and to resist in-service use conditions that the building will experience, including exposure to the weather, without failure.

1. Design each member to withstand stresses resulting from combinations of loads that produce the maximum allowable stresses in that member as prescribed in MBMA's "Design Practices Manual."

B. Design Loads: Basic design loads, as well as auxiliary and collateral loads, are indicated on the drawings.
   1. Basic design loads include live load, wind load and seismic load, in addition to the dead load.
   2. Collateral loads include additional dead loads over and above the weight of the metal building system such as sprinkler systems and roof-mounted mechanical systems. In addition, design for HVAC units shown on the Drawings.

C. Structural Framing and Roof and Siding Panels: Design primary and secondary structural members and exterior covering materials for applicable loads and combinations of loads in accordance with the Metal Building Manufacturers Association's (MBMA) "Design Practices Manual."
   1. Structural Steel: Comply with the American Institute of Steel Construction's (AISC) "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" for design requirements and allowable stresses.
   2. Light Gage Steel: Comply with the American Iron and Steel Institute's (AISI) "Specification for the Design of Cold Formed Steel Structural Members" and "Design of Light Gage Steel Diaphragms" for design requirements and allowable stresses.
   3. Welded Connections: Comply with the American Welding Society's (AWS) "Standard Code for Arc and Gas Welding in Building Construction" for welding procedures.

1.4 Submittals:

A. General: Submit the following in accordance with Conditions of the Contract and Division 1 Specification Sections.

B. Product data consisting of metal building system manufacturer's product information for building components and accessories.

C. Shop drawings for metal building structural framing system, roofing and siding panels and other metal building system components and accessories that are not fully detailed or dimensioned in manufacturer's product data.
   1. Structural Framing: Furnish complete erection drawings prepared by or under the supervision of a professional engineer legally authorized to practice in the jurisdiction where the Project is located. Include details showing fabrication and assembly of the metal building system. Show anchor bolt settings, sidewall, end wall, and roof framing. Include transverse cross-sections.
   2. Roofing and Siding Panels: Provide layouts of panels on walls and roofs, details of edge conditions, joints, corners, custom profiles, supports, anchorages, trim, flashings, closures and special details. Include transverse cross-sections.
   3. Building Accessory Components: Provide details of metal building accessory components to clearly indicate methods of installation including the following:
      a) Sheet Metal Accessories: Provide layouts at 1/4-inch scale. Provide details of ventilators, louvers, gutters, downspouts and other sheet metal accessories at not less than 1-1/2 inch scale showing profiles, methods of joining and anchorages.

D. Samples for initial selection purposes in form of manufacturer's color charts or chips showing full range of colors, textures and patterns available for metal roofing and siding panels with factory-applied finishes.

E. Professional engineer's certificate prepared and signed by a Professional Engineer, legally authorized to practice in the jurisdiction where Project is located, verifying that

the structural framing and covering panels meet indicated loading requirements and codes of authorities having jurisdiction.

1.5 Quality Assurance:

A. Installer Qualifications: Engage an experienced Installer to erect the pre-engineered metal building who has specialized in the erection and installation of types of metal building systems similar to that required for this project and who is certified in writing by the metal building system manufacturer as qualified for erection of the manufacturer's products.

B. Manufacturer's Qualifications: Provide pre-engineered metal building manufactured by a firm experienced in manufacturing metal building systems that are similar to those indicated for this project and have a record of successful in-service performance.

C. Single-Source Responsibility: Obtain the metal building system components, including structural framing, wall and roof covering, and accessory components, from one source from a single manufacturer.

D. Design Criteria: The drawings indicate size, profiles and dimensional requirements of the pre-engineered metal buildings and are based on the specific type and model indicated. Metal building systems having equal characteristics by other manufacturers may be considered provided that deviations in dimensions and profiles are minor and do not change the design concept or intended performance as judged by the Architect. The burden of proof of equality is on the proposer.

1.6 Delivery, Storage and Handling:

A. Deliver prefabricated components, sheets, panels and other manufactured items so they will not be damaged or deformed. Package wall and roof panels for protection against transportation damage.

B. Handling: Exercise care in unloading, storing and erecting wall and roof covering panels to prevent bending, warping, twisting and surface damage.

C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering. Store metal wall and roof panels so that water accumulations will drain freely. Do not store panels in contact with other materials that might cause staining, denting or other surface damage.

1.7 Guarantees:

A. The roofing and associated work shall be guaranteed by the General Contractor for five (5) years starting on date of acceptance of the project by the Owner for all costs of repairs to the roofing panels and flashing necessary to correct roof leaks from improper workmanship; deterioration of roofing panels and flashing caused by ordinary weathering; or deterioration of roof membrane due to occasional ponding water.

B. The "Roofing Guarantee," as included in these Specifications, shall be executed in triplicate, signed by the appropriate party and submitted to the Owner through the Architect.

C. This guarantee does not include costs which might be incurred by the General Contractor in making visits to the site requested by the Owner regarding roof problems that are clearly due to lack of proper maintenance (keeping gutters clear of debris that cause a stoppage of drainage which results in water-ponding, overflowing of flashing, etc.), or damages caused by vandalism or misuse of roof areas. Should the Contractor be required to return to the job to correct problems of this nature that are determined not to be related to faulty workmanship and material in the installation of the roof, payment for actions taken by the Contractor in response to such requests will be the

responsibility of the Owner. A detailed written report shall be made by the General Contractor on each of these "Service Calls" with copies to the Architect and the Owner.

D. Roofing and Siding Panel Finish Warranty: In addition to the General Contractor's Roofing Guarantee, furnish the roofing and siding panel manufacturer's written warranty, covering failure of the factory-applied exterior finish on metal wall and roof panels within the warranty period. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents. Standard manufacturer's roofing guarantees which contain language regarding the governing of the guarantee by any state other than the State of Alabama, must be amended to exclude such language, and substituting the requirement that the Laws of the State of Alabama shall govern all such guarantees.
   1. Warranty period for factory-applied exterior finishes on wall and roof panels is 20 years after the date of Substantial Completion.

1.8 Pre-Roofing Conference:

A. A pre-roofing conference is required before any roofing materials are installed. This conference shall be conducted by a representative of the Architect and attended by representatives of the Owner, General Contractor, Roofing Contractor, Sheet Metal Contractor, Roof Deck Manufacturer (if applicable), and the Roofing Materials Manufacturer (if warranty is required of this manufacturer). If equipment of substantial size is to be placed on the roof, the Mechanical Contractor must also attend this meeting.

B. The pre-roofing conference is intended to clarify demolition (for renovation or re-roofing projects) and application requirements for work to be completed before roofing operations can begin. This would include a detailed review of the specifications, roof plans, roof deck information, flashing details, and approved shop drawings, submittal data, and samples. If conflict exists between the specifications and the Manufacturer's requirements, this shall be resolved. If this pre-roofing conference cannot be satisfactorily concluded without further inspection and investigation by any of the parties present, it shall be reconvened at the earliest possible time to avoid delay of the work. In no case should the work proceed without inspection of all roof deck areas and substantial agreement on all points.

C. The following are to be accomplished during the conference:
   1. Review all Factory Mutual and Underwriters Laboratories requirements listed in the specifications and resolve any questions or conflicts that may arise.
   2. Establish trade-related job schedules, including the installation of roof-mounted mechanical equipment.
   3. Establish roofing schedule and work methods that will prevent roof damage.
   4. Require that all roof penetrations and walls be in place prior to installing the roof.
   5. Establish those areas on the job site that will be designated as work and storage areas for roofing operations.
   6. Establish weather and working temperature conditions to which all parties must agree.
   7. Establish acceptable methods of protecting the finished roof if any trades must travel across or work on or above any areas of the finished roof.

D. The Architect shall prepare a written report indicating actions taken and decisions made at this pre-roofing conference. This report shall be made a part of the project record and copies furnished the General Contractor and the Owner.

1.9 Extra Materials:

A. Maintenance Stock: Furnish at least 5 percent excess over required amount of nuts, bolts, screws, washers and other required fasteners for each metal building. Pack in cartons labeled to identify the contents and store on the site where directed.

PART 2 — PRODUCTS

2.1 Manufacturer: Subject to compliance with specified requirements, provide metal building systems provided by one of the following:
- A. A & S Building Systems, Inc.
- B. American Buildings Co.
- C. Armco Steelox Building Systems
- D. Bigbee Steel Buildings, Inc.
- E. Gulf States Manufacturers, Inc.

2.2 Materials:
- A. Hot-Rolled Structural Steel Shapes: Comply with ASTM A 36 or A 529.
- B. Steel Tubing or Pipe: Comply with ASTM A 500, Grade B, ASTM A 501, or ASTM A 53.
- C. Steel Members Fabricated from Plate or Bar Stock: Provide 42,000 psi minimum yield strength. Comply with ASTM A 529, ASTM A 570 or ASTM A 572.
- D. Steel Members Fabricated by Cold Forming: Comply with ASTM A 607, Grade 50.
- E. Cold-Rolled Carbon Steel Sheet: Comply with requirements of ASTM A 366 or ASTM A 568.
- F. Hot-Rolled Carbon Steel Sheet: Comply with requirements of ASTM A 568 or ASTM A 569.
- G. Structural Quality Zinc-Coated (Galvanized) Steel Sheet: Comply with ASTM A 446 with G90 coating complying with ASTM A 525. Grade to suit manufacturer's standards.
- H. Aluminum-Coated Steel Sheets: Comply with ASTM A 463 with T1-40 coating.
- I. Aluminum Sheets: Comply with ASTM B 209 for Alclad alloy 3003 or 3004 with temper as required to suit forming operations.
- J. Bolts for Structural Framing: Comply with ASTM A 307 or ASTM A 325 as necessary for design loads and connection details.
- K. Thermal Insulation: Glass fiber blanket insulation, complying with ASTM C 991, of 0.5 lb. per cu. ft. density, thickness as indicated, with UL flame spread classification of 25 or less, and 2 inch wide continuous vapor-tight edge tabs.
  1. Vapor Barrier: Foil-reinforced kraft paper.
  2. Retainer Strips: 26-gage (0.0179-inch) formed galvanized steel retainer clips colored to match the insulation facing.
- L. Paint and Coating Materials: Comply with performance requirements of the federal specifications indicated. Unless specifically indicated otherwise, compliance with compositional requirements of federal specifications indicated is not required.
  1. Shop Primer for Ferrous Metal: Fast-curing, lead-free, universal primer, selected by the manufacturer for resistance to normal atmospheric corrosion, compatibility with finish paint systems and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure. Comply with FS TT-P-645.
  2. Shop Primer for Galvanized Metal Surfaces: Zinc dust-zinc oxide primer selected by the manufacturer for compatibility with substrate. Comply with FS TT-P-641.

2.3 Structural Framing:

A. Rigid Frames: Fabricate from hot-rolled structural steel shapes. Provide factory-welded, shop-painted, built-up "I-beam"-shape or open-web-type frames consisting of tapered or parallel flange beams and tapered columns. Furnish frames with attachment plates, bearing plates and splice members. Factory drill for field-bolted assembly.
   1. Provide rigid frames at endwalls where indicated.

B. Primary Endwall Framing: Provide the following primary endwall framing members fabricated for field-bolt assembly:
   1. Endwall Columns: Manufacturer's standard shop-painted, built-up factory-welded "I"-shape or cold-formed "C" sections.
   2. Endwall Beams: Manufacturer's standard shop-painted "C"-shape roll-formed sections.

C. Secondary Framing: Provide the following secondary framing members with minimum thicknesses as indicated:
   1. Roof Purlins, Sidewall and Endwall Girts: "C" or "Z"-shaped sections fabricated from 16 gage (0.0598-inch) shop-painted roll-formed steel. Purlin spacers shall be fabricated from 14-gage (0.0747-inch) cold-formed galvanized steel sections.
   2. Eave Struts: Unequal flange "C"-shaped sections formed to provide adequate backup for both wall and roof panels. Fabricate from 16-gage (0.0598-inch) shop-painted roll-formed steel.
   3. Flange and Sag Bracing: 1-5/8 by 1-5/8 inch angles fabricated from 16-gage (0.0598-inch) shop-painted roll-formed steel.
   4. Base or Sill Angles: Fabricate from 14-gage (0.0747-inch) cold-formed galvanized steel sections.
   5. Secondary endwall structural members, except columns and beams, shall be the manufacturer's standard sections fabricated from 14-gage (0.0747-inch) cold-formed galvanized steel.

D. Wind Bracing: Provide adjustable wind bracing using threaded steel rods; comply with ASTM A 36 or ASTM A 572, Grade D. Locate interior end bay bracing only where indicated.

E. Bolts: Provide shop-painted bolts except when structural framing components are in direct contact with roofing and siding panels. Provide zinc-plated or cadmium-plated bolts when structural framing components are in direct contact with roofing and siding panels.

F. Shop Painting: Clean surfaces to be primed of loose mill scale, rust, dirt, oil, grease and other matter precluding paint bond. Follow procedures of SSPC-SP3 for power-tool cleaning, SSPC-SP7 for brush-off blast cleaning and SSPC-SP1 for solvent cleaning.
   1. Prime structural steel primary and secondary framing members with the manufacturer's standard rust-inhibitive primer.
   2. Prime galvanized members, after phosphoric acid pretreatment, with manufacturer's standard zinc dust-zinc oxide primer.

2.4 Roofing and Siding Panels:

A. Roof Panels: Shall be Bigbee VR-218 standing seam roof system as manufactured by Bigbee Steel Buildings, Inc., Muscle Shoals, Alabama or prior approved equal.
   1. Panels: The panel shall be fabricated from Galvalume coated steel. The panel shall be factory precision roll-formed pan panel with side seams formed by 14 forming stations. The panel shall have a nominal 2" high rib/seam and shall be a nominal 18" wide. Panels shall have a male and female vertical leg formed so that the two legs can be seamed in the field with a hand seamer or motorized field

seaming machine. Maximum panel lengths shall be provided to minimize the need for end splices. Panel lengths shall be cut using one-piece die that sheers the panel to length and makes factory notches in the male and female sides. The panel line shall be capable of producing panels with length tolerances within 1/16" from panel to panel.

2. Seams: The factory-applied sealant shall be injected into the female side of the seam during panel forming. Continuous field seaming shall interlock the two panels, forming a TripleLok seam.
3. Panel Clips: Provide standard floating clips with a tab and a base with a sliding interlock allowing the roof 1-3/4" of expansion movement and 1-3/4" of contraction movement. The floating tab will move in the sliding interlock of the 16 gauge galvanized steel clip base. The clip base will be protected from corrosion by galvanized coating that has similar weather resistance to that of the panel coating. The clip tabs will have a top portion formed so they will be folded into the TripleLok seam during seaming of the side lap. Panel clips will be attached to the secondary structurals with two 1/4"-14 self tapping screws. Provide high clips to accommodate specified insulation blankets.
4. Panel Endlaps: Panel endlaps will be required only if the panel run length is greater than the maximum length that the panel can be shipped. Roof panels shall be provided with butyl tape sealant placed between the panels and then tightly clamped to a heavy-gauge back-up plate.
5. Eave and Termination Perimeter Plates: Eave perimeter plates shall be installed over the eave member so that the outer edge extends over the wall panel. The eave perimeter plate shall provide a solid, non-compressible attachment point for the eave end of the panel run.
6. Ridge Flashing: The design of the ridge flashing shall accommodate roof expansion and contraction. The ridge flashing shall have a finish that matches the roof panel finish.
7. Eave Trim and Gutter: The roof panel shall be sealed to the wall panel with an eave flashing. The eave flashing shall be provided with a gasket sealing point to seal the underside of the roof panel and act as a shingle to shed water over the outside of the wall panel.
8. Fasteners: The roof system shall not have exposed through fasteners that penetrate the roof membrane over the building envelope except at panel endlaps on roof runs that are longer than the length a panel can be shipped.
    a) Endlap Fasteners:
        (1) Six (6) endlap fasteners shall be required to seal each panel endlap.
        (2) Endlap fasteners shall be oversized #12 x 1-1/4" self drilling fasteners.
        (3) All exposed fasteners shall be self-drilling with metal backed neoprene sealing washers.]
9. Material and Finish:
    a) Panel and Flashing Material:
        (1) The roof panels shall be of 24 gauge steel, 50,000 psi minimum yield strength (ASTM A792, Grade 50), coated with AZ5a5 (minimum) aluminum/zinc alloy for unpainted finish.
        (2) The flashing and trim shall be 26 gauge steel, 50,000 psi minimum yield strength (ASTM A792 Grade 50), coated with AZ50 (minimum) aluminum/zinc alloy for painted finish.
    b) Sealants:

(1) The seam sealant will be a non-drying, non-hardening, non-oxidizing butyl rubber based sealant specifically formulated for factory sealing standing seam roof panels.
(2) Sealant for the eave, end splice, ridge flashing, and rake trim will be non-drying, non-hardening, butyl based tape sealant specifically formulated for field application at temperatures of 20° F to 120° F.
(3) Service temperature of both sealants shall be -60° F to 180° F.

c) Closures:
(1) The end dam to be used at the high side of a single slope roof shall be a die-formed steel closure with factory punched holes. The tape sealant shall be sandwiched between the roof panel, which is fully supported by a rigid heavy gauge back-up plate and the flange of the end dam.

B. Wall Panels: Shall be equal to Bigbee Rib II wall panels or prior approved equal.
1. Provide minimum 26 gauge rib wall panels of manufacturer's standard profile and 36" coverage.
a) Finish: Panels shall have a factory applied coating of a Kynar® finish as selected by the Architect from any of manufacturer's standard colors.
b) 50,000 psi minimum yield strength (ASTM A792, Grade 50)
2. Trim Profiles: Provide trim profiles and reinforcing as required for door and window openings and parapet caps.

C. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets, self-locking bolts, end-welded studs and other suitable fasteners designed to withstand design loads.
1. Provide metal-backed neoprene washers under heads of fasteners bearing on weather side of panels.
2. Use aluminum or stainless steel fasteners for exterior application and galvanized or cadmium-plated fasteners for interior applications.
3. Locate and space fastenings in true vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of neoprene washer.
4. Provide fasteners with heads matching color of roofing or siding sheets by means of plastic caps or factory-applied coating.

D. Accessories: Provide the following sheet metal accessories factory-formed of the same material in the same finish as roof and wall panels:
1. Flashings
2. Closers
3. Fillers
4. Metal Expansion Joints
5. Ridge Covers
6. Fascias

E. Flexible Closure Strips: Closed-cell, expanded cellular rubber, self-extinguishing flexible closure strips. Cut or premold to match configuration of roofing and siding sheets. Provide closure strips where indicated or necessary to ensure weathertight construction.

F. Snow Guards: Shall be #33T Snow Guard as manufactured by Alpine SnowGuards, 289 Harrel St., Morrisville, VT 05661, Tel. (888) 766-4273, Fax. (888) 766-9994, Website: www.alpinesnowguards.com or prior approved equal.
1. Materials:
a) Snow Guard Block: 6000 Series Aluminum.
b) Snow Guard Bracket: 5052-H32 Aluminum.
c) Bolt and Washer: 300 Series Stainless Steel, 5/16" diameter.

d) Finish: Powder coated.

G. Sealing Tape: Pressure-sensitive 100 percent solids grey polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

H. Joint Sealant: One-part elastomeric polyurethane, polysulfide or silicone rubber sealant as recommended by the building manufacturer.

I. Baked Enamel Finish: Provide the manufacturer's standard shop-applied baked enamel finish to galvanized steel roof and wall panels, and related trim and accessory elements. For roofing and siding, apply finish coat on exterior facings and manufacturer's standard wash coat on reverse face.
   1. Clean galvanized steel with an alkaline compound, then treat with a zinc phosphate conversion coating and seal with a chromic acid rinse.
   2. Apply baked-on thermo-setting modified acrylic enamel to pretreated steel sheets, in one or more coats as standard with the manufacturer to achieve a minimum dry film thickness of 1.5 mils.

2.5 Sheet Metal Accessories:

A. General: Provide coated steel sheet metal accessories with coated steel roofing and siding panels.

B. Gutters: Form in 8-foot long sections, complete with end pieces, outlet tubes and other special pieces as required. Size in accordance with SMACNA. Joint sections with riveted and soldered or sealed joints. Provide expansion-type slip joint at center of runs. Furnish gutter supports spaced 36 inches on center, constructed of same metal as gutters. Provide bronze, copper or aluminum wire ball strainers at outlets. Finish to match roof fascia and rake.

C. Downspouts: Form in 10-foot long sections, complete with elbows and offsets. Join sections with 1-1/2 inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 5 feet on center in between. Finish to match wall panels.

2.6 Fabrication:

A. General: Design prefabricated components and necessary field connections required for erection to permit easy assembly and disassembly.
   1. Fabricate components in such a manner that once assembled, they may be disassembled, repackaged and reassembled with a minimum amount of labor.
   2. Clearly and legibly mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.

B. Structural Framing: Shop-fabricate framing components to indicated size and section with base plates, bearing plates and other plates required for erection, welded in place. Provide holes for anchoring or connections shop-drilled or punched to template dimensions.
   1. Shop Connections: Provide power riveted, bolted or welded shop connections.
   2. Field Connections: Provide bolted field connections.

PART 3 — EXECUTION

3.1 Erection:

A. Framing: Erect structural framing true to line, level, plumb, rigid and secure. Level base plates to a true even plane with full bearing to supporting structures, set with

double-nutted anchor bolts. Use a non-shrinking grout to obtain uniform bearing and to maintain a level base line elevation. Moist cure grout for not less than 7 days after placement.

B. Purlins and Girts: Provide rake or gable purlins with tight fitting closure channels and fascias. Locate and space wall girts to suit door and window arrangements and heights. Secure purlins and girts to structural framing and hold rigidly to a straight line by sag rods.

C. Bracing: Provide diagonal rod or angle bracing in both roof and sidewalls as indicated.
   1. Movement resisting frames may be used in lieu of sidewall rod bracing, to suit manufacturer's standards.
   2. Where diaphragm strength of roof or wall covering is adequate to resist wind forces, rod or angle bracing will not be required.

D. Framed Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical or electrical work. Securely attach to building structural frame.

3.2 Roofing and Siding:

A. General: Arrange and nest sidelap joints so that prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line. Protect factory finishes from damage.
   1. Field cutting of exterior panels by torch is not permitted.
   2. Provide weather seal under ridge cap. Flash and seal roof panels at eave and rake with rubber, neoprene or other closures to exclude weather.

B. Standing-Seam Roof Panel System: Fasten roof panels to purlins with concealed clip in accordance with the manufacturer's instructions.
   1. Install clips at each support with self-drilling fasteners.
   2. At end laps of panels, install tape caulk between panels.
   3. Install factory-caulked cleats at standing-seam joints. Machine-seam cleats to the panels to provide a weathertight joint.

C. Wall Sheets: Apply elastomeric sealant continuous between metal base channel (sill angle) and concrete and elsewhere as necessary for waterproofing. Handle and apply sealant and back-up in accordance with sealant manufacturer's recommendations.
   1. Align bottoms of wall panels and fasten panels with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws. Fasten window and door frames with machine screws or bolts. When building height requires two rows of panels at gable ends, align lap of gable panels over wall panels at eave height.
   2. Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads or panels. Install screws in predrilled holes.
   3. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

D. Sheet Metal Accessories: Install gutters, downspouts, ventilators, louvers and other sheet metal accessories in accordance with manufacturer's recommendations for positive anchorage to building and weathertight mounting. Adjust operating mechanism for precise operation.

E. Thermal Insulation: Install insulation concurrently with installation of roof panels in accordance with manufacturer's directions. Install blankets straight and true in one-piece lengths with both sets of tabs sealed to provide a complete vapor barrier. Locate insulation on underside of roof sheets, extending across the top flange or purlin

members and held taut and snug to roofing panels with retainer clips. Install retainer strips at each longitudinal joint, straight and taut, nesting with roof rib to hold insulation in place.

F. Cleaning and Touch-Up: Clean component surfaces of matter that could preclude paint bond. Touch up abrasions, marks, skips or other defects to shop-primed surfaces with same type materials as shop primer.

END OF SECTION 13 34 21

SECTION 22 05 00 - PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.1 Related Documents:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:

A. Provide all materials, labor, management, equipment, fixtures, start-up, fabrication, services, cleaning, testing and balancing required for complete installation of all plumbing provisions indicated on Drawings, Schedules and specified in this section.

B. This Contractor shall review all of the Contract Documents including all Drawings and Specifications of all Trades to ensure the complete implementation of Work.

C. Where shown or noted on the Drawings or where called for in other Sections of the Contract Documents, the Contractor for this Division shall install equipment furnished by Others, and shall make required service connections. Contractor shall verify with the supplier of the equipment the requirements for the installation.

D. Where the words "provide," "furnish," "include," or "install" are used in the Specification or on the Drawings, shall mean to furnish, install, and test complete and ready for operation, the items mentioned.

E. Drawings for the Work are diagrammatic to express the scope of the Work and to indicate the general arrangement and locations of the Work. Due to Drawings constraints, certain items such as pipe fittings, offsets, access panels, devices and sleeves may not be shown. This Contractor shall be responsible for confirming that the fixtures, piping and equipment fit the space provided. The location and sizes for pipe, fittings, sleeves, access panels and other basic items required by Code and other sections shall be coordinated and included for the proper installation of the work.

F. Specifications may not deal with diminutive installation requirements, parts, controls, and devices required which may be required to produce the equipment performance specified or as required to meet the equipment warranties and applicable Code. Such items shall be included, whether or not specifically called for in the Contract Documents.

G. Coordinate with all Trades in submittal of shop drawings. Shop drawings shall be prepared to clearly indicate all applicable components. Space conditions shall be detailed to the satisfaction of all trades, subject to review and final acceptance by the Engineer. In the event that the Contractor installs work before coordinating with other trades or so as to cause any interference with work of other Trades, the necessary changes shall be made to the work to correct, at no additional cost to the Owner, Architect or Engineer.

1.3 Contractors Qualifications:

A. The qualifications of this Contractor for shall be as follows:

1. Contractor must be a licensed contractor, specific to this section's Trade, in the project's State.

2. The Contractor shall have been in the plumbing contracting business for the last five consecutive years, under their current corporation name with more than 75% of the same corporate officers.
3. The Contractor shall have completed at least two projects of comparable size and scope within the past two years without receipt of a Notice to Cure.
4. If Contractor has received a Notice to Cure on any project, that Contractor is excluded from performing work on this project.
5. The Contractor's main construction and service office shall be located within 150 driving miles distance of the project site unless approval, 10 days prior to project bid date, has been issued in writing by the Owner, Architect and Engineer.
6. The Contractor shall provide substantiating proof of these requirements 10 days prior to project bid date. If substantiating proof is not submitted and approved, the Contractor will not be allowed to bid or work the project.
7. The General Contractor shall not purchase this Contractor's equipment, materials, etc. All materials, equipment, labor, etc. required to perform the Work herein shall be at the cost of this Contractor.

1.4 Codes and Standards:

A. Conform to latest edition of governing codes, ordinances, adoptions and or regulations of the authority having jurisdiction. Where local codes are not applicable, conform to the latest International Code Counsel requirements.

1.5 Fees, Permits, and Inspections:

A. Secure all permits and pay all fees required in connection with the Work.
B. Coordinate and provide such inspections as are required by the Authorities having jurisdiction over the site.
C. Where applications are required for procuring of services to the building, prepare and file such application with the authority having jurisdiction. Furnish all information required in connection with the application in the form required by the authority having jurisdiction.

1.6 Site Inspection:

A. Contractor shall inspect the site to become familiar with conditions of the site which will affect this Contractor's work and shall verify points of connection with utilities, routing of Work to include required clearances from any obstacles.
B. Additional payment will not be provided for changes in the Work required because of Contractor's failure of said familiarization and understanding.

1.7 Active Service:

A. Existing active services are to be located and shall be protected against damage. Do not disrupt operation, functionality and cleanliness of active services which are to remain. If active services are encountered which require relocation, make request to authorities having jurisdiction for determination of procedures. Where existing services are to be abandoned, they shall be terminated in compliance with requirements of the authority having jurisdiction.

1.8 Substitutions:

A. Any equipment, material, etc. submitted as "equal" to the basis of design shall be accompanied with a "one – to – one" comparison letter from the vender stating any differences from the equipment being submitted and the basis of design. A letter is

also to be submitted from the vender, on the vender's letterhead, stating that the vender has received a copy of the job all Specifications, Addendums and Drawings.

B. Substitutions for the scheduled and specified equipment shall only be done with the prior approval of the Engineer, and shall be obtained in writing. Prior approvals shall be obtained no less than 10 days prior to the project bid date. Prior approval shall not relieve the contractor of supplying equipment that meets the specifications, capacities, efficiencies, physical dimensions, etc.

1.9 Substitutions and Product Options:

A. Products specified only by reference standard, select product meeting that standard in accordance to the projects funding requirements, i.e. Made in the USA.

B. For products specified by naming several products or manufacturers, select any one of products and manufacturers named which complies with the schedules and specifications. When three are mentioned, the 10 day prior approval is still required.

C. For products specified, noted or scheduled stating "or equivalent," "or equal" or similar wording, submit a request for proposed substitutions for any product or manufacturer which is not specifically named for review and prior approval by the Engineer.

D. For products specified by naming only one product and manufacturer, the Engineer may provide approval of a product of equal or greater quality or performance. Submittal must be received 10 days prior to project bid date accompanied with a one – to – one comparison letter.

1.10 Substitution Submissions:

A. Each substitution submittal request shall be accompanied with:

1. Comprehensive data proving compliance of proposed substitution with requirements stated in the contract documents:
    a. Product identification.
    b. Manufacturer's literature shall identify:
        1) Manufacturer's name, address, phone number, point of contact and email address.
        2) Product description.
        3) Reference standards.
        4) Performance and test / compliance data.
        5) Warranty information of all components.
    c. Two projects of similar size and scope on which product has been used, date of each installation and project Owner's recommendation.
    d. Itemized comparison of the proposed substitution with product specified listing any variations.
    e. Changes in construction schedule.
    f. How the substitution will affect other Trades.
    g. List of changes required in any other work, products or required to be made by other Trades.
    h. Availability of repair services, sources of replacement materials, etc.

B. Substitutions will not be considered for acceptance when:

1. Substitution requires substantial revision of contract documents.
2. They are indicated or implied on shop drawings or product data submittals without a formal request from Contractor or Supplier prior to bid.
3. Information is deemed inadequate by the Engineer necessary for complete evaluation.

1.11 Contractor's Substitution Responsibilities:

A. Contractor affirms that:
   1. Contractor has determined that the substitution is equivalent to or superior in all respects to that scheduled and or specified.
   2. Contractor will provide the same warranties, guarantees and or bonds for substitution as for product scheduled and or specified.
   3. Contractor will coordinate installation of accepted substitution into the work, and will make changes as required for the work to be complete in all respects.
   4. Contractor waives claims for additional costs caused by substitution.

B. The Contractor shall have included all costs associated with the substitution for the specified products or materials, and that no additional cost will be incurred by any other party in order to fully incorporate the substituted item(s).

C. The Contractor agrees to reimburse the Architect/Engineer for any architectural or engineering re-design that is required by the substitution to be fully incorporated. The reimbursement shall be at the Architect/Engineer's standard billing rate.

1.12 Engineer's Duties:

A. Notify Contractor in writing of decision to accept or reject requested substitution.

1.13 Submittals:

A. General:
   1. Submit to Engineer shop drawings and product data required by the Drawings and Specifications.
   2. Contractor shall compile all data required to satisfy the Scope of Work implied by the Contract Documents.
   3. Submit a minimum of 6 copies of data, more if required by the Architect. Coordinate with Architect and Engineer to verify if Electronic Submittals, i.e. PDF, may be allowed 10 days prior to bidding the project. If Electronic Submittals are allowed, 2 bound hard copies, as stated below must be submitted as well as the Electronic file.

B. Submittal Requirements:
   1. Review shop drawings and product data prior to submission to Engineer.
   2. Submit only complete project submittals. Partial submittals or submittals not complying with the above requirements shall be returned to the contractor un-marked and rejected.
   3. Engineer's review is only to check for general conformance with the design concept of the project and general compliance with Contract Documents. No responsibility is assumed by the Engineer for correctness of dimensions, details, quantities, procedures, etc. shown on shop drawings or submittals.
   4. In the interest of project expediency, the contractor may pre-submit long lead items for pre-approval pending prior approval of the Engineer. However, the Contractor shall not be relieved of including the same data as required by submittal binder and shall be included therein.
   5. If a pre-submittal is made, provide a tab for items not included and include an explanation of why item is not included in the submittal and the expected submittal date.
   6. PDF submittals must be searchable and tabbed per section. All devices, materials, etc. that assemble a fixture, system, etc. shall reside in the same tab.

7. Hard copy submittals shall be compiled in a 3-ring, hard bound, loose leaf binder. The face of the binder shall be clearly marked with the project title and number, the name of the Owner, Architect, Engineer, General Contractor and this Contractor.
8. Provide an index, numerically indicating all sections applicable to the submittal.
9. Separate binders shall be provided for HVAC, Plumbing and Fire Suppression trades.
10. Provide tab dividers for each section submitted.
11. If an item appears on the drawings not specifically covered by the specifications, provide an additional numeric tab at the end of the index detailing the item and include the submittal data in the binder. All devices, materials, etc. that assemble a fixture, system, etc. shall reside in the same tab.
12. All equipment included on the submittal sheets shall be marked to indicate the mark of the equipment as shown on the drawings. The equipment shall be high-lighted to clarify which items are being submitted.
13. When required, the contractor will be provided with an electronic copy of this section's Drawings. Shop drawing submittals shall consist of one digital copy in .dwg format and one in PDF format. The drawing's sheet sizes shall be formatted to the same size as the Contract Documents. A digital copy in PDF format shall be returned to the contractor with the Engineer's approval stamp and comments.
14. Verify field measurements, field construction criteria, catalog numbers, and similar data.
15. Notify Engineer in writing of deviations from requirements of Contract Documents at time submittals are made. A "deviation" shall be construed to mean a minor change to the sequence indicated on drawings or specification. A "deviation" is not intended to allow substitutions or product options.
16. Deviations in submittals from requirements of the Contract Documents are not relieved by Engineer's review of submittals, unless Engineer gives written acceptance of specific deviations.
17. Work may not commence until submittals have been returned with Engineer's stamp and signature indicating approval. Materials and equipment that were installed prior to being approved shall be removed and replaced with approved items at no additional cost to other parties.
18. Shop Drawings and or submittals requiring resubmission to the Engineer due to non-compliance with the Contract Documents and or incompleteness shall be thoroughly reviewed by the Contractor prior to delivery to the Engineer for review. The Contractor shall ensure the completeness and compliance of the submittal materials and shall reimburse the Engineer at the Engineer's standard hourly billing rate for review of submittals beyond the second submission.
19. Omission in shop drawings of any materials indicated in Contract Drawings, mentioned in Specifications, Scheduled or required for proper execution and completion of Work, does not relieve the Contractor from responsibility for providing such materials.

1.14 Openings, Cutting, and Patching:

A. This Contractor shall coordinate required openings in the structure, walls, ceiling, floor roof, etc. with all Trades and applicable Engineers.

B. When additional patching is required due to failure of coordination; provide the patching required to properly close openings including "put back" and painting. Patching must meet the Owner's, Architect's and all applicable Engineer's approval.
C. When cutting and patching of the building is required due to failure to install piping, sleeves, or equipment on schedule or failure to provide the information required for openings, provide the cutting and patching as required. Patching must meet the Owner's, Architect's and Engineer's approval.

1.15 Protection:
A. Equipment and material shall be completely protected from weather elements, painting, plaster, etc. until the project is completed. Damage from rust, paint, scratches, etc. shall be repaired as required to restore equipment to original condition. If repair is deemed unacceptable by the Owner, Architect or Engineer, the equipment, material, device, etc. shall be replaced with new at no additional cost to the Owner, Architect or Engineer.
B. Piping within walls, in particular within studs, shall be protected with 16 gauge metal cover plate, on both sides of stud, equal to Sampson HSS Stud Shoe.
C. Where the installation or connection of equipment requires work in areas previously finished by other Contractors, the area shall be protected and not marred, soiled, or otherwise damaged during the course of such work. Contractor shall arrange with all other Contractors for repairing and refinishing of such areas which may be damaged.
D. When welding is required inside the building, a fire watch shall be provided. The fire watch shall provide adequate protection of existing surfaces and observance of adjacent floors where penetrations exist or are to be made.

1.16 Wiring for Equipment:
A. Division 22 shall provide all motors, controllers and contactors for equipment furnished under this Division, except where they are to be provided under another Division. Coordinate among all Trades prior to bidding project.
B. Electrical work provided under Division 22 shall conform to the requirements of Division 26.
C. Division 26 shall provide power for motors and equipment furnished by this Contractor including safety disconnect switches, starters and final connections. This Contractor is responsible for coordinating with the Electrical Contractor and all other Trades, for wiring that is beyond this Contractor's credentials.
D. Include provisions required for systems controls and integration into building Life Safety and Building Automation Systems.
E. Coordinate with Division 26 for all equipment which requires electrical services. Provide information as to the exact location for rough-in, electrical load, size, and electrical characteristics for all services required.

1.17 Protection of Electrical Equipment:
A. Water piping shall not be installed in electrical rooms, unless it serves the room and meets the AHJ's requirements, or directly above electrical equipment.

1.18 Excavating, Trenching, and Backfilling:
A. Provide excavation necessary for underground piping, etc. Backfill trenches and excavations after work has been installed, tested and approved. Care shall be taken in excavating, that walls and footings and adjacent load bearing soils are not disturbed, except where lines must cross under a wall footing. Where a line must

pass under footing, the crossing shall be made by the smallest possible trench to accommodate the pipe. Excavation shall be kept free form water by pumping if necessary. Any open trench shall be protected with signage, fencing, etc. Trenches shall be excavated in accordance with all regulatory Codes and AHJ requirements.

B. Trenches for piping and utilities located inside foundation walls and five (5) feet outside of the exterior wall shall be not less than sixteen (16) inches or more than twenty-four (24) inches wider than the outside diameter of the pipe to be laid. The widths of trenches for piping and utilities located more than five (5) feet outside of building foundation walls, other than for sewers, shall be governed by conditions found at the site.

C. Pipes must be buried 24" (min.) to the top of the pipe. Grade the trench and provide 6" sand base for the pipe, with the body of the pipe supported. Bottoms of trenches shall be so shaped that when pipe is in place the lower fourth of the circumference for the full length of the pipe will be supported on compacted fill. Bell holes shall be dug so that no part of the weight of the pipe is supported by the bell but shall be no larger than necessary for proper jointing. All piping required for the structure shall be excavated to at least six (6) inches below pipe invert.

D. Immediately after testing and/or inspection, the trench shall be carefully backfilled with earth free from clods, brick, etc., to a depth one-half the pipe diameter and then firmly tamped in such a manner as not to disturb the alignment or joints of the pipe. Thereafter, the backfill shall be tamped every vertical foot.

1.19 Concrete Work:

A. Provide concrete bases and housekeeping pads for equipment unless indicated otherwise. Concrete work shall be as specified in the applicable Civil and Structural Sections. Vibration pads, equipment bases, pipe supports and thrust blocks shall be provided by this Contractor.

B. Provide equipment anchor bolts and coordinate their proper installation and accurate location.

1.20 Anchoring of Equipment:

A. All equipment located on floor slab that is capable of being moved shall be secured to the floor with anchor bolts. A minimum of two bolts are required per each piece of equipment and bolts shall be of sufficiently size to prevent equipment from overturning.

B. Roof mounted equipment and curb shall be secured to the roof structure in compliance to ICC wind loading provisions.

1.21 Access Panels:

A. Access Panel shall be of appropriate size to allow for full service and removal of device behind the access panel.

B. Provide access panels where required and not shown on the drawings for installation by the drywall or masonry Contractor. Access panels shall be steel, primed ready for paint. All access panel locations shall be approved by the Architect/Engineer.

C. Provide fire rated access panels in rated walls, ceilings and floors. Rates shall be in compliance to the assemblies rating. This Contractor shall review Life Safety Drawings for required locations of fire rated access panels.

1.22 Sleeves:

A. Sleeves passing through non-load bearing or non-fire rated walls and partitions shall be Schedule 40 PVC pipe or cast iron pipe.

B. Sleeves passing under or through load bearing walls, concrete beams, foundations, footings, and waterproof floors shall be Schedule 40 galvanized steel pipe. Sleeve diameter shall be a minimum of 2 pipe sizes larger than pipe being protected.

C. Sleeves for insulated piping shall be of sufficient internal diameter to take pipe and insulation and to allow for free movement of pipe. Sleeve diameter shall be a minimum of 2 pipe sizes larger than pipe being protected. Waterproof sleeves shall be of sufficient internal diameter to take pipe and waterproofing material.

D. In finished areas where pipes are exposed, sleeves shall be terminated flush with wall, partitions, and ceilings, and shall extend 1/2" above finished floors. Extend sleeves 1" above finished floors in areas likely to entrap water.

1.23 Escutcheons:

A. Provide chrome plated escutcheons at each sleeved opening into finished and exposed exterior spaces. Escutcheons shall fit around insulation or around pipe when not insulated; outside diameter shall cover sleeve. Where sleeve extends above finished floor, escutcheon shall clear sleeve extension. Secure escutcheons to sleeve with set screws or other approved devices.

1.24 Insulation Protection:

A. Where exposed insulated piping extends to floor, provide aluminum wrap guard around insulation. Aluminum wrap and straps shall be trimmed to eliminate sharp cutting edges.

1.25 Connections for Fixtures and Equipment Under Another Section or By Owner:

A. Rough all equipment requiring connection to systems provided under this Division. Verify requirements and current locations before proceeding with work.

B. Make all connections to equipment furnished under another Section or by the Owner as required to obtain complete and working systems.

1.26 Test and Demonstrations:

A. Systems shall be tested and placed in proper working order prior to demonstrating systems to Owner.

B. Prior to acceptance of the installation, demonstrate to the Owner representative all features and functions of all systems installed, and instruct the Owner in the proper operation and maintenance of such systems. The Contractor shall allow for five working days and all required tools, devices, etc. to perform the demonstrations / instructions.

C. Provide necessary trained personnel to perform the demonstrations and instructions. Provide manufacturer's representatives for systems as required to assist with the demonstrations.

D. Dates and times for performing the demonstrations shall be coordinated with the Owner.

E. Upon completion of demonstrations, provide a certificate testifying that demonstrations have been completed. Certificate shall list each system demonstrated, dates demonstrations were performed, names of parties in attendance, and shall be signed by the Contractor and Owner.

1.27 Observations of Work:

A. The Contractor shall schedule an observation, performed by the Engineer and AHJ, one week in advance of the observation, prior to any Work being concealed, covered, etc.

B. If the Contractor schedules an observation and the Work is found not ready or not per the Contract Documents by the Engineer, the Contractor shall reimburse the Engineer, at the Engineer's standard hourly rate, including travel time, for a follow up observation.

C. A copy of the AHJ's report for any work observed or inspected by the AHJ shall be submitted to the Architect and Engineer.

1.28 Operating and Maintenance Manuals:

A. General:

1. Provide three "As Built" copies of shop drawings, product data, and other information described in this Section for use in compiling operating and maintenance manuals.
2. Provide legible submittals made by permanent reproduction copy equipment from typewritten or typeset originals.
3. Pre-punch 8-1/2 inch x 11 inch sheets in three ring, hardback, binders.
4. Submit larger sheets in rolled, protected packages.
5. Submit all in a PDF format as well as the hard copy sets mentioned above.

B. Compilation:

1. The Contractor will compile shop drawings, brochures, materials lists, technical data, warranties, guarantees, and other pertinent information and will assemble, catalog, and file information in loose-leaf, hardback three-ring binders.
2. Submittal Format: Provide each of the following items, as applicable, for each required item or system. Refer to specific Specification section requirements.
   a. Item: Use appropriate Section title.
   b. System Description: Provide a detailed description of each system, describing function, components, capacities, controls and other data specified, and including the following:
      1) Quantity.
      2) Sizes.
      3) Operation.
      4) Detailed operating instructions, including start-up and shut-down of each system, with indications for position of all controls, as applicable.
      5) Wiring Diagrams: Complete wiring diagrams for internally wired components including controls.
      6) Operating Sequence: Describe in detail.
      7) Manufacturers Data: Provide catalog data sheets, specifications, nameplate data and parts list.
      8) Preventative Maintenance: Provide manufacturer's detailed maintenance recommendations.
      9) Troubleshooting: Provide manufacturer's sequence for trouble-shooting procedures for operational problems.
      10) Extra Parts: Provide a listing of extra stock parts furnished as part of the Contract.
      11) Warranties: Provide specific manufacturer's warranty. List each component and control covered, with day and date warranty begins,

date of expiration and name, address and telephone number of person to contact regarding problems during warranty period.

12) Directory: Provide names, addresses, emails and telephone numbers of Contractor, its subcontractors, suppliers, installers and authorized service and parts suppliers.

1.29 Record Drawings:

A. The Contractor shall record the exact locations, as installed, all equipment, pipes, and vents whether concealed or exposed which were not installed exactly as shown on the contract drawings.

B. Upon completion of the work, this data shall be recorded to scale, by a competent CAD operator in .dwg format of no more than two versions past current. Electronic drawings in .dwg format will be furnished to the Contractor by the Architect/Engineer. Where the work was installed exactly as shown on the contract drawings the .dwg file shall not be disturbed other than being marked "As-Built." In showing the changes, the same legend shall be used to identify piping, etc., as was used on the contract drawings. Separate electronic drawings shall be prepared for plumbing, heating, air conditioning, and ventilating work unless two or more divisions are shown on the same sheets of the contract drawings, in which case the various subcontractors shall also show their changes on the same sheets. Each sheet shall bear the date and name of the Contractor submitting the drawings.

C. The Contractor shall review the completed As-Built drawings and ascertain that all data furnished on the .dwg files is accurate and truly represent the work as actually installed. Where plumbing, hot or chilled water pipes, inverts etc., are involved as part of the work, the Contractor shall furnish true elevations and locations, all properly referenced by using the original bench mark used for the institution or for this project.

D. The Contractor shall not distribute the Drawings without the expressed written consent of the Engineer. The Engineer shall authorize the Contractor to produce and distribute the As-Built drawings as follows:

1. One (1) to the Engineer.
2. One (1) to the Architect.
3. One (1) to the Owner.

1.30 System Guarantee:

A. Work required under this Division shall include a one-year guarantee. Guarantee by Contractor to Owner to replace for Owner any defective workmanship or material which has been furnished under contract at no cost to the Owner, Architect or Engineer for a period of one year from date of Substantial Completion. Guarantee shall also include all reasonable adjustments of system required for proper operation during guarantee period. Guarantee shall not include normal preventative maintenance services or filters.

B. At "Demonstration," one-year guarantee provision by Contractor shall be explained to Owner.

1.31 Painting and Identification:

A. Touch-up paint where equipment has sustained "minor" damage shall be applied with factory provided paint and finish, to match original finish. Damaged shall only be deemed "minor" by the Engineer's assessment.

B. Provide engraved, laminated plastic tags for all equipment. Tags shall be attached with permanent adhesive or pop-rivet(s).

1.32 Finishing:

A. Prior to acceptance of the installation and final payment of the Contract, the Contractor shall perform the work outlined in the Contract Documents.

B. At the conclusion of the construction, all portions of the project work shall be cleaned thoroughly of all debris and unused materials remaining from construction.

C. Equipment and piping systems shall be cleaned internally. The Contractor shall open all dirt legs and remove strainers / filters, completely blowing down as required and clean strainer screens of all accumulated debris. Finished strainers, sized by the manufacturer shall be installed in place of startup strainers, filters, etc.

D. All tanks, fixtures, and pumps shall be drained and proven free of sludge and accumulated matter.

E. All temporary labels, stickers, etc., shall be removed from all fixtures and equipment. (Do not remove permanent name plates, equipment model numbers, ratings, etc.). Painting over equipment nameplates will not be allowed. Nameplates will be replaced with new if damaged or painted over. All equipment shall have affixed adjacent to the permanent nameplate, the unit identification on an engraved label with permanent adhesive or pop-rivet(s).

F. Plumbing fixtures, equipment, tanks, pumps, etc., shall be thoroughly cleaned externally as well.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 22 05 00

SECTION 22 05 32 - SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 Related Documents:
- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all materials, labor, administration and services required for complete installation of all supports and anchors indicated on Drawings and specified within this section.
- B. Vent piping, water and waste piping, vent piping appurtenances, hangers, supports and required anchors.
- C. Equipment bases, frames and supports.
- D. Flashing and sealing equipment and pipe penetrations.
- E. Sleeves and seals.

1.3 References:
- A. American Society of Mechanical Engineers (ASME)
- B. American Society of Testing and Materials (ASTM)
- C. National Fire Protection Association (NFPA)

1.4 Work Furnished, Installed Under Other Sections:
- A. Furnish hangers and sleeve inserts for placement into formwork, framework, structure, slab, etc.

1.5 Submittals:
- A. Submit shop drawings and product data for all items listed under this section.
- B. Indicate hanger / support framing and attachment methods.
- C. Provide hanger / support framing loading limits, location and load of each hanger / support frame.

1.6 Site Condition:
- A. Do not drill, cut, burn or weld structural members in connection with the installation of pipe supports, bracing and anchorage devices, unless proposed in writing and approved in writing by the Engineer.

PART 2 - PRODUCTS

2.1 Pipe Sleeves:
- A. Sleeves Through Interior Walls, Floors and Ceilings:
  1. Sleeves through Non-Fire Rated floors: Schedule 40 PVC pipe.
  2. Sleeves through Non-Fire Rated walls, footings, and foundation walls: Schedule 40 PVC 2 pipe sizes larger than service pipe.

3. Sleeves through beams shall be only in locations and of construction approved by the Structural Engineer.
4. Sleeves for floor or wall penetrations at rated assemblies shall conform to Specifications Section 23 05 60.

B. Sleeves Through Exterior Below Grade Walls, Floors and Ceilings:
1. Schedule 40 Bitumen Coated Steel 2 pipe sizes larger than service pipe.

C. Sleeves Through Exterior Above Grade Walls:
1. Schedule 40 Bitumen Coated Steel 2 pipe sizes larger than service pipe. Sleeve shall extend 1/8" past finished interior and exterior of wall assembly and painted to match finished wall. Sleeve shall be sealed weather tight.

D. Escutcheons:
1. Public Areas: Solid plate stainless steel with satin finish.
2. Non-Public Areas: Split ring chrome plated with set screws.
3. Size: Minimum one inch annulus shall be provided except at building seismic joints. Building seismic joint pipe sleeves shall be minimum of 5 inches greater than the nominal diameter of the pipe.

2.2 Fabrication:

A. Size pipe sleeves large enough to allow for movement due to expansion and contraction and continuous insulation.

2.3 Flashing:

A. Metal Flashing: paint grip galvanized steel.
B. Lead Flashing: 5 lb/ft^2 sheet lead for waterproofing.
C. Caps: 20 gauge minimum galvanized steel; minimum 16 gauge at fire resistant elements or as required per assembly rating. Caps shall be paint grip when exposed.

2.4 Pipe Hangers and Supports:

A. Provide pipe hangers, supports and guides hot-dip galvanized unless otherwise indicated. Provide copper-plated hangers on un-insulated copper pipes.
B. Hangers and support components shall be factory fabricated materials designed.
1. Components shall have hot dipped galvanized coating; electroplate is not acceptable.
2. Strap type hangers shall not be used on any piping system; use only clevis type. The clevis hanger fastener nuts shall be nylon lock type.

C. Anchors for pipe hanger and supports shall be either of the following types as applicable to installation condition:
1. Galvanized metal inserts cast into concrete at time of placing.
2. Anchor bolts for floor mounted equipment may be of a type to be placed in drilled holes and set in place with high strength cement grout.
3. Wedge type, type 316 stainless steel, expansion bolts, anchor bolts set in drilled holes in accordance with manufacturer's instructions. Use of drop-in anchors are prohibited.

2.5 Types of Hangers:

A. Hangers for Cold Pipe: Carbon steel, adjustable clevis.
B. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable clevis.
C. Hangers for Hot Pipe Sizes 6 inches and Larger: Adjustable steel yoke, cast iron roll clevis.
D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

E. Vertical Support: Steel riser clamp.
F. Copper Pipe: Carbon steel rings, adjustable, copper plated.
G. Hanger Rods: Mild steel continuous threaded.
H. Inserts: Malleable iron case or galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms. Size inserts to suit threaded hanger rods.

2.6 Anchors and Anchorage Devices:
A. Anchors and Bolts: Bolts and studs, nuts and washers shall be Type 316 stainless steel.
B. Fasteners and Accessories: Provide anchors and fasteners, washers, straps and accessories required for a complete and finished installation. Fasteners shall be Type 316 stainless steel.
C. Expansion Bolts: Where anchors are not included in the concrete or masonry construction, anchors shall be Type 316 stainless steel screws or bolts with expansion-shield type concrete or masonry anchors, of sizes and types indicated or required.

2.7 Finish:
A. Concealed: Provide rust inhibiting primer coat to all support, hanger, anchor, etc.
B. Exposed: Provide rust inhibiting primer coat and two finish coats, color to be selected during the submittal phase, to all support, hanger, anchor, etc.

PART 3 - EXECUTION

3.1 Pipe Hangers and Supports:
A. Support horizontal piping as follows:

Pipe Size	Maximum Hanger Spacing	Hanger Diameter
1/2" – 1-1/4"	6'-6"	3/8"
1-1/2" – 2"	10'-0"	3/8"
2-1/2" – 3"	10'-0"	1/2"
4" – 6"	10'-0"	5/8"
PVC (all)	4'-0"	3/8"
Pex (all)	2'-8"	3/8"
Cast Iron (all)	5'-0"	5/8"

B. Install hangers to provide minimum 1/2" space between finished covering and adjacent work.
C. Place a hanger within 12" of each elbow.
D. Use hangers with 1-1/2" minimum vertical adjustment.
E. Support horizontal cast iron pipe adjacent to each hub.
F. Support vertical piping at every floor or every 10 feet whichever is more frequent.
G. Support vertical cast iron pipe at each floor at hub.
H. Support riser piping independently of connected horizontal piping.
I. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
J. All hangers, hanger rods, supports, etc. shall be double-nutted.

3.2 Equipment Bases and Supports:
A. Provide equipment bases of concrete type, minimum 6" thick with 4" A.F.F.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
C. Construct support of steel members. Brace and fasten with flanges bolted to structure.
D. Provide rigid anchors for pipes after vibration isolation components are installed in accordance with the vibration isolation manufacturer's requirements.

3.3 Flashing:
A. Flash vent and soil pipes projecting 3" minimum above finished roof surface with lead worked 1" minimum into hub, 8" minimum clear on sides. Turn flanges back into wall and caulk, metal counter flash and seal pipes through outside walls.
B. Flash floor drains with lead 10" clear on sides. Fasten flashing to drain clamp device.

3.4 Sleeves:
A. Extend sleeves through floors one inch above finished floor level. Caulk sleeves full depth and provide floor plate.
B. Install escutcheons as described above.

END OF SECTION 22 05 32

SECTION 22 05 53 - PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.1 Related Documents:
- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all materials, labor, administration and services required for complete installation of all plumbing identification indicated on Drawings and specified within this section.
- B. Identification of domestic cold, hot, recirculating water, deionizer water, industrial water, non-potable water, sanitary drain, sanitary vent, acid waste, acid vent and rain leader piping systems.

1.3 Submittals:
- A. Submit samples and manufacturer's installation instructions for all identification products used.

PART 2 - PRODUCTS

2.1 Materials:
- A. Pipe Markers:
  1. Equal to Seton Snap Around Pipe Markers. Acrylic plastic with UV inhibitors. Markers shall indicate direction of flow. Legends shall be alternately reversed and repeated for viewing from any angle. Markers shall be factory formed for the installed diameter.
- B. Valve Markers:
  1. Engraved Metal Tack Markers shall be provide and pop riveted to the Tee Bar main for use of identifying valve locations above acoustical tile ceilings. Color to be selected by submittal. Markers shall be numbered with standard 3/16" characters.
  2. Valve tags shall be Seton, 2" stamped brass tags with chain. Tag shall indicate floor served and service of respective valve.

PART 3 - EXECUTION

3.1 Piping:
- A. Piping shall be identified at maximum 20 feet intervals, at each side of floor / wall penetration, and at each valve. Piping identification shall include type of service, size of pipe and direction of flow.
- B. Piping shall be marked by the following schedule:
  1. Domestic Cold Water: White letters on Green.
  2. Domestic Hot Water: Black letters on Yellow.
  3. Hot Water Recirculating: Black letters on Yellow.

4. Non-potable Water: Black letters on Yellow.
5. Industrial Water: Black letters on Yellow.
6. Sprinkler Water: White letters on Red.
7. Natural Gas: Black letters on Yellow.
8. Sanitary Drain: White letters on Green.
9. Sanitary Vent: White letters on Green.
10. Roof Drain: White letters on Green.
11. Compressed Air: White letters on Blue.
12. Acid Waste: Black letters on Orange.
13. Medical air: Black letters on Yellow.
14. Nitrogen: White letters on Black.
15. Nitrous Oxide: White letters on Blue.
16. Oxygen: White letters on Green.
17. Medical / Surgical Vacuum: Black letters on White.

END OF SECTION 22 05 53

SECTION 22 05 60 - THROUGH PENETRATION FIRE STOPPING

PART 1 - GENERAL

1.1 Related Documents:
- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all materials, labor, administration and services required for complete installation of all through penetration fire stopping indicated on Drawings and specified within this section.
- B. Provide fire stopping for the following through penetrations:
  1. Domestic hot, cold and hot water recirculation water, rain leaders, sanitary waste and vent.
  2. Conduit for wiring and controls.

1.3 References:
- A. Underwriters Laboratories (UL).
- B. American Society for Testing and Materials (ASTM).

1.4 Contractor Requirements:
- A. The contractor shall have at least 5 years experience with through penetration fire stopping systems and shall have completed a least 2 comparable scale projects using these systems.
- B. Provide statement from manufacturer that installer has to be trained in the proper method of installing fire stop systems

1.5 Submittals:
- A. Product data including the following:
  1. Detailed specification of construction and fabrication installation instructions and technical data.
- B. Shop Drawings:
  1. For each standard application of penetration item and surface being penetrated provide a manufacturers UL approved system cut sheet identifying the UL system number, UL classified devices or materials to be used, other materials to be used, anchorages, sleeves, annular space requirements and sizes, dimensions and locations of all items.
  2. For each non-standard application, provide a manufacturer's qualified engineering judgment and drawing.
  3. All UL approved systems shall be selected based on their rating. All systems shall provide the same ratings as the rating of the penetration, as shown on the plans.
- C. Guarantee:
  1. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, co-adhesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or

general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be one year from date of substantial completion.

1.6 Storage:
A. Coordinate delivery with scheduled installation date, allow minimum storage at site. Store and protect materials in a manner and environment per the manufacturer's requirements.

1.7 Project Conditions:
A. Contractor shall review and become familiar with all Drawings and / or visit the job site prior to bid, to verify wall and floor types to be penetrated. Fire ratings of walls are indicated on the Architectural Drawings. Ratings of the floors are assumed to be two (2) hours unless otherwise indicated on the Architectural Drawings.
B. Contractor shall coordinate with the other Trades for any penetrating items that have to be routed differently than shown on the plans. Contractor shall provide fire stopping for all rerouted items whether different UL approved systems or additional materials are required.

PART 2 - PRODUCTS

2.1 Through Penetration Fire Stopping:
A. Acceptable manufacturers and products shall be those listed in the UL fire resistance directory for the UL system involved.
B. All systems and devices shall be asbestos free.
C. All fire stopping products shall be from a single manufacturer.

PART 3 - EXECUTION

3.1 General:
A. Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
B. Verify that penetrations are properly sized and in suitable condition for application of materials.
C. Prepare surfaces in accordance with the fire stopping manufacturer's requirements.

3.2 Installation:
A. Install penetration seal materials in accordance with printed instructions of the U.L. Fire Resistance Directory and in accordance with manufacturer's instruction.
B. Where floor openings without penetrating items are more than four inches in width and subject to traffic or loading, install fire stopping materials capable of supporting same loading as floor.
C. Place non-intumescent fire stopping in annular space around fire dampers before installation of damper's anchoring flanges, which are installed in accordance with fire damper manufacturers requirements.

D. Where large openings are created in walls or floors to permit installation of pipes, ducts, cable tray or other items, close unused portions of opening in accordance with the U.L. assembly. See U.L. Fire Resistance Directory.

3.3 Adjusting and Cleaning:

A. Neatly trim materials as required.
B. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

3.4 Field Quality Control:

A. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.
B. Keep areas of work accessible until inspection by applicable code authorities.

END OF SECTION 22 05 60

SECTION 22 07 10 - INSULATION FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 Related Documents:
- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all labor, materials, accessories, equipment, administration and perform all operations required for the correct fabrication and installation of thermal insulation applied to the following piping systems indicated on Drawings and Specifications.
- B. Insulation work shall be performed by a competent insulation contractor whose primary business is the installation of insulation systems and who has been in this type of insulating business for a minimum of five years.
- C. Work of this section shall include the insulation for the following plumbing systems that may or may not be present on this project:
  1. Domestic cold, hot, hot water recirculating water and non-potable water.
  2. Hot water piping below grade.
  3. Rain Leaders including Emergency Rain Leaders.
  4. Traps, trap arms, cold and hot water supplies.
  5. Traps on condensate receiving floor / hub drains systems above grade.
  6. Heated or chilled equipment.

1.3 Submittals:
- A. Submit product literature for each insulation and finish type, for material and or equipment served. Submit installation requirements for each type of insulation used.
- B. Product samples shall be provided at the discretion of the Engineer.

1.4 System Performance:
- A. Insulation materials furnished shall meet the minimum thickness requirements of ASHRAE 90.1

PART 2 - PRODUCTS

2.2 Thermal Insulation:
- A. All insulating systems shall be tested on a composite basis in accordance with:
  1. ASTM E-84
  2. NFPA 255
  3. UL 723
- B. All material shall be finished having a maximum flame spread rating of 25 and a maximum smoke developed rating of 50.
- C. Interior Piping:
  1. Rigid Fiberglass equal to Owens Corning - Fiberglas ASJ and SSL II adhesive closure system.

2. Closed cell, flexible electrometric thermal insulation, black in color, supplied in unslit tubing, equal to Armaflex AP 2000. Thickness shall be in accordance with ASHRAE 90.1.

D. Interior fittings on 1/2 and 3/4 inch pipes and accessories may use job built mitered fittings of similar material as piping. Valves and fittings 1 inch and up shall use molded preformed fiberglass fittings sized for the fitting or device being insulated. All fittings and devices being insulated shall be covered with a preformed, white, snap-on type, molded PVC jacket cover. Fittings and accessories to be covered include, but not limited to, 45 and 90-degree elbows, tees, reducers, increasers, valves, check valves and unions.

E. Equipment, tanks, etc. shall be insulated with closed cell, flexible electrometric thermal sheet insulation, black in color, equal to Armaflex AP 2000. Thickness shall be in accordance with ASHRAE 90.1.

F. Above ground exterior piping shall be equal to Foamglass with 0.29K factor @ 75°F, maximum service temperature of 900°F and 7.5 lb/ft^3 density equal to Pittsburgh Corning system with factory formed aluminum jacket.

1. Fittings for above ground exterior piping shall be machine formed, routed and fitted for specific size fitting.

G. Below ground / below slab piping shall be of same materials as F except without aluminum jacket.

2.3 Insulation Finish Materials:

A. White All Service Jacket (ASJ).

B. Glass fabric equal to Foster Mast-A-Fab.

C. Smooth Aluminum 0.016-inch thickness and 0.032 inch thickness for exterior use.

D. Aluminum fittings for elbows, tees and devices, precision formed, smooth and mar-free finish, 0.024 inches thick.

2.4 Adhesives:

A. An air-drying contact adhesive specifically designed for joining seams and ends of Armaflex AP-2000 equal to Armstrong 520 Adhesive.

2.5 Finishes:

A. A white elastomeric, UL classified outdoor grade, vinyl mastic for finished outdoor insulation. Water based latex enamel; equal to WB Armaflex Finish.

PART 3 - EXECUTION

3.1 Workmanship:

A. All materials shall be applied by workmen skilled in this trade. Unsightly work shall be cause for rejection.

B. Work shall be fastened, joined, adhered per the manufacturer's requirements.

C. Materials shall be applied only after systems have been tested and all surfaces are clean and dry.

D. Cellular glass block supports or other suitable non-compressible insulation material equal in thickness to the insulation and three times the pipe diameter in length shall be installed at hangers. Provide 18 gauge, 180 degree, galvanized sheet metal saddles under glass block supports.

E. All joints, laps, breaks, and faults in vapor barriers of insulations covering cold surfaces, shall be thoroughly sealed.
F. Insulation that becomes wet for any reason shall be removed, replaced and resealed at the expense of this Contractor.
G. Piping systems requiring testing to be witnessed by the Engineer shall not be insulated until such systems have been tested and approved.
H. Do not insulate any moving parts, valve handles, etc.

3.2 Application:

A. Cold Water Insulation Application Schedule:

Pipe Size	Interior Space	Exterior Above Grade	Below Grade / Slab
1/2" – 1-1/4"	1/2"	1-1/2"	1-1/2"
1-1/2" and above	1"	2"	2"

B. Hot Water Insulation Application Schedule:

Pipe Size	Interior Space	Exterior Above Grade	Below Grade / Slab
1/2" – 1-1/4"	1"	1-1/2"	1-1/2"
1-1/2" and above	1-1/2"	2"	2"

C. Rigid Fiberglass Insulation (For interior domestic cold, hot and recirculating):
1. Piping: All insulation shall be butted together and securely stapled in place (if required by the manufacturer) with outward clinching staples on 3" centers on the lapping seams. Factory provided laps of ASJ tape of same type as jacket on insulation shall be used on joints.
2. Fittings: Fittings shall be molded fiberglass with snap on PVC jacket and matching white tape on adjacent pipe insulation.
3. Insulation joints and buts shall be beveled at 30 degrees and sealed with two coats Childers CP-30.

D. Rain Leaders and/or Emergency Rain Leaders:
1. Insulation Thickness Schedule:

Pipe Size	Exposed Conditioned Space	Exposed Non-Conditioned Space	Concealed within Building Insulation Barrier	Concealed Outside Building Insulation Barrier
3" and 4"	1"	1-1/2"	1"	2"
6" – 10"	1"	1-1/2"	1"	2"
12" – 16"	1"	1-1/2"	1"	2-1/2"
18" – 24"	1"	1-1/2"	1"	2-1/2"

2. Rain leaders and emergency rain leaders all portions, horizontal and vertical, are to be insulated. Insulation will continue up to the roof drain hub. The roof drain hub and pan and any area surrounding the roof drain exposed shall be insulated by this Contractor.
3. Piping: All insulation shall be butted together and securely stapled in place (if required by the manufacturer) with outward clinching staples on 3" centers on the lapping seams. Factory provided laps of ASJ tape of same type as jacket on insulation shall be used on joints. Exterior insulation shall be FoamGlas with aluminum jacketing.
4. Fittings: Fittings shall be molded fiberglass with snap on PVC jacket and matching white tape on adjacent pipe insulation.
5. Roof drain hubs and pans to be insulated. Miter cut the insulation to fit and glue into place.

6. Insulation joints and buts shall be beveled at 30 degrees and sealed with two coats Childers CP-30.

E. Traps on Condensate Receiving Floor Drains Above Grade:
   1. Insulation shall be cut and formed to the contours of the hub and wrapped around pipe. Factory adhesive shall be used to seal the mitered joints and connection.

F. Storage Tanks:
   1. Hot water storage tanks shall be wrapped with Owens Corning Flexwrap insulation. Cut the insulation and strip off a 3" wide strip for the overlap. Wrap the insulation around the tank and verify that the insulation is butted. Attach the 3" wide overlap with outward clinching staples spaced 3 inches O.C. Cut neatly for all penetrations and seal off any tears, joints or staples with ASJ jacket tape of same materials.

G. Hot Water Piping Below Grade:
   1. Provide Foamglass insulation for underground hot water piping as specified above. Underground piping insulation shall be applied over a clean dry surface.
   2. Underground fittings shall be installed as described above.

H. Cold, Hot Water, Hot Water Re-Circulating, Non-Potable Water, Rain Water and Waste Piping Above Exterior Grade Exposed and Concealed:
   1. Above grade exterior cold and hot water shall be insulated with Foamglass as specified above.
   2. Piping: All insulation shall be applied over a clean dry surface. Factory provided laps of ASJ tape of same type as jacket on insulation shall be used on butt joints. All laps and penetrations shall be sealed with a vapor barrier mastic finish.
   3. Fittings: Fitting insulation shall be covered with two coats of vapor barrier mastic.
   4. All above grade exterior piping shall be covered with aluminum jacketing. Aluminum shall be applied to a clean dry surface. Overlap butt joints 4" and apply 1/2" wide bands of aluminum on 8" O.C. and at each end of fittings. On exterior piping, the longitudinal seam shall be located at the bottom center of piping and turned 1/4" down for a drip edge. All joints on exterior piping shall be made water tight with exterior grade silicone caulking.

I. All interior exposed piping and fittings shall be wrapped with PVC insulating jacketing equal to Pittsburg Corning Zeston 2000 and Zeston 300.

3.3 Miscellaneous:

A. This Contractor will contact the Engineer prior to start of all phases of work as follows:
   1. Installation of underground insulation.
   2. Exterior above grade installation.
   3. Interior insulation installation.

B. The Engineer will ascertain the continuation of work subject to the requirements aforementioned.

END OF SECTION 22 07 10

SECTION 22 11 10 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 Related Documents:
- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all materials, labor, administration and services required for complete installation of all domestic water piping indicated on Drawings and specified in this section.
- B. Work to Include: All domestic water service and piping to all fixtures and equipment.

1.3 References:
- A. All plumbing Work shall be in accordance with the latest edition of governing codes, ordinances, and or regulations of city, county, state, utility provider, and or authority having jurisdiction. Where local codes are not applicable, conform to the latest International Code Counsel requirements.

1.4 Submittals:
- A. Submit complete product and performance data for all materials listed under this section.
- B. All materials shall be new, without defect, unless specifically noted or specified otherwise.
- C. The supplier, by submitting, certifies the materials and equipment to be satisfactory for the application of this Work.
- D. Contractor agrees that if deviations, discrepancies or conflicts between submittals and the Contract Documents are discovered either prior to or after submittals are processed by the Engineer, the Contract Documents shall supersede.

PART 2 - PRODUCTS

2.1 Domestic Water Piping System:
- A. All plumbing systems shall be equipped with a pressure reducing valve at the building's water service entry. Pressure reducing valve and accessories is specified below.
- B. Buried, Exterior:
  1. Copper Pipe, 3-1/2" and Smaller: Type K hard drawn copper per ASTM B-88. Fittings: Wrought copper or cast brass.
     a. Joints: Hard temper with brazed joints.
  2. Ductile Iron Pipe, 4" and Larger: Cement lined, per ANSI/AWWA C151/A21.51.
     a. Joints: Shall be mechanical type.
  3. Buried, Exterior:
     a. Polypropylene Pipe (All Sizes):
        1) Pipe shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389. The

pipe shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipe shall be made in a three layer extrusion process. Domestic hot water and heating piping shall contain a fiber layer (faser) to restrict thermal expansion. All pipe shall comply with the rated pressure requirements of ASTM F 2389. All pipe shall be certified by NSF International as complying with NSF 14, NSF 61, and ASTM F 2389 or CSA B137.11.

2) Underground Piping: Polypropylene (PP-R) piping in SDR 7.4.
3) Install hangers and supports at intervals specified in the applicable Mechanical Code and as recommended by pipe manufacturer.
4) Support vertical piping at each floor and as specified in the applicable Mechanical Code.
5) Fire stopping shall be provided to both be compatible with the Aquatherm Piping and meet the requirements of ASTM E 814 or ULC S115, "Fire Tests of Through-Penetration Firestops". Pipe insulation shall be terminated 3 to 6 inches from where the pipe passes through a fire stop, as recommended by the fire stop manufacturer.
6) Pipe shall be Greenpipe available from Aquatherm, Inc. or prior approved equal.
7) Fittings:
    a) Fittings shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389. The fittings shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All fittings shall be certified by NSF International as complying with NSF 14, NSF 61, and ASTM F 2389 or CSA B137.11.
    b) Install fittings and joints using socket-fusion, elecrofusion, or butt-fusion as applicable for the fitting type. All fusion-well joints shall be made in accordance with the pipe and fitting manufacturer's specifications and product standards.
    c) Fusion-weld tooling, welding machines, and electrofusion devices shall be as specified by the pipe and fittings manufacturer.
    d) Prior to joining, the pipe and fittings shall be prepared in accordance with F 2389 and the manufacturer's specifications.
    e) Joint preparation, setting and alignment, fusion process, cooling times and working pressure shall be in accordance with the pipe and fitting manufacturer's specifications.
    f) Fittings shall be Greenpipe available from Aquatherm, Inc. or prior approved equal.
8) Valves:
    a) Valves with PP-R bodies shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389. The valves shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material.

b) Valves with brass bodies shall be manufactured in accordance with the manufacturers specifications and shall by certified by NSF International as complying with NSF 61.
c) Valves shall be Aquatherm® Fusiotherm® available from Aquatherm, Inc. or prior approved equal.

9) Warranty:
a) Manufacturer shall warrantee pipe and fittings for 10 years to be free of defects in materials or workmanship.
b) Warrantee shall cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system do to defects in materials or workmanship.

b. Testing: Testing shall be performed, documented and submitted per the manufacturer's requirements.

C. Buried Below Slab:
1. Copper Pipe: Type K soft copper per ASTM B-88 with continuous protective plastic cover.
a. Fittings: Wrought copper or lead free cast brass.
b. Joints: All joints below slab shall be hard temper with brazed joints.
2. PEX Piping:
a. PEX-A piping (SDR9 crosslinked polyethylene manufactured using the Engel method) shall be acceptable if the following is met: (Note: Clip Ring PEX will not be allowed).
1) Minimum degree of cross-linking shall be between 70-89% when tested in accordance with ASTM D2765, Method B.
2) Manufactured in accordance with ASTM F876 and ASTM F877 and tested for compliance by an independent, third-party agency.
3) Piping to have a minimum material designation of PEX 5106.
4) Potable water piping shall comply with NSF 14 and NSF 61 and bear the "NSF-pw" marking.
5) Temperature and pressure requirements in accordance with PPI TR-3: 73.4°F at 80psi, 180°F at 100psi and 200°F at 80psi.
6) Pipe shall be PEX-A ProPex available from Uponor or prior approved equal.
b. Joints: Manufactured Joints shall be ASTM F1960 cold-expansion type and must comply with the following:
1) 20% glass-filled polysulfone as specified in ASTM D6394
2) Unreinforced polysulfone (group 01, class 1, grade 2) as specified in ASTM D6394
3) Polyphenylsulfone (group 03, class 1, grade 2) as specified in ASTM D6394
4) Blend of polyphenylsulfone (55-80%) and unreinforced polysulfone (rem.) as specified in ASTM D6394
5) Reinforcing cold-expansion rings shall be manufactured from the same source as PEX-a piping and marked "F1960".
6) Potable water fittings shall comply with NSF 14 and NSF 61 and bear the "NSF-pw" marking.
7) All threaded fittings shall be lead free brass.
8) Fittings shall have the same inside diameter as the piping.

D. Above Grade:
   1. Copper Pipe: Type L hard drawn copper per ASTM B-88.
      a. Fittings: Wrought copper or cast brass.
      b. Solder: Lead-free, tin-silver solder.
      c. Notes:
         1) Mechanically formed pull Tees and field brazed Tee connections will not be allowed on metallic piping. All fittings must be factory fabricated.
         2) Copper press fittings on above grade copper piping will be allowed. System shall be Viega "Pro-Press" system, factory copper fittings with EPDM 'O' rings secured with factory approved crimping tools, jaws and crimp rings.

2.2 Dielectric Fittings:
   A. Insulating Material: Suitable for system fluid, pressure, and temperature.
   B. Dielectric Unions, Nipples, Couplings and Flanges:
      1. See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. Retain one of two subparagraphs and list of manufacturers below. See Division 01 Section "Product Requirements."
      2. Shall be of brass material rated for applicable service. Dielectric fittings with EDPM type materials will not be allowed. The fitting will be all brass compression type.

2.3 Domestic Water Specialties:
   A. Pressure Reducing Valves (PRV): All plumbing systems shall be equipped with a pressure reducing valve at the building's water service entry. PRV shall be equal to Zurn model ZW209 and shall be line size unless otherwise noted. Provide full port ball valve, union and strainer at inlet of PRV and union and full port ball valve at outlet of PRV.
   B. Backflow Preventer (BFP): All plumbing systems shall be equipped with a lead free backflow preventer at the building's water service entry. BFP shall be equal to Watts LF007 with strainer and shall be line size unless otherwise noted.
   C. Vaults (if called for on the drawings) shall be as manufactured by Eagle Wholesale series 9648, 96" x 48" x 48" deep (unless a different length is provided on the drawings), pre-cast reinforced concrete vault. Frame and lid to be Eagle series 9648 with optional hydraulically assisted two-piece aluminum doors. Door locks and hinges to be stainless steel. Frame channel to be self-draining to grade. Drain to be installed from the frame channel horizontally thru the side of the vault. Vault shall be factory fitted with the backflow preventer and pressure reducing valve and piping thru the vault walls for connection by the Plumbing Contractor. Pipes within the vault to be class 350 cement lined ductile iron. Vault installation shall be as detailed on the drawings. Permanent ladder / steps shall be provided within vaults deeper than 4 feet below grade.
   D. Water Hammer Arrestors (WHA): ASSE 1010; sized in accordance with PDI WH-201, piston type, suitable for operation to 250°F a maximum working pressure of 350 psig. WHA shall be Sioux Chief 650 series or prior approved equal.
   E. Provide circuit setters equal to Circuit Solver stainless steel thermostatic balancing valve.

F. Hot water recirculation pump(s) shall be Bell & Gossett model ecocirc XL 15-75 lead free bronze body with stainless steel impeller and shaft, 1/6 HP 120/1V, 0.1 to 2.3 Amps.
G. Thermal Expansion Tanks: Amtrol model Therm-X-Trol, or prior approved equal, bladder or diaphragm type, rated for potable water systems. Size shall be as Scheduled or indicated on the Drawings. Tank shall be ASME rated whenever the water heater or storage tank for the respective hot water system is indicated to be ASME rated.
H. Gauge Cocks shall be brass valves with 1/4" NPT female connections and handles. Valves shall be suitable for 200 psi. Gauge Cock shall be Trerice model 865 or equal.
I. Pressure gauges shall have type 316 stainless steel interior and exterior construction. Windows shall be glass. Gauges shall have 4" dials with white faces and black graduations. Gauge ranges shall be selected so that the normal operating point is approximately 50% but shall not exceed 75% of scale. Unit of measure shall indicate psi. All gauges shall be provided with a pulsation damper, snubber or similar device to dampen pulsation surges. Gauges shall have 1/4" NPT bottom outlets. Weiss style NF4S-2 or prior approved equal.
J. Thermometers shall be Weiss model DVU35 or prior approved equal. Thermometer case shall be constructed of hi-impact ABS, 3/8" LCD digits, wide ambient formula, 1% of reading or 1° accuracy whichever is greater, resolution shall be 1/10° between -19.99/199.9°F, 10 second update, ambient operating range -30/140°F, glass passivated thermistor. Thermometer stem assembly shall be ASME B40.3 compliant. Sockets on insulated pipes shall have extensions of adequate length to clear insulation.
K. Service valves 1/2" thru 4" shall be full port 1/4 turn brass ball valves, two-piece construction, threaded end connection, with PTFE seats and seals, adjustable stem packing gland, stem o-ring and steel handle with vinyl sleeve. 1/2" thru 2" valves shall be pressure rated at 600 psi WOG and 150 psi WSP. 2-1/2" and 3" valves shall be pressure rated at 600 psi WOG and 125 WSP. Valves shall be Kitz series #58 or prior approved equal. All valves shall be furnished with valve handle extensions.
L. Check valves shall be bronze body horizontal swing wye-type with renewable seat and disc, screw cap, threaded end connections, pressure rated at 200 psi non-shock cold working pressure. Valves shall be Nibco T-413-Y-LF or prior approved equal.
M. Strainers shall be bronze body with tapped retainer cap and closure plug, threaded end connections, 20 mesh strainer screen, pressure rated at 400 psi WOG and 125 psi WSP. Strainers shall be Watts series LF777 or prior approved equal.
N. Piping inside chase areas shall be supported with bracketing system equal to Sioux Chief Grid Iron series. System shall include, but not be limited to, a center span bracket, two end bracket clamps and necessary retaining brackets to support the copper piping. Where piping is supported off the vent system, the vent piping shall be bracketed to the inside chase wall. Stainless steel clamps shall be incorporated into the support system when connections are made to the PVC piping.

2.4 P & T Relief Piping:
A. Above Slab:
1. Copper Pipe: Type L hard drawn copper per ASTM B-88. Fittings: Wrought copper or cast brass. Solder: Lead-free, tin silver solder.
2. Relief piping terminating outside the area of the installed water heater shall be installed with an air gap. The air gap shall be Watts model 909, 1" in-line type, and installed at the water heater below the T & P relief valve.

2.5 Primer Drain Piping (When Applicable):
- A. Above Slab:
  - 1. Copper Pipe: Type L hard drawn copper per ASTM B-88.
    - a. Fittings: Wrought copper or cast brass.
    - b. Joints: Lead-free, tin-silver solder.
- B. Below Slab:
  - 1. Copper Pipe: Type L soft drawn copper with no fittings or joints below the slab. Provide continuous protective plastic covering.

PART 3 - EXECUTION

3.1 General:
- A. Work shall be installed so that all exposed piping will be straight and true without bends or off-sets.
- B. Water supplies shall connect through walls with stops and chrome plated escutcheons with setscrews. Split ring escutcheons will not be allowed.
- C. Installation dimensions shall be taken from the Architectural Drawings.

3.2 Domestic Water Piping:
- A. Provide a complete domestic water piping system including interior and exterior work as indicated.
- B. Piping shall be run as directly as possible, avoiding all unnecessary fittings and joints. Changes in routing of piping due to field conditions shall be at the expense of this Contractor.
- C. Piping shall be accurately cut to measurements established at the project site, worked into place without springing or forcing, run as directly as possible, run parallel or perpendicular to building lines, located as indicated on the Drawings and supported as specified elsewhere. Parallel piping shall be grouped together as much as practical. Piping shall be supported as high as practical. Piping shall be concealed unless noted otherwise.
- D. Contractor shall provide for expansion and contraction of piping systems. Expansion and contraction of piping shall not impart excess stress or strain on the building, pipe fittings, joints or connections to equipment.
- E. Provide sleeves for all piping penetrations under or through footings, foundation walls, grade beams, floors above grade and walls. Sleeves for insulated piping above grade shall be sized for the insulation diameter. Annular space between the insulation and sleeve shall be sealed or fire caulked as detailed on the drawings. Sleeves shall be 2 pipe sizes larger than the service pipe.
- F. Piping thru slabs on grade shall be protected with 1/2" thick Armaflex closed cell foam insulation a minimum of 6 inches above and below slab. Wrap all pipes below slab in an approved jacketing material.
- G. Piping installed below grade shall have a minimum of 24" cover. See other sections for trenching and backfill requirements.
- H. Provide solid type chrome escutcheon plates at each exposed piping penetration of walls and ceilings and inside casework.
- I. Provide shutoff valves at each branch from main. Provide shutoff valves for each fixture group to minimize interruption of service for maintenance and repair. Provide an exterior main shutoff valve and valve box as indicated on drawings. Provide area

shut-off valves as necessary to facilitate testing and isolation of piping where tested and approved pipes are put into service.

J. Piping thru metal studs, structural members, etc. shall be isolated from metal to metal contact with plastic bushings specifically designed for the application.

3.3 Trap Primer Drains (When Applicable):

A. Provide a complete system of drains as indicated on the floor plans from the primer assembly to the floor drain/hub drain connections.

B. Piping below slabs shall be installed in the gravel bedding below the concrete flooring and held as level as possible. Piping to be sleeved with an approved protective covering.

3.4 Testing:

A. Water piping systems shall be subjected to a hydrostatic test of 125psig or 1-1/2 times operating pressure whichever is greater.

B. All piping shall be tested before being insulated or concealed. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory.

C. Provide test report showing all field tests performed to prove compliance with the specified criteria. The testing report shall be bound or submitted in PDF format. Report shall be submitted and approved prior to final payment. The report shall include the following:

1. Date of test.
2. Persons present.
3. System tested.
4. Test medium.
5. Pressure tested.
6. Lines tested and location.
7. Duration of test.
8. Pressure drop.

D. This Contractor shall conduct all specified tests until approved by the Engineer. All tests shall be repeated until approved by the Engineer. Piping systems shall not be covered or otherwise concealed until tests inspections have been made and approvals obtained. This Contractor shall notify the Engineer four days prior to testing to allow for scheduling. If the Engineer is called for an observation and the Engineer finds the work not ready or the test failed, this Contractor shall reimburses the Engineer at the Engineer's standard hourly rate.

3.5 Sterilization of Domestic Water Piping System:

A. The entire system shall be flushed for a minimum of two hours and then drained prior to sterilizing by the following method or other methods satisfactory to the Engineer and the Authority Having Jurisdiction.

B. Fill piping system with a 50 ppm chlorine solution. Open and close all valves to thoroughly distribute solution thru all piping. Allow solution to stand for 24 hours then test for residual chlorine at the ends of the system. If less than 25 ppm is indicated, repeat the sterilization process. When tests show at least 25 ppm of residual chlorine, flush out the system until all traces of chlorine is removed. Open and close all valves in system several times during flushing period.

C. The Engineer reserves the right to test, or have, the water tested again at any time prior to final acceptance of the work. If found to be unsafe, the Contractor shall re-

chlorinate the system until the water is proven equal to that supplied by the public system. It is the responsibility of this Contractor to ensure the water is equal to that supplied by the public system.

D. Contractor shall arrange for laboratory testing for a bacteriological examination of potable water system at various locations. The samples shall be tested to meet requirement of the AHJ and shall not be of less quality than provided by the public system. Submit a copy from testing agency prior to submitting for final payment.

E. Minor work such as repairs or replacement of a single fitting or valve, shall be pre-cleaned and disinfected by immersion in solution of 300 ppm chlorine for 1 hour.

3.6 Final Acceptance:

A. Before final acceptance, this Contractor shall furnish a certificate of inspection and final approval from the AHJ to the Owner and be in accordance with the latest revisions of the applicable Codes and the Approved Plumbing Drawings and Specifications. Contractor shall also furnish report of test, sterilization compliance and backflow device(s) certificates.

END OF SECTION 22 11 10

SECTION 22 13 10 - SANITARY SEWER PIPING SYSTEM

PART 1 - GENERAL

1.1 Related Documents:
- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all labor, materials, accessories, equipment, administration and perform all operations required for the correct installation of all sanitary sewer piping systems indicated on Drawings and specified in this section.
- B. Work Included: All sanitary sewer piping and equipment indicated throughout the building and extension of the sanitary sewer to the indicated termination point.

1.3 References:
- A. All plumbing installation and fabrication shall be in accordance with applicable State and Local Plumbing Codes.

1.4 Submittals:
- A. Submit catalog data and Shop Drawings for all materials and equipment listed under this section. Include submittal data on related specifications as applicable.
- B. Materials or equipment installed without review or after rejection shall be replaced with new by this contractor at no additional cost to other parties.
- C. All materials and equipment shall be new and without defect unless specifically noted or specified otherwise.
- D. The supplier certifies the materials and equipment to be satisfactory for the application involved.
- E. The Contractor agrees that if deviations, discrepancies or conflicts between submittals and specifications are discovered either prior to or after submittals are processed by the Engineer, the Contract Documents shall supersede.

PART 2 - PRODUCTS

2.1 Sanitary Sewer Piping System:
- A. Buried, Exterior and Below Slab:
  1. Cast Iron Pipe: ASTM A-74 spun service weight.
     a. Fittings: Cast iron.
     b. Joints: Hub-and-spigot, compression type with ASTM C-564 neoprene gaskets.
  2. PVC Pipe and Fittings: Schedule 40 per ASTM D-1785 / ASTM D-2665.
     a. Joints: Solvent weld per ASTM D-2855 with solvent per ASTM D-2564.
  3. Provide sleeves for all piping penetrations under or through footings, foundation walls, grade beams, floors above grade and walls. Sleeves for insulated piping above grade shall be sized for the insulation diameter. Annular space between the insulation and sleeve shall be sealed or fire caulked as detailed on the drawings. Sleeves shall be 2 pipe sizes larger than the service pipe. Coordinate with the Architectural and Structural drawings for locations.

4. This Contractor shall provide and install all cast iron pipe for all kitchen waste systems.

B. Above Slab, Interior:
   1. Cast Iron Pipe: ASTM A-888 spun service weight. Cast iron fittings and joints shall be no hub. Couplings shall be CISPI Standard No. 310-95 with corrugated stainless steel shield and 4 stainless steel retaining bands with 5/16" worm gear hex head socket. Couplings shall be Husky HD 2000.
   2. PVC Pipe and Fittings: Schedule 40 per ASTM D-1785 / ASTM D-2466.
      a. Joints: Solvent weld per ASTM D-2855 with solvent per ASTM D-2564.
   3. This Contractor shall provide and install all cast iron pipe at all fire rated assemblies, continuous floor to floor through assemblies. This Contractor shall provided and install cast iron pipe in return air plenums and where indicated on the Drawings. This Contractor shall coordinate with Contract Documents for compliance. This Contractor shall provide and install all cast iron pipe for all kitchen waste systems.

2.2 Sanitary Sewer Specialties:
   A. Cleanouts: Cleanouts shall be the same nominal size as the pipe served up to 4" and not less than 4" for line sizes greater than 4".

2.3 Sanitary Sewer System Insulation:
   A. All sanitary piping exposed in or installed over unheated spaces shall be insulated. Exposed floor drain bodies and P-traps shall be insulated.

PART 3 - EXECUTION

3.1 General:
   A. Installation dimensions between partitions or walls shall be acquired from the Architectural Drawings. Work shall be roughed-in so that all exposed piping will be straight and true without bends or off-sets.

3.2 Sanitary Sewer Piping System:
   A. Provide a complete system of sanitary sewer drain, waste and vent piping including interior and exterior work as indicated.
   B. Piping up to 2-1/2" shall be sloped at least 1/4" inch per foot. Piping 3", 4" and 6" shall be sloped at least 1/8 inch per foot. Piping 8" and larger shall be sloped at least 1/16 inch per foot.
   C. Provide cleanouts as required by Code and as indicated on the Drawings. Provide two way exterior cleanouts within 5 feet of the building. Interior cleanouts in floors shall be flush with finished floors. Interior cleanouts in walls shall be above the flood level of plumbing fixtures. Exterior cleanouts in unpaved areas and areas paved with other than concrete shall be set in concrete pads flush with finished grade as detailed on the drawings. All Clean Outs are to be the same size as the pipe they serve.
   D. Vents through roof shall be a minimum of 3 inches in diameter and shall terminate at least 12 inches above the roof. This Contractor shall review all Drawings and ensure vent termination is a minimum of 10 feet from any door, window or outside air inlet.
   E. Drainage piping shall be installed with hubs upstream of each pipe section. Provide reducing fittings where different sizes of pipe are to be connected. Bushings shall not

be used. Provide longsweep fittings, sanitary tees and combination wyes with 1/8 bends as applicable.

F. Escutcheons shall be provided on exposed wall penetrations. Escutcheons shall completely cover the piping, insulation and penetration. Escutcheon shall be single piece construction with chrome finish.

G. Interior wall cleanouts shall have stainless steel wall covers sized for the cleanout and covering the wall opening. Cleanout covers shall be installed flush with the wall.

H. Back to back water closets shall be installed with double combination wye with 1/8-bend. Double sanitary tees and double fixture fitting will not be allowed.

3.3 Testing:

A. All piping shall be tested before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory.

B. All waste and vent piping shall be subjected to a hydrostatic test of not less than a 10-foot head. Piping shall be tested for not less than 4 hours, prior to installing fixtures. Underground piping shall be tested before backfilling.

C. All vent piping shall be smoke tested.

3.4 Cleaning:

A. At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned.

3.5 Final Acceptance:

A. Before final acceptance, the Plumbing Contractor shall furnish a certificate of inspection and final approval from the AHJ to the Owner and be in accordance with the latest revisions of the applicable codes and the approved Plumbing Drawings and Specifications. Contractor shall also furnish a report of test and backflow device certificates.

B. Provide test report showing all field tests performed to prove compliance with the specified criteria. The testing report shall be bound or submitted in PDF format. Report shall be submitted and approved prior to final payment. The report shall include the following:

1. Date of test.
2. Persons present.
3. System tested.
4. Test medium.
5. Pressure tested.
6. Lines tested and location.
7. Duration of test.
8. Pressure drop.

C. This Contractor shall conduct all specified tests until approved by the Engineer. All tests shall be repeated until approved by the Engineer. Piping systems shall not be covered or otherwise concealed until tests inspections have been made and approvals obtained. This Contractor shall notify the Engineer four days prior to testing to allow for scheduling. If the Engineer is called for an observation and the Engineer finds the work not ready or the test failed, this Contractor shall reimburses the Engineer at the Engineer's standard hourly rate.

END OF SECTION 22 13 10

SECTION 22 42 10 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 Related Documents:
- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all fixtures, labor, materials, equipment, administration, balancing and services required for complete installation of all plumbing fixtures indicated on Drawings and specified within this section.

1.3 References:
- A. All plumbing installation and fabrication shall be in accordance with applicable State and Local Plumbing Codes and project funding requirements.

1.4 Submittals:
- A. Submit catalog data and shop drawings for all materials and equipment listed under this section.
- B. Materials, fixtures, or equipment installed without review or after rejection shall be replaced by this Contractor with Basis of Design items.
- C. All materials, equipment, and appliances shall be new, without defect, first line quality unless specifically noted or specified otherwise.
- D. The supplier, by submitting, certifies the materials and equipment to be satisfactory for the application involved.
- E. Contractor further agrees that if deviations, discrepancies or conflicts between submittals and specifications are discovered either prior to or after submittals are processed by the Engineer, the design drawings and specifications shall supersede.

PART 2 - PRODUCTS

2.1 Plumbing Fixtures – General:
- A. Provide all plumbing fixtures complete with trim required, and connect in a manner conforming to the Local, State and International Building Codes. Certain fixtures may be furnished by others under other sections of these Specifications. Provide rough-in and final connections including all valves, traps, specialties, etc. required.
- B. Provide traps for all waste connections where not furnished with the equipment and stop cocks or valved shut-offs for all water connections to all sinks and other items of equipment. All exposed pipe and metal, including that within cabinets, shall be chrome plated cast brass with the same gauge thickness as the specified trap. Stainless steel bell escutcheons shall be installed covering the hub connections below sinks and lavatories and extend to the wall or back of cabinet for a tight fit.
- C. Quality and Type of Fixtures:
  1. Plumbing fixtures, carriers, etc. are specified by manufacture and model numbers for the purpose of establishing type and quality. Equals must be pre approved by

the Engineer. Pre approval submittals must be received by this office no later than 10 working days before the job bids.

2.2 Fixture Schedule:

A. P-1 Water Closet (ADA Compliant): Zurn model Z5665-BWL (manual diaphragm flush valve), 1.6 gal/flush, 16-3/4" high, white, floor mounted elongated siphon jet, 2-1/8" fully glazed trap-way& bolt caps, with Z6000AV flush valve chrome finish flush valve with solid ring pipe support. Install with Olsonite model 10SSCT solid plastic open front seat with stainless steel self-sustaining check hinge. Toilet flange shall be metal. Plastic toilet flanges will not be accepted. Maximum seat height shall be 17-19" A.F.F. Water closet and flush valve shall be by the same manufacturer

B. P-2 Water Closet: Zurn model Z5655-BWL (manual diaphragm flush valve), 1.6 gal/flush,15" high, white, floor mounted elongated siphon jet, 2-1/8" fully glazed trap-way& bolt caps, with Z6000AV flush valve chrome finish flush valve with solid ring pipe support. Install with Olsonite model 10SSCT solid plastic open front seat with stainless steel self-sustaining check hinge. Toilet flange shall be metal. Plastic toilet flanges will not be accepted. Water closet and flush valve shall be by the same manufacturer

C. P-3 Urinal (ADA Accessible): Zurn Z5755-U (manual diaphragm), 0.5 gal/flush white, vitreous china with asymmetrical backwall, wall hung, with a Z6003AV-EWS, 0.5 GPF, chrome finish flush valve with solid ring pipe support. Fixture carrier shall be Zurn Z1222 dual plate carrier. Carrier shall be installed inside the masonry wall / stud wall to not take up space inside the access chase. Closely coordinate with the General, Masonry, Framing Contractor. Rim of urinal shall be 17" above floor. See Architectural interior elevations for urinal height prior to rough-in. Urinal and flush valve shall be by the same manufacturer

D. P-4 Lavatory: (ADA Accessible): Kohler K-1722 (1 hole drill) 19-1/4" x 17-1/4" vitreous china with overflow. Install Zurn Z1231 concealed arm carrier. Carrier shall be installed inside the masonry wall / stud wall to not take up space inside the access chase. Closely coordinate with the General, Masonry, Framing Contractor. Install Delta 520LF-HDF all brass faucet. Install McGuire No. 155WC offset grid drain, 17-gauge cast brass chrome plated trap with cleanout and Zurn Z-8804-XL-LR-LK supplies with stops. Insulate the water and waste pipes below the lavatory with TrueBro Lav Guard2 EZ series molded vinyl covering, white finish, latex paintable, with reusable internal snap clip fasteners. Provide Powers LM495 series, point of use ASSE 1070 thermostatic mixing valve with a maximum discharge temperature of 105°F to 109°F. Mount mixing valve to wall. Mixing valve shall not be installed loose. See Architectural interior elevations for fixture height prior to rough-in.

E. P-5 Lavatory (ADA Accessible): Kohler K-2699 20-1/8" x 16-1/2" vitreous china, drop-in, single hole center drilling, overflow. Install Kohler model K-97282-4 faucet. Install McGuire No. 155WC offset grid drain, 17-gauge cast brass chrome plated trap with cleanout and Zurn Z-8804-XL-LR-LK supplies with stops. Insulate the water and waste pipes below the lavatory with Plumberex Pro-Extreme series molded vinyl covering, white finish with reusable snap clip fasteners. Provide Powers LM495 series, point of use ASSE 1070 thermostatic mixing valve with a maximum discharge temperature of 105°F to 109°F. Mount mixing valve to wall. Mixing valve shall not be installed loose

F. P-6 Electric Water Cooler (ADA Accessible Dual Unit with Bottle Filling Station): Elkay model LZSTL8WSSK, wall mounted, dual unit, 120 volt, 370 watts, 8 gallons per hour cold water, with filtration system and bottle filling station, stainless steel basin and

shrouds. Install with Zurn model Z1225-BL dual plate carrier, 17 gauge cast brass chrome plated trap and Zurn Z-8804-XL-LR-LK supplies with stops. Unit mounting height shall be as selected by the Architect. See interior elevations. Anchor the cooler firmly to the carrier plates on top and bottom. Refrigeration system shall have a 5-year warranty. Four (4) additional replacement filters shall be furnished with the cooler

G. P-7 Mop Sink: Fiat model TSB3000 24"x 24" x 12" deep pre-cast terrazzo sink, with stainless steel caps on drop front, 3" deep seal trap, stainless steel strainer, quick drain connector, stainless steel wall guards, three-mop hanger and 30" long flexible hose with hose mounting bracket. Seal the sink to the wall and floor with silicone sealant prior to installing the stainless steel wall guards. Install T&S Brass B-0665-CRBSTPVR with body mounted vacuum break, garden hose end, 3" lever handles and wall support bracket. Mount the mixing faucet 42" above the floor. Mount the mop hanger 5' above the floor on the opposite wall of the faucet or as shown on Architectural Drawings.

H. P-8 Electric Water Heater: AO Smith Commercial Electric Water Heater model DEN-52, storage capacity of 50 gallon, 4.5 kW input (2 – 4.5kW elements, non-simultaneous operation), 208/1, seamless glass-lined steel tank construction, foam insulated, operating and safety controls, vacuum breaker and AGA/ASME T&P relief valve. Tank shall have a 3 year warranty. Provide an Amtrol Therm-X-Trol ST-12 expansion tank. Drain piping from the T&P relief and drain pan shall be Type L copper.

I. P-9 Circulation Pump: Bell & Gossett model LFNBF-22, Lead Free Bronze body, 92 Watts, 0.8 FLA, 2940 rpm, 115/1/60, 5 GPM at 15' head pressure. Control from a pipe mounted immersion Aquastat. Provide lead free circuit setter at pump outlet to control flow. Contractor shall submit circuit setter balance chart with pressure drop across the circuit sitter prior to substantial completion. Pump shall be enabled and disabled via the aquastat and a 7 day time clock provided by this Contractor.

J. P-10 Emergency Eye / Face Wash: Guardian G1724. Provide Guardian G3600LF Low Lead thermostatic mixing valve certified to ASSE 1071 factory set to 85°F and shall have a flow range of 0.5 gpm to 5 gpm with a maximum pressure drop of 20 psi. Valve shall include a built in cold water bypass, rough bronze finish, solid bimetal thermostat, locking temperature regulator with limit stop, integral check stops and dial thermometer. G3600LF valve to be mounted 8'-0" AFF on the back side of the wall serving the Eye / Face Wash. Route tempered water connection to the Eye / Face Wash inside the wall. Eye / Face Wash waste to be trapped and routed in the wall. Provide Trap Guard insert in drain trap.

K. P-11 Shower (ADA Accessible): Aquarius Model G 3838 BF ADA 0.50. Finished surface shall be of a sanitary grade polyester Gelcoat with a minimal thickness of 15 dry mils. Unit construction shall be of molded reinforced fiberglass with a 15% minimum fiberglass content. Unit outside dimensions shall be 38" x 39" x 78-1/4". Enclosure shall be equipped with one 18" x 33-1/2" x 1-1/2" diameter 18 gauge stainless steel L – grab bar, one 24" x 1-1/2" 18 gauge stainless steel diameter grab bar vertical on the valve wall with 1-1/2" statute clearance mounted with stainless steel bolts secured in the rear with a 3" x 3" x 11 gauge metal mounting plate, 32" x 21" white frameless HDPE fold up seat, 1/2" threshold, molded soap dish, foot ledge, 1" diameter 18 gauge stainless steel curtain rod with receiver cups, antibacterial weighted shower curtain with hooks. Provide and install Delta T13H322-25 shower faucet trim kit with temperature and volume control compliant with ASSE 1016, ADA handheld shower with adjustable spray patterns package including hand held spray,

adjustable grab bar accessory for handheld shower, vacuum breaker and 60" stainless steel hose. Provide and install Zurn ZS415BS two piece cast iron, fully adjustable collar, 2" drain body, 5" stainless steel strainer. Coordinate wall and slab recess requirements with the General Contractor.

L. P-12 Ice Maker Wall Box: Sioux Chief 696 series 1/4" wall box with Lead Free 1/4 turn valve with integral water hammer arrestor, faceplate and 18 gauge support bracket. Zurn Z8860-XL braided stainless steel supply line shall be provided and installed by Plumbing Contractor. Elevation of the wall box shall be as detailed on the Architectural Drawings.

M. P-13 Floor Drain: Zurn model ZN-415BZ-7B, two-piece cast iron threaded fully adjustable drain body with flashing collar. Install with type "B" 7" diameter polished nickel bronze, heel proof strainer, trap primer connection and deep seal trap. Floor drain shall be furnished with a Trap Guard insert. Contractor shall remove the strainer and provide a sheet metal construction cover during construction and reinstall strainer just before final observations.

N. P-14 Recessed Floor Drain: Zurn model ZN-415-7I, two-piece cast iron threaded fully adjustable drain body with flashing collar. Install with type "I" 7" diameter polished nickel bronze, heel proof strainer with raised flange and deep seal trap. Floor drain shall be furnished with a Trap Guard insert. See Drawings for line size. See detail for installation requirements. Contractor shall remove the strainer and provide Zurn Z499B, sheet metal construction cover during construction and reinstall strainer just before final observations.

O. P-15 Exterior Wall Hydrant: Zurn Z1320-CXL-CL-NB-WC, anti-siphon, non-freeze, automatic draining with vacuum breaker, integral backflow preventer, wall clamp assembly, polished nickel bronze finish and furnished with loose key operator. Install tight to wall and caulk weather tight. Coordinate operating rod depth with wall thickness and building insulation location. Coordinate hydrant termination with finished grade. Hydrant shall be no more than 24" above finished grade. Hydrant piping may have to be installed below the slab. If piping is installed below slab, the piping shall be encased in a 2" sleeve.

P. P-16 Interior Wall Hydrant: Zurn Z1333XL, lead free, anti-siphon, integral backflow preventor, and 1/2 turn ceramic disc cartridge interior wall hydrant for flush installation.

Q. P-17 Two Compartment Sink: Elkay model DLR291810, 29" x 18" with two 12" x 12" x 9-7/8"" deep compartments, 18-gauge stainless steel, self-rimming, counter mounted, fully undercoated. Install with model LKD2433C mixing faucet with retractable spray, two model LK-99 stainless steel strainers, Zurn Z-8804-XL-LR supplies with stops, 17 gauge cast brass chrome plated trap with cleanout and dishwasher tailpiece. Provide Powers LM495 series point of use mixing valve with a maximum discharge temperature of 120°F. Mount mixing valve to wall. Mixing valve shall not be installed loose. Furnished and installed In-Sink-Erator model 777ss stainless steel garbage disposer, continuous feed, dual direction. 1 hp 120 volt, with stainless steel grind chamber and grinding elements, fully insulated outer shell & 1-piece stainless steel stopper. Disposer shall have a 7-year warranty.

R. CO Cleanout: Provide threaded brass cap and stainless steel cover plate. Plate shall bolt into brass cap.

S. WCO Cleanout: Provide threaded brass cap and stainless steel cover plate. Plate shall bolt into brass cap.

T. ECO Exterior Cleanout: Zurn model Z1400-K-BP-DC, coated cast iron adjustable body with anchor flange, ductile heavy-duty scoriated secured cleanout cover and

internal bronze plug. Install to the listed waste pipe with a Huskey SD4000 coupling with stainless steel connector bands.

U. PRV Pressure Reducing Valve: Zurn 500XLYSBR 2" lead free pressure reducing valve with integral strainer. Provide a service valve upstream of the PRV and unions on each end of the PRV.

PART 3 - EXECUTION

3.1 General:

A. Obtain exact centerline rough-in dimensions between partitions or walls from the Architectural Drawings. Work shall be roughed-in so that all exposed piping will be straight and true without bends or off-sets. Water supplies shall connect through walls with stops and chrome plated escutcheons with setscrews. Where fixtures are without supporting legs or carriers secure wall hangers to bolts welded to 3/16" steel plates, mounted against walls within chases.

B. Where backs of fixtures join wainscoting or tile, the tile shall be ground flat and the joints made close. Apply a smooth bead of paintable white caulking compound around back of fixture at outside edge before final setting. When fixture is set, wipe compound so that joint is sealed smooth.

C. Mount fixtures to the heights above finished floor as indicated on the Architectural drawings.

3.2 Cleaning:

A. At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned and all temporary stickers, markings, etc. shall be removed.

B. All strainer screens shall be removed and cleaned. All floor drain strainer screens grid pattern shall match that of the floor covering grid pattern. All lavatory and sink strainers shall align with the geometry of the fixture. This Contractor shall coordinate rough-in work with necessary Trades for compliance.

END OF SECTION 22 42 10

SECTION 23 05 00 - MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 Related Documents:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:

A. Provide all materials, labor, management, equipment, fixtures, start-up, fabrication, services, cleaning, testing and balancing required for complete installation of all provisions indicated on Drawings, Schedules and specified herein.

B. This Contractor shall review all of the Contract Documents including all Drawings and Specifications of all Trades to ensure the complete implementation of Work.

C. Where shown or noted on the Drawings or where called for in other Sections of the Contract Documents, the Contractor for this Division shall install equipment furnished by Others, and shall make required service connections. Contractor shall verify with the supplier of the equipment the requirements for the installation.

D. Where the words "provide," "furnish," "include," or "install" are used in the Specification or on the Drawings, shall mean to furnish, install, and test complete and ready for operation, the items mentioned.

E. Drawings for the Work are diagrammatic, to express the scope of the Work and to indicate the general arrangement and locations of the Work. Due to Drawings constraints, certain items such as pipe fittings, offsets, access panels, devices and sleeves may not be shown. This Contractor shall be responsible for confirming that the devices, piping and equipment fit the space provided. The location and sizes for pipe, fittings, sleeves, access panels and other basic items required by Code and other sections shall be coordinated and included for the proper installation of the work.

F. Specifications may not deal with diminutive installation requirements, parts, controls, and devices required which may be required to produce the equipment performance specified or as required to meet the equipment warranties and applicable Code. Such items shall be included, whether or not specifically called for in the Contract Documents.

G. Coordinate with all Trades in submittal of shop drawings. Shop drawings shall be prepared to clearly indicate all applicable components. Space conditions shall be detailed to the satisfaction of all trades, subject to review and final acceptance by the Engineer. In the event that the Contractor installs work before coordinating with other trades or so as to cause any interference with work of other Trades, the necessary changes shall be made to the work to correct, at no additional cost to the Owner, Architect or Engineer.

1.3 Seismic Restraint / Protection:

A. All Life Safety Rated Systems shall be seismically restrained and protected including sway bracing, flexible couplings, anchoring, etc. Unless otherwise noted on the Drawings, Specifications and or general Contract Documents, the Seismic Site Class shall be "D" and Design Category shall be "C." The seismic design shall be by a

competent Professional Engineer licensed in the Project's State. The Professional Engineer responsible for the seismic design shall have no less than 5 years experience in the design of seismic protection systems. The Contractor installing the seismic protection shall have no less than 5 years experience in the installation of seismic protection systems shall meet the Contractor's Qualifications herein. Seismic designer shall coordinate with Architectural Life Safety Drawings and Structural Engineer / Drawings, prior to bid, and determine the required extent of Seismic restraint / protection.

1.4 Contractors Qualifications:

A. The qualifications of this Contractor shall be as follows:
   1. Contractor must be a licensed contractor, specific to this section's Trade, in the project's State.
   2. The Contractor shall have been in the mechanical contracting business for the last five consecutive years, under their current corporation name with more than 75% of the same corporate officers.
   3. The Contractor shall have completed at least two projects of comparable size and scope within the past two years without receipt of a Notice to Cure.
   4. If Contractor has received a Notice to Cure on any project, that Contractor is excluded from performing work on this project.
   5. The Contractor's main construction and service office shall be located within 150 driving miles distance of the project site unless approval, 10 days prior to project bid date, has been issued in writing by the Owner, Architect and Engineer.
   6. The Contractor shall provide substantiating proof of these requirements 10 days prior to project bid date. If substantiating proof is not submitted and approved, the Contractor will not be allowed to bid or work the project.
   7. The General Contractor shall not purchase this Contractor's equipment, materials, etc. All materials, equipment, labor, etc. required to perform the Work herein shall be at the cost of this Contractor.

1.5 Codes and Standards:

A. Conform to latest edition of governing codes, ordinances, and or regulations of city, county, state, utility provider, and or authority having jurisdiction. Where local codes are not applicable, conform to the latest International Code Counsel requirements.
B. Adopted ICC and ASCE 7 where seismic restraint / protection is required.

1.6 Fees, Permits, And Inspections:

A. Secure all permits and pay all fees required in connection with the Work.
B. Coordinate and provide such inspections as are required by the Authorities having jurisdiction over the site.
C. Where applications are required for procuring of services to the building, prepare and file such application with the Utility Company. Furnish all information required in connection with the application in the form required by the Utility Company.

1.7 Active Service:

A. Existing active services; water, gas, sewer, electric, are to be located and shall be protected against damage. Do not prevent or disturb operation of active services which are to remain. If active services are encountered which require relocation, make request to authorities having jurisdiction for determination of procedures. Where existing services are to be abandoned, they shall be terminated in

conformance with requirements of the Utility, Municipality or Authority having jurisdiction.

1.8 Site Inspection:

A. Contractor shall inspect the site to become familiar with conditions of the site which will affect this Contractor's work and shall verify points of connection with utilities, routing of Work to include required clearances from any obstacles.

B. Additional payment will not be provided for changes in the Work required because of Contractor's failure of said familiarization and understanding.

1.9 Openings, Cutting, And Patching:

A. This Contractor shall coordinate required openings in the structure, walls, ceiling, floor roof, etc. with all Trades and applicable Engineers.

B. When additional patching is required due to failure of coordination; provide the patching required to properly close openings including "put back" and painting. Patching must meet the Owner's, Architect's and all applicable Engineer's approval.

C. When cutting and patching of the building is required due to failure to install piping, sleeves, or equipment on schedule or failure to provide the information required for openings, provide the cutting and patching as required. Patching must meet the Owner's, Architect's and Engineer's approval.

1.10 Protection:

A. Equipment and material shall be completely protected from weather elements, painting, plaster, etc. until the project is completed. Damage from rust, paint, scratches, etc. shall be repaired as required to restore equipment to original condition. If repair is deemed unacceptable by the Owner, Architect or Engineer, the equipment, material, device, etc. shall be replaced with new at no additional cost to the Owner, Architect or Engineer.

B. Piping within walls, in particular within studs, shall be protected with 16 gauge metal cover plate, on both sides of stud, equal to Sampson HSS Stud Shoe.

C. Where the installation or connection of equipment requires work in areas previously finished by other Contractors, the area shall be protected and not marred, soiled, or otherwise damaged during the course of such work. Contractor shall arrange with all other Contractors for repairing and refinishing of such areas which may be damaged.

D. When welding is required inside the building, a fire watch shall be provided. The fire watch shall provide adequate protection of existing surfaces and observance of adjacent floors where penetrations exist or are to be made.

1.11 Wiring for Equipment:

A. Electrical work provided under Division 23 shall conform to the requirements of Division 26.

B. Division 26 shall provide power for motors and equipment furnished by this Contractor including safety disconnect switches, starters and final connections. This Contractor is responsible for coordinating with the Electrical Contractor and all other Trades, for wiring that is beyond this Contractor's credentials.

C. Division 23 shall provide all motors, controllers and contactors for equipment furnished under this Division, except where they are to be provided under another Division.

D. Include provisions required for integration into building Life Safety and Building Automation Systems.

E. Coordinate with Division 26 for all equipment which requires electrical services. Provide information as to the exact location for rough-in, electrical load, size, and electrical characteristics for all services required.
F. Where motors or equipment furnished require larger services or services of different electrical characteristics than those called for on the Electrical Drawings, this Contractor shall coordinate with the Electrical Contractor and the Electrical Engineer to provide a larger service as required, the cost of which shall be the responsibility of this Contractor.

1.12 Substitutions:
A. Any equipment, material, etc. submitted as "equal" to the basis of design shall be accompanied with a "one – to – one" comparison letter from the vender stating any differences from the equipment being submitted and the basis of design. A letter is also to be submitted from the vender, on the vender's letterhead, stating that the vender has received a copy of the job all Specifications, Addendums and Drawings.
B. Substitutions for the scheduled and specified equipment shall only be done with the prior approval of the Engineer, and shall be obtained in writing. Prior approvals shall be obtained no less than 10 days prior to the project bid date. Prior approval shall not relieve the contractor of supplying equipment that meets the specifications, capacities, efficiencies, physical dimensions, etc.

1.13 Submittals:
A. General:
1. Submit to Engineer shop drawings and product data required by the Drawings and Specifications.
2. Contractor shall compile all data required to satisfy the Scope of Work implied by the Contract Documents.
3. Submit a minimum of 6 copies of data, more if required by the Architect. Coordinate with Architect and Engineer to verify if Electronic Submittals, i.e. PDF, will be allowed or required prior to bidding the project. If Electronic Submittals are allowed, 2 bound hard copies must be submitted as well as the Electronic file.
B. Submittal Requirements:
1. Review shop drawings and product data prior to submission to Engineer.
2. Submit only complete project submittals. Partial submittals or submittals not complying with the above requirements shall be returned to the contractor un-marked and rejected.
3. Engineer's review is only to check for general conformance with the design concept of the project and general compliance with Contract Documents. No responsibility is assumed by the Engineer for correctness of dimensions, details, quantities, procedures, etc. shown on shop drawings or submittals.
4. In the interest of project expediency the contractor may pre-submit long lead items for pre-approval pending prior approval of the Engineer. However, the Contractor shall not be relieved of including the same data as required by submittal binder and shall be included therein.
5. The Contractor may turn in submittals without control drawings if they require a longer production time. All other items shall be included.

6. If a pre-submittal is made, provide a tab for items not included and include an explanation of why item is not included in the submittal and the expected submittal date.
7. PDF submittals must be searchable and tabbed per section. All devices, materials, etc. that assemble a fixture, system, etc. shall reside in the same tab.
8. Hard copy submittals shall be compiled in a 3-ring, hard bound, loose leaf binder. The face of the binder shall be clearly marked with the project title and number, the name of the Owner, Architect, Engineer, General Contractor and this Contractor.
9. Provide an index, numerically indicating all sections applicable to the submittal.
10. Separate binders shall be provided for HVAC, Plumbing and Fire Suppression trades.
11. Provide tab dividers for each section submitted.
12. If an item appears on the drawings not specifically covered by the specifications, provide an additional numeric tab at the end of the index detailing the item and include the submittal data in the binder. All devices, materials, etc. that assemble a fixture, system, etc. shall reside in the same tab.
13. All equipment included on the submittal sheets shall be marked to indicate the mark of the equipment as shown on the drawings. The equipment shall be high-lighted to clarify which items are being submitted.
14. When required, the contractor will be provided with an electronic copy of this section's Drawings. Shop drawing submittals shall consist of one digital copy in .dwg format and one in PDF format. The drawing's sheet sizes shall be formatted to the same size as the Contract Documents. A digital copy in PDF format shall be returned to the contractor with the Engineer's approval stamp and comments.
15. Verify field measurements, field construction criteria, catalog numbers, and similar data.
16. Notify Engineer in writing of deviations from requirements of Contract Documents at time submittals are made. A "deviation" shall be construed to mean a minor change to the sequence indicated on drawings or specification. A "deviation" is not intended to allow substitutions or product options.
17. Deviations in submittals from requirements of the Contract Documents are not relieved by Engineer's review of submittals, unless Engineer gives written acceptance of specific deviations.
18. Work may not commence until submittals have been returned with Engineer's stamp and signature indicating approval. Materials and equipment that were installed prior to being approved shall be removed and replaced with approved items at no additional cost to other parties.
19. Shop Drawings and or submittals requiring resubmission to the Engineer due to non-compliance with the Contract Documents and or incompleteness shall be thoroughly reviewed by the Contractor prior to delivery to the Engineer for review. The Contractor shall ensure the completeness and compliance of the submittal materials and shall reimburse the Engineer at the Engineer's standard hourly billing rate for review of submittals beyond the second submission.
20. Omission in shop drawings of any materials indicated in Contract Drawings, mentioned in Specifications, Scheduled or required for proper execution and completion of Work, does not relieve the Contractor from responsibility for providing such materials.

1.14 Operating and Maintenance Manuals:

A. General:

1. Provide three "As Built" copies of shop drawings, product data, and other information described in this Section for use in compiling operating and maintenance manuals.
2. Provide legible submittals made by permanent reproduction copy equipment from typewritten or typeset originals.
3. Pre-punch 8-1/2 inch x 11 inch sheets in three ring, hardback, binders.
4. Submit larger sheets in rolled, protected packages.
5. Submit all in a PDF format as well as the hard copy sets mentioned above.

B. Compilation:

1. The Contractor will receive shop drawings, brochures, materials lists, technical data, warranties, guarantees, and other pertinent information and will assemble, catalog, and file information in loose-leaf, hardback three-ring binders.
2. Submittal Format: Provide each of the following items, as applicable, for each required item or system. Refer to specific Specification section requirements.
   a) Item: Use appropriate Section title.
   b) System Description: Provide a detailed description of each system, describing function, components, capacities, controls and other data specified, and including the following:
      (1) Quantity.
      (2) Sizes.
      (3) Type of operation.
      (4) Detailed operating instructions, including start-up and shut-down of each system, with indications for position of all controls, as applicable.
      (5) Wiring Diagrams: Complete wiring diagrams for internally wired components including controls.
      (6) Operating Sequence: Describe in detail.
      (7) Manufacturers Data: Provide catalog data sheets, specifications, nameplate data and parts list.
      (8) Preventative Maintenance: Provide manufacturer's detailed maintenance recommendations.
      (9) Troubleshooting: Provide manufacturer's sequence for trouble-shooting procedures for operational problems.
      (10) Extra Parts: Provide a listing of extra stock parts furnished as part of the Contract.
      (11) Warranties: Provide specific manufacturer's warranty. List each component and control covered, with day and date warranty begins, date of expiration and name, address and telephone number of person to contact regarding problems during warranty period.
      (12) Directory: Provide names, addresses, emails and telephone numbers of Contractor, its subcontractors, suppliers, installers and authorized service and parts suppliers.

1.15 Record Drawings:

A. Detailed Requirements for Record Drawings:

1. During the progress of the work, the General Contractor shall require the job superintendent for the plumbing, air conditioning, heating, ventilating, and fire protection subcontractors to record on their field sets of drawings the exact

locations, as installed, of all conduits, pipes, and ducts whether concealed or exposed which were not installed exactly as shown on the contract drawings.

2. Upon completion of the work, this data shall be recorded to scale, by a competent CAD operator in .dwg format of no more than two versions past current. Electronic drawings in .dwg format will be furnished to the Contractor by the Architect/Engineer. Where the work was installed exactly as shown on the contract drawings the .dwg file shall not be disturbed other than being marked "As-Built." In showing the changes, the same legend shall be used to identify piping, etc., as was used on the contract drawings. Separate electronic drawings shall be prepared for plumbing, heating, air conditioning, and ventilating work unless two or more divisions are shown on the same sheets of the contract drawings, in which case the various subcontractors shall also show their changes on the same sheets. Each sheet shall bear the date and name of the Contractor submitting the drawings.
3. The Contractor shall review the completed As-Built drawings and ascertain that all data furnished on the .dwg files is accurate and truly represent the work as actually installed. Where plumbing, hot or chilled water pipes, inverts etc., are involved as part of the work, the Contractor shall furnish true elevations and locations, all properly referenced by using the original bench mark used for the institution or for this project.
4. The Engineer shall authorize the Contractor to produce and distribute the As-Built drawings as follows:
   a) One (1) to the Engineer.
   b) One (1) to the Architect.
   c) One (1) to the Owner.

1.16 Substitutions and Product Options:

A. Products specified only by reference standard, select product meeting that standard in accordance to the projects funding requirements, i.e. Made in the USA.
B. For products specified by naming several products or manufacturers, select any one of products and manufacturers named which complies with the schedules and / or specifications pending prior approval.
C. For products specified, noted or scheduled stating "or equivalent," "or equal" or similar wording, submit a request for proposed substitutions for any product or manufacturer which is not specifically named for review and approval by the Engineer.
D. For products specified by naming only one manufacturer product, the Engineer may approve a product of equal or greater quality or performance. Submittal must be received 10 days prior to project bid date accompanied with a one – to – one comparison letter.

1.17 Substitution Submissions:

A. Each substitution submittal request shall be accompanied with:
   1. Comprehensive data proving compliance of proposed substitution with requirements stated in the contract documents:
      a) Product identification.
      b) Manufacturer's literature shall identify:
         (1) Manufacturer's name and supporting address, phone number, point of contact and email address.
         (2) Product description.

(3) Reference standards.
(4) Performance and test data.
(5) Warranty information of all components.

c) Two projects of similar size and scope on which product has been used, and date of each installation.
d) Itemized comparison of the proposed substitution with product specified listing any variations.
e) Changes in construction schedule.
f) Any effect of substitution on other contracts.
g) List of changes required in any other work, products or required to be made by other Trades.
h) Designation of availability of maintenance services, sources of replacement materials.

B. Substitutions will not be considered for acceptance when:
1. Substitution will require substantial revision of contract documents.
2. They are indicated or implied on shop drawings or product data submittals without a formal request from Contractor or Supplier prior to bid.
3. Information is deemed inadequate by the Engineer necessary for complete evaluation.

1.18 Contractor's Substitution Responsibilities:
A. Contractor affirms that:
1. Contractor has determined that the substitution is equivalent to or superior in all respects to that specified.
2. Contractor will provide the same warranties and or bonds for substitution as for product specified.
3. Contractor will coordinate installation of accepted substitution into the work, and will make such changes as required for the work to be complete in all respects.
4. Contractor waives claims for additional costs caused by substitution which may subsequently become apparent.

B. The Contractor shall have included all costs associated with the substitution for the specified products or materials, and that no additional cost will be incurred by any other party in order to fully incorporate the substituted item(s).
C. The Contractor agrees to reimburse the Architect/Engineer for any architectural or engineering re-design that is required by the substitution to be fully incorporated. The reimbursement shall be at the Architect/Engineer's standard billing rate.

1.19 Engineer's Duties:
A. Review Contractor's requests for substitutions with reasonable promptness.
B. Notify Contractor in writing of decision to accept or reject requested substitution.

1.20 Observations of Work:
A. The Contractor shall schedule an observation, performed by the Engineer and AHJ, one week in advance of the observation, prior to any Work being concealed, covered, etc.
B. If the Contractor schedules an observation and the Work is found not ready by the Engineer, the Contractor shall reimburse the Engineer, at the Engineer's standard hourly rate, including travel time, for a re-observation.
C. A copy of the AHJ's report for any work observed or inspected by the AHJ shall be submitted to the Architect and Engineer.

1.21 Finishing:

A. General: Prior to acceptance of the installation and final payment of the Contract, the Contractor shall perform the work outlined in the Contract Documents.

B. Cleaning: At the conclusion of the construction, all portions of the project work shall be cleaned thoroughly of all debris and unused materials remaining from construction.

C. Equipment, piping and duct systems shall be cleaned internally. The Contractor shall open all dirt legs and remove strainers / filters, completely blowing down as required and clean strainer screens of all accumulated debris. Finished strainers, sized by the manufacturer shall be installed in place of startup strainers, filters, etc.

D. All tanks, fixtures, and pumps shall be drained and proven free of sludge and accumulated matter.

E. All temporary labels, stickers, etc., shall be removed from all fixtures and equipment. (Do not remove permanent name plates, equipment model numbers, ratings, etc.). Painting over equipment nameplates will not be allowed. Nameplates will be replaced with new if damaged or painted over. All equipment shall have affixed adjacent to the permanent nameplate, the unit identification on an engraved label with permanent adhesive or pop-rivet(s).

F. Plumbing fixtures, equipment, tanks, pumps, etc., shall be thoroughly cleaned externally as well.

1.22 Test and Demonstrations:

A. Systems shall be tested and placed in proper working order prior to demonstrating systems to Owner.

B. Prior to acceptance of the mechanical installation, demonstrate to the Owner or designated representatives all essential features and functions of all systems installed, and instruct the Owner in the proper operation and maintenance of such systems. The contract shall allow for five working days and all required tools, devices, etc. to perform the demonstrations / instructions.

C. Provide necessary trained personnel to perform the demonstrations and instructions. Provide manufacturer's representatives for systems as required to assist with the demonstrations.

D. Dates and times for performing the demonstrations shall be coordinated with the Owner.

E. Upon completion of demonstrations, provide a certificate testifying that demonstrations have been completed. Certificate shall list each system demonstrated, dates demonstrations were performed, names of parties in attendance, and shall bear signatures of the Contractor and Owner.

1.23 Painting and Identification:

A. Touch-up paint where equipment has sustained "minor" damage shall be applied with factory provided paint and finish, to match original finish. Damaged shall only be deemed "minor" by the Engineer's assessment.

B. Provide engraved, laminated plastic tags for all equipment. Tags shall be attached with permanent adhesive or pop-rivet(s).

1.24 Excavating, Trenching, And Backfilling:

A. Provide excavation necessary for underground piping, etc. Backfill trenches and excavations after work has been installed, tested and approved. Care shall be taken

in excavating, that walls and footings and adjacent load bearing soils are not disturbed, except where lines must cross under a wall footing. Where a line must pass under footing, the crossing shall be made by the smallest possible trench to accommodate the pipe. Excavation shall be kept free form water by pumping if necessary. Any open trench shall be protected with signage, fencing, etc. Trenches shall be excavated in accordance with all regulatory Codes and AHJ requirements.

B. Trenches for piping and utilities located inside foundation walls and five (5) feet outside of the exterior wall shall be not less than sixteen (16) inches or more than twenty-four (24) inches wider than the outside diameter of the pipe to be laid. The widths of trenches for piping and utilities located more than five (5) feet outside of building foundation walls, other than for sewers, shall be governed by conditions found at the site.

C. Bottoms of trenches shall be so shaped that when pipe is in place the lower fourth of the circumference for the full length of the pipe will be supported on compacted fill. Fitting holes shall be dug so that no part of the weight of the pipe is supported by the fitting but shall be no larger than necessary for proper jointing. All sewers and piping required for the structure shall be excavated to at least (6) inches below pipe invert.

D. Immediately after testing and/or inspection, the trench shall be carefully backfilled with earth free from clods, brick, etc., to a depth one-half the pipe diameter and then firmly tamped in such a manner as not to disturb the alignment or joints of the pipe. Thereafter, the backfill shall be tamped every vertical foot.

1.25 Concrete Work:

A. Provide concrete bases and housekeeping pads for mechanical equipment unless indicated otherwise. Concrete work shall be as specified in the applicable Civil/Site and Structural Sections. Vibration pads, equipment bases, pipe supports and thrust blocks shall be provided by this Contractor.

B. Provide equipment anchor bolts and coordinate their proper installation and accurate location.

1.26 Access Panels:

A. Access Panel shall be of appropriate size to allow for full service and removal of device behind the access panel.

B. Provide access panels where required and not shown on the drawings for installation by the drywall or masonry Contractor. Access panels shall be steel, primed ready for paint. All access panel locations shall be approved by the Architect/Engineer.

C. Provide fire rated access panels in rated walls, ceilings and floors. Rates shall be in compliance to the assemblies rating. This Contractor shall review Life Safety Drawings for required locations of fire rated access panels.

1.27 Sleeves:

A. Sleeves passing through non-load bearing or non-fire rated walls and partitions shall be Schedule 40 PVC pipe or cast iron pipe.

B. Sleeves passing through load bearing walls, concrete beams, foundations, footings, and waterproof floors shall be Schedule 40 galvanized steel pipe. Sleeve diameter shall be a minimum of 2 pipe sizes larger than pipe being protected.

C. Sleeves for insulated piping shall be of sufficient internal diameter to take pipe and insulation and to allow for free movement of pipe. Sleeve diameter shall be a minimum of 2 pipe sizes larger than pipe being protected. Waterproof sleeves shall be of sufficient internal diameter to take pipe and waterproofing material.

D. In finished areas where pipes are exposed, sleeves shall be terminated flush with wall, partitions, and ceilings, and shall extend 1/2" above finished floors. Extend sleeves 1" above finished floors in areas likely to entrap water.

1.28 Escutcheons:

A. Provide chrome plated escutcheons at each sleeved opening into finished and exposed exterior spaces. Escutcheons shall fit around insulation or around pipe when not insulated; outside diameter shall cover sleeve. Where sleeve extends above finished floor, escutcheon shall clear sleeve extension. Secure escutcheons to sleeve with set screws or other approved devices.

1.29 Insulation Protection:

A. Where exposed insulated piping extends to floor, provide aluminum wrap guard around insulation. Aluminum wrap and straps shall be trimmed to eliminate sharp cutting edges.

1.30 Anchoring of Equipment:

A. All equipment located on floor slab that is capable of being moved shall be secured to the floor with anchor bolts. A minimum of two bolts are required per each piece of equipment and bolts shall be of sufficiently size to prevent equipment from overturning.

B. Roof mounted equipment and curb shall be secured to the roof structure in compliance to ICC wind loading provisions.

1.31 Protection of Electrical Equipment:

A. Water piping shall not be installed in electrical rooms, unless it serves the room and meets the AHJ's requirements, or directly above electrical equipment.

1.32 Connections for Fixtures and Equipment Under Another Section or By Owner:

A. Rough all equipment requiring connection to systems provided under this Division. Verify requirements and current locations before proceeding with work.

B. Make all connections to equipment furnished under another Section or by the Owner as required to obtain complete and working systems.

1.33 System Guarantee:

A. Work required under this Division shall include a minimum one-year guarantee. Guarantee by Contractor to Owner to replace any defective workmanship or material which has been furnished under this contract at no cost to the Owner, Architect or Engineer for a period of one year, or long if so specified in other sections, from date of Substantial Completion. Guarantee shall also include all reasonable adjustments to system required for proper operation during guarantee period. Guarantee shall not include normal preventative maintenance services or filters.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 05 00

SECTION 23 05 32 - SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 Related Documents:
- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all materials, labor, administration and services required for complete installation of all supports and anchors indicated on Drawings and specified within this section.
- B. Ductwork, piping, equipment hangers, supports and required anchors.
- C. Equipment bases, frames and supports.
- D. Flashing and sealing equipment and pipe penetrations.
- E. Sleeves and seals.

1.3 References:
- A. American Society of Mechanical Engineers (ASME)
- B. American Society of Testing and Materials (ASTM)
- C. National Fire Protection Association (NFPA)

1.4 Work Furnished, Installed Under Other Sections:
- A. Furnish hangers and sleeve inserts for placement into formwork, framework, structure, slab, etc.

1.5 Submittals:
- A. Submit shop drawings and product data for all items listed under this section.
- B. Indicate hanger / support framing and attachment methods.
- C. Provide hanger / support framing loading limits, location and load of each hanger / support frame.

1.6 Site Condition:
- A. Do not drill, cut, burn or weld structural members in connection with the installation of pipe supports, bracing and anchorage devices, unless proposed in writing and approved in writing by the Engineer.

PART 2 - PRODUCTS

2.1 Pipe Sleeves:
- A. Sleeves Through Interior Walls, Floors and Ceilings:
  1. Sleeves through Non-Fire Rated floors: Schedule 40 PVC pipe.
  2. Sleeves through Non-Fire Rated walls, footings, and foundation walls: Schedule 40 PVC 2 pipe sizes larger than service pipe.
  3. Sleeves through beams shall be only in locations and of construction approved by the Structural Engineer.

4. Sleeves for floor or wall penetrations at rated assemblies shall conform to Specifications Section 23 05 60.

B. Sleeves Through Exterior Below Grade Walls, Floors and Ceilings:
   1. Schedule 40 Bitumen Coated Steel 2 pipe sizes larger than service pipe.

C. Sleeves Through Exterior Above Grade Walls:
   1. Schedule 40 Bitumen Coated Steel 2 pipe sizes larger than service pipe. Sleeve shall extend 1/8" past finished interior and exterior of wall assembly and painted to match finished wall. Sleeve shall be sealed weather tight.

D. Escutcheons:
   1. Public Areas: Solid plate stainless steel with satin finish.
   2. Non-Public Areas: Split ring chrome plated with set screws.
   3. Size: Minimum one inch annulus shall be provided except at building seismic joints. Building seismic joint pipe sleeves shall be minimum of 5 inches greater than the nominal diameter of the pipe.

2.2 Duct Sleeves:

A. Exterior Insulated Ductwork: Galvanized steel. Parameter shall be large enough to allow for specified insulation to remain continuous through the penetration. Wall shall be sealed tight to ductwork sleeve by General Works Contractor installing wall assembly.

B. Double Wall Spiral / Internally Insulated Ductwork: Galvanized paint grip steel. Wall shall be sealed tight to ductwork sleeve by General Works Contractor installing wall assembly.

C. Sleeves for floor or wall penetrations at rated assemblies shall conform to Specifications Section 23 05 60.

2.3 Fabrication:

A. Size pipe sleeves large enough to allow for movement due to expansion and contraction and continuous insulation.

2.4 Flashing:

A. Metal Flashing: paint grip galvanized steel.

B. Lead Flashing: 5 lb/ft^2 sheet lead for waterproofing.

C. Caps: 20 gauge minimum galvanized steel; minimum 16 gauge at fire resistant elements or as required per assembly rating. Caps shall be paint grip when exposed.

2.5 Pipe Hangers and Supports:

A. Provide pipe hangers, supports and guides hot-dip galvanized unless otherwise indicated. Provide copper-plated hangers on un-insulated copper pipes.

B. Hangers and support components shall be factory fabricated materials designed.
   1. Components shall have hot dipped galvanized coating; electroplate is not acceptable.
   2. Strap type hangers shall not be used on any piping system; use only clevis type. The clevis hanger fastener nuts shall be nylon lock type.

C. Anchors for pipe hanger and supports shall be either of the following types as applicable to installation condition:
   1. Galvanized metal inserts cast into concrete at time of placing.
   2. Anchor bolts for floor mounted equipment may be of a type to be placed in drilled holes and set in place with high strength cement grout.

3. Wedge type, type 316 stainless steel, expansion bolts, anchor bolts set in drilled holes in accordance with manufacturer's instructions. Use of drop-in anchors are prohibited.

2.6 Types of Hangers:
A. Hangers for Cold Pipe: Carbon steel, adjustable clevis.
B. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable clevis.
C. Hangers for Hot Pipe Sizes 6 inches and Larger: Adjustable steel yoke, cast iron roll clevis.
D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
E. Vertical Support: Steel riser clamp.
F. Copper Pipe: Carbon steel rings, adjustable, copper plated.
G. Hanger Rods: Mild steel continuous threaded.
H. Inserts: Malleable iron case or galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms. Size inserts to suit threaded hanger rods.

2.7 Anchors and Anchorage Devices:
A. Anchors and Bolts: Bolts and studs, nuts and washers shall be Type 316 stainless steel.
B. Fasteners and Accessories: Provide anchors and fasteners, washers, straps and accessories required for a complete and finished installation. Fasteners shall be Type 316 stainless steel.
C. Expansion Bolts: Where anchors are not included in the concrete or masonry construction, anchors shall be Type 316 stainless steel screws or bolts with expansion-shield type concrete or masonry anchors, of sizes and types indicated or required.

2.8 Finish:
A. Concealed: Provide rust inhibiting primer coat to all support, hanger, anchor, etc.
B. Exposed: Provide rust inhibiting primer coat and two finish coats, color to be selected during the submittal phase, to all support, hanger, anchor, etc.

PART 3 - EXECUTION

3.1 Pipe Hangers and Supports:
A. Support horizontal piping as follows:

Pipe Size	Maximum Hanger Spacing	Hanger Diameter
1/2" – 1-1/4"	6'-6"	3/8"
1-1/2" – 2"	10'-0"	3/8"
2-1/2" – 3"	10'-0"	1/2"
4" – 6"	10'-0"	5/8"
PVC (all)	6'-0"	3/8"
Cast Iron (all)	5'-0"	5/8"

B. Install hangers to provide minimum 1/2" space between finished covering and adjacent work.
C. Place a hanger within 12" of each elbow.
D. Use hangers with 1-1/2" minimum vertical adjustment.

E. Support horizontal cast iron pipe adjacent to each hub.
F. Support vertical piping at every floor or every 10 feet whichever is more frequent.
G. Support riser piping independently of connected horizontal piping.
H. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
I. All hangers, hanger rods, supports, etc. shall be double-nutted.

3.2 Equipment Bases and Supports:
A. Provide equipment bases of concrete type, minimum 4" thick A.F.F.
B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
C. Construct support of steel members. Brace and fasten with flanges bolted to structure.
D. Provide rigid anchors for pipes after vibration isolation components are installed in accordance with the vibration isolation manufacturer's requirements.

3.3 Flashing:
A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

3.4 Sleeves:
A. Extend sleeves through floors one inch above finished floor level. Caulk sleeves full depth and provide floor plate.
B. Install escutcheons as described above.

END OF SECTION 23 05 32

SECTION 23 05 53 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 Related Documents:
- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all materials, labor, administration and services required for complete installation of all mechanical identification indicated on Drawings and specified within this section.
- B. Identification of equipment, piping and ductwork.
- C. Identification and painting of exposed mechanical piping.
- D. Identification and painting of accessible, concealed mechanical piping.

1.3 Submittals:
- A. Submit samples and manufacturer's installation instructions for mechanical identification products.
- B. Submit valve chart and schedule including valve tag number, size, function, location and valve manufacturer's name and model number.
- C. Submit manufacturer's application instructions and color samples for paint products.

PART 2 - PRODUCTS

2.1 Materials:
- A. Nameplates: Laminated three-layer plastic with engraved white letters on black background color.
- B. Metal Tags: Brass with 1/2 inch high black filled numbers and/or letters, minimum 1-1/2 inch diameter, brass link chain and hooks.
- C. Engraved Metal Tack Markers shall be provide and pop riveted to the Tee Bar main for use of identifying VAV boxes, valves, controls devices, filter access, etc. locations above acoustical tile ceilings. Color to be selected by submittal. Markers shall be numbered with standard 3/16" characters.
- D. Paint: Gloss enamel.
- E. Stencil Paint: Semi-gloss enamel.
- F. Pipe Markers: Equal to Seton Snap Around Pipe Markers. Acrylic plastic with UV inhibitors. Markers shall indicate direction of flow. Legends shall be alternately reversed and repeated for viewing from any angle. Markers shall be factory formed for the installed diameter. Color-coded background, color of legend letter size and length of color field shall conform completely to the latest edition of ANSI A13.1. Legends shall be alternately reversed and repeated for viewing from any angle.

PART 3 - EXECUTION

3.1 General:

A. Degrease and clean surfaces to receive adhesive for identification materials.
B. Prepare surfaces in accordance with paint manufacturer's requirements.
C. Plastic nameplates shall be installed with corrosion resistant mechanical fasteners.
D. Metal tags shall be installed with corrosion resistant chain.
E. Engraved metal markers should be identified and located on as-built drawings.
F. Stenciling shall produce neat, high contrast markings. Sizes of markings shall be per the following schedule:

Insulation or Pipe Size	Length of Stencil	Marking Size
3/4" - 1-1/4"	8"	1/2"
1-1/2" - 2	8"	3/4"
2-1/2" - 6"	12"	1-1/4"
8" - 10"	24"	2-1/2"
Over 10"	32"	3-1/2"
Ductwork and Equipment	-	2-1/2"

3.2 Piping:

A. Piping shall be identified at maximum 20 feet on center, at each side of each wall penetration, at each valve and at each connection to equipment. Piping identification shall include type of service, pipe size and direction of flow.
B. Exposed mechanical piping shall be painted with gloss enamel paint and identified per the following schedule:

Type of Service	**Mark**	**Marker / Letter Color**	**Exposed Piping / Lettering Color**
WSHP Loop Water Supply	WSHP LWS	Green / White	Green / White
WSHP Loop Water Return	WSHP LWR	Green / White	Green / White
Chilled Water Supply	CHWS	Blue / White	Blue / White
Chilled Water Return	CHWR	Blue / White	Dark Blue / White
Condenser Water Supply	CWS	Green / White	Green / White
Condenser Water Return	CWR	Green / White	Green / White
Heating Water Supply	HWS	Red / White	Red / White
Heating Water Return	HWR	Red / White	Light Red / White
Hydronic Make-Up Water	HMUW	Brown / White	Brown / White
Evaporator Condensate	CD	Light Blue / White	Purple / White
Refrigerant Lines	FREON	Green / White	White / Black
Reheat Condenser Water Supply	RHCWS	Orange / White	Dark Orange / White
Reheat Condenser Water Return	RHCWR	Orange / White	Light Orange / White
High Pressure Steam	HPS	Blue / White	Blue / White
Low Pressure Steam	LPS	Blue / White	Blue / White
Condensate Return (Gravity)	CDR	Blue / White	Blue / White
Pumped Condensate Return	PCDR	Blue / White	Blue / White
High Pressure Condensate	HPC	Blue / White	Blue / White
Low Pressure Condensate	LPC	Blue / White	Blue / White
Compressed Air	CA - XXX PSI	Red / White	Red / White
Industrial Cold Water	ICW	Brown / White	Light Brown / White
Industrial Hot Water	IHW	Brown / White	Dark Brown / White
Natural Gas	NAT GAS – XXX PSI	Yellow / Black	Yellow / Black
Liquid Petroleum Gas	LP GAS – XXX PSI	Yellow / Black	Yellow / Black
Chemical Fume Hood Exhaust	CFHE	Purple / White	Purple / White

Note: Piping exposed in finished rooms shall be painted per the direction of the Architect / Owner.

C. Concealed mechanical piping shall be identified with stenciled painting or snap around pipe markers.
D. Refrigerant lines shall be labeled using snap around pipe markers.

3.3 Valves:
A. Valves in main and branch piping shall be identified with metal tags.
B. Provide valve chart and schedule, framed with clear plastic shield. Install at location as directed.
C. All valve locations shall be indicated on "As-Built" Drawings.

3.4 Air Bleeds:
A. Provide air bleed chart and schedule, framed with clear plastic shield. Install at location as directed.
B. All air bleed locations shall be indicated on "As-Built" Drawings.

3.5 Ductwork:
A. Ductwork shall be identified with stenciled painting. Identify as to unit number, and area served.

3.6 Equipment:
A. 2,000 MBH and less boilers, base mounted pumps, fans, etc., shall be identified with plastic laminated plates. Large equipment such as fluid coolers, cooling towers, chillers, horsepower rated boilers shall be identified with stenciled painting.
B. Roof top equipment, air handling units, fans, etc., shall be identified using plastic nameplates.
C. Small equipment such as in-line pumps shall be identified with metal tags.
D. Starters for mechanical equipment shall be labeled with the corresponding equipment designation using plastic nameplates
E. Control panels, gauges, instruments and major control components not located at control panels shall be identified with plastic nameplates.

END OF SECTION 23 05 53

SECTION 23 05 60 - THROUGH PENETRATION FIRE STOPPING

PART 1 - GENERAL

1.1 Related Documents:
- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all materials, labor, administration and services required for complete installation of all through penetration fire stopping indicated on Drawings and specified within this section.
- B. Provide fire stopping for the following through penetrations:
  1. Hydronic piping.
  2. Gas piping.
  3. Pneumatic piping.
  4. Refrigerant piping.
  5. Conduit for wiring and controls.

1.3 References:
- A. Underwriters Laboratories (UL).
- B. American Society for Testing and Materials (ASTM).

1.4 Contractor Requirements:
- A. The contractor shall have at least 5 years experience with through penetration fire stopping systems and shall have completed a least 2 comparable scale projects using these systems.
- B. Provide statement from manufacturer that installer has been trained in the proper method of installing fire stop systems.

1.5 Project Conditions:
- A. Contractor shall review all Drawings and, when applicable, visit the job site prior to bid to verify wall and floor types to be penetrated. Fire ratings of walls are indicated on the Architectural Drawings.
- B. Contractor shall coordinate with all Trades for any penetrating items that have to be routed differently than shown on the plans. Contractor shall provide fire stopping for all rerouted items whether different UL approved systems or additional materials are required.

1.6 Submittals:
- A. Shop Drawings:
  1. Provide detailed drawings with installation instruction, indicating any required accessories, per assembly penetration.
  2. Each system must indicate the UL approval for the particular penetration.
  3. Provide detailed specification of construction and fabrication installation instructions.
  4. Provide system performance and technical data.

5. For each non-standard application, provide a manufacturer's qualified engineering judgment and drawing.
6. All UL approved systems shall be selected based on their rating. All systems shall provide the same ratings as the rating of the penetration, as shown on the plans.

B. Warranty:
1. Submit copies of written manufacturer's warranty agreeing to repair or replace work due to a lack of general durability or the appearance of deterioration in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The warranty period shall be one year from date of substantial completion.

1.7 Storage:
A. Store and protect materials in a manner and environment per the manufacturer's requirements.

PART 2 - PRODUCTS

2.1 Through Penetration Fire Stopping:
A. Acceptable manufacturers and products shall be those listed in the UL fire resistance directory for the UL system involved.
B. All systems and devices shall be asbestos free.
C. All fire stopping products shall be from a single manufacturer.

PART 3 - EXECUTION

3.1 General:
A. Verify on site conditions and measurements affecting the work of this Section. Verify that detrimental conditions are corrected before proceeding with installation.
B. Prepare surfaces in accordance with the fire stopping manufacturer's requirements.

3.2 Installation:
A. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instruction.
B. Provide non-intumescent fire stopping in annular space around fire dampers before installation of damper's retaining angles in accordance with fire damper manufacturer's requirements. Provide non-intumescent fire stopping around the parameter of retaining angles in accordance with fire damper manufacturer's AHJ's requirements.

3.3 Adjusting and Cleaning:
A. Clean any spills of liquid components.
B. Dispose of system materials, debris and components leaving the project area undamaged and in a clean condition.
C. Cut and trim excess materials neatly, flush with adjacent surfaces.

3.4 Field Observation and Quality Control:

A. Contractor is responsible to inspect all penetrations to verify the proper installation of the fire stopping system.

B. Contractor shall leave work accessible for inspection of the Authority Having Jurisdiction.

END OF SECTION 23 05 60

SECTION 23 05 91 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 Related Documents:
- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all devices, labor, materials, equipment, administration and services required for all testing, adjusting, and balancing indicated on Drawings and specified herein.

1.3 References:
- A. Associated Air Balance Council (AABC).
- B. National Environmental Balancing Bureau (NEBB).
- C. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
- D. Sheet Metal and Air Conditioning Contractor's Association (SMACNA).

1.4 Contractor's Qualifications:
- A. The T&B Contractor shall be certified by either AABC or NEBB.
- B. The T&B Contractor shall be an independent contractor from the Mechanical Contractor.
- C. The qualifications of this Contractor shall be as follows:
  1. Contractor must be a licensed Contractor, specific to this section's Trade, in the project's State.
  2. The Contractor shall have been in the testing and balancing contracting business for the last five consecutive years, under their current corporation name with more than 75% of the same corporate officers.
  3. The Contractor shall have completed at least two projects of comparable size and scope within the past two years without receipt of a Notice to Cure.
  4. If Contractor has received a Notice to Cure on any project, that Contractor is excluded from performing work on this project.
  5. The Contractor's main construction and service office shall be located within 60 driving miles distance of the project site unless approval, 10 days prior to project bid date, has been issued in writing by the Owner, Architect and Engineer.
  6. The Contractor shall provide substantiating proof of these requirements 10 days prior to project bid date. If substantiating proof is not submitted and approved, the Contractor will not be allowed to bid or work the project.
  7. The General Contractor shall not purchase this Contractor's equipment, materials, etc. All materials, equipment, labor, etc. required to perform the Work herein shall be at the cost of this Contractor.

1.5 Submittals:
- A. Qualifications: Within 30 days of Contractor's Notice to Proceed, submit qualifications of agency and personnel, including a sample copy of the AABC National Performance

Guaranty. If not submitted within the timeframe specified, the Engineer has the right to choose a T&B Contractor at the Contractor's expense.

B. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit T&B strategies and step-by-step procedures as specified in Section 3.2, "Preparation."
C. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, T&B agency shall provide system readiness checklists as specified in Section 3.2, "Preparation," to be used and filled out by the installing contractors verifying that systems are ready for T&B.
D. Examination Report: Provide a summary report of the examination review required in Section 3.1, if issues are discovered that may preclude the proper testing and balancing of the systems.
E. Certified T&B report: Within 10 working days of completion of balancing work, submit AABC or NEBB certified TAB report.

1.6 Quality Assurance:

A. Agency Qualifications: Engage an independent T&B agency certified by AABC or NEBB.
    1. Supervisor: Employee of the T&B agency who is certified by AABC or NEBB as a TBE.
    2. Technician: Employee of the T&B agency who is certified by AABC or NEBB as a TBT.
B. TBE shall perform the following:
    1. Review field data reports to validate accuracy of data and to prepare certified T&B reports.
    2. Certify that the T&B team complied with the approved T&B plan and the procedures referenced in this Specification.
    3. Certify the T&B report.
C. TAB Report Forms: Use approved forms submitted with the Strategies and Procedures Plan.
D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in the AABC National Standards for Total System Balance.

1.7 Contractor Responsibilities:

A. Provide T&B agency one complete set of contract documents, change orders, and approved submittals in digital and hard copy formats.
B. Controls contractor shall provide required BAS hardware, software, personnel and assistance to T&B agency as required to balance the systems. Controls contractor shall also provide trending report to demonstrate that systems are complete.
C. Coordinate meetings and assistance from suppliers and contractors as required by T&B agency.
D. Provide additional valves, dampers, sheaves and belts as required by T&B agency.
E. Flag all manual volume dampers with fluorescent or other high-visibility tape.
F. Provide access to all dampers, valves, test ports, nameplates and other appurtenances as required by T&B agency.
G. Replace or repair insulation as required by T&B agency.
H. Have the HVAC systems at complete operational readiness for T&B to begin. As a minimum, verify the following:
    1. Airside:
        a) All ductwork is complete with all terminals installed.

b) All volume, smoke and fire dampers are open and functional.
c) Clean filters are installed.
d) All fans are operating, free of vibration, and rotating in correct direction.
e) VFD start-up is complete and all safeties are verified.
f) System readiness checklists are completed and returned to T&B agency.

2. Hydronics:
a) Piping is complete with all terminals installed.
b) Water treatment is complete.
c) Systems are flushed, filled and air purged.
d) Strainers are pulled and cleaned.
e) Control valves are functioning per the sequence of operation.
f) All shutoff and balance valves have been verified to be 100% open.
g) Pumps are started, and proper rotation is verified.
h) Pump gauge connections are installed directly at the pump inlet and outlet flange or in discharge and suction pipe prior to any valves or strainers.
i) VFD start-up is complete and all safeties have been verified.
j) System readiness checklists are completed and returned to T&B agency.

I. Promptly correct deficiencies identified during T&B.
J. Maintain a construction schedule that allows the T&B agency to complete work prior to occupancy.

PART 2 – PRODUCTS (Not Applicable)

PART 3 — EXECUTION

3.1 General:
A. All systems are to be tested in occupied and unoccupied, modes and set points, minimum and maximum positions and set points, CO_2 control, special control scenarios found in the Sequence of Control and all values be recorded on the Test and Balance report.
B. Air systems are to be balanced with the Outside Air damper(s) closed and the return duct and take offs damper positions set. Once set, the outside air damper is to be opened to its set point position(s) and the return grilles throughout the space be retested and values recorded to match the intent of the Contract Documents.

3.2 Examination:
A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper T&B of systems and equipment.
B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Note the locations of devices that are not accessible for testing and balancing.
C. Examine the approved submittals for HVAC systems and equipment.
D. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas.
E. Examine equipment performance data including fan and pump curves.

F. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, clean permanent filters are installed, and controls are ready for operation.
G. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected, configured by the control's contractor and functioning.
H. Examine strainers to verify that mechanical contractor has replaced startup screens with permanent screens and that all strainers have been cleaned.
I. Examine two-way valves for proper installation and function.
J. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
L. Examine air vents to verify that mechanical contractor has removed all air from all hydronic systems.

3.3 Preparation:
A. Prepare a T&B plan that includes:
1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.
B. Prepare system-readiness checklists, as described in the AABC National Standards for Total System Balance, for use by contractors in verifying system readiness for T&B. These shall include, at a minimum:
1. Airside:
a) All ductwork is complete with all terminals installed.
b) All volume, smoke and fire dampers are open and functional.
c) Clean filters are installed.
d) All fans are operating, free of vibration, and rotating in correct direction.
e) VFD start-up is complete and all safeties are verified.
f) Automatic temperature-control systems are operational.
g) Ceilings are installed.
h) Windows and doors are installed.
i) Suitable access to balancing devices and equipment is provided.
2. Hydronics:
a) Piping is complete with all terminals installed.
b) Water treatment is complete.
c) Systems are flushed, filled and air purged.
d) Strainers are pulled and cleaned.
e) Control valves are functioning per the sequence of operation.
f) All shutoff and balance valves have been verified to be 100% open.
g) Pumps are started and proper rotation is verified.
h) Pump gauge connections are installed directly at the pump inlet and outlet flange or in discharge and suction pipe prior to any valves or strainers.
i) VFD start-up is complete and all safeties are verified.
j) Suitable access to balancing devices and equipment is provided.

3.4 General Procedures for Testing and Balancing:

A. Perform testing and balancing on each system according to the procedures contained in the latest version of the AABC National Standards for Total System Balance and in this Section.
B. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
C. Air flow balancing shall be done at the individual device, i.e. VAV Box, inlet and run-out manual dampers. Adjusting mass air flow by the Return, Outside or Supply control dampers, i.e. VAV box damper, through a control system setpoint will not be allowed.
D. Hydronic flow balancing shall be done at the individual device balancing valves. Adjusting flow by a control valve through a control system setpoint will not be allowed.
E. Take and report testing and balancing measurements in inch-pound (IP) units.
F. Test and Balance all air and water systems at occupied, unoccupied, minimum and maximum scheduled flow rates, temperatures, etc.

3.5 General Procedures for Balancing Air Systems:

A. Prepare test reports for both fans and outlets. Obtain approved submittals and any manufacturer-recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
B. Prepare a single-line schematic diagram of systems for the purpose of identifying HVAC components.
C. For variable-air-volume systems, develop a plan to simulate diversity.
D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
F. Verify that motor starters are equipped with properly sized thermal protection.
G. Check condensate drains for proper connections and functioning.
H. Check for proper sealing of air-handling-unit components.

3.6 Procedures for Constant-Volume Air Systems:

A. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.
    1. Measure total airflow as follows:
        a) Set outside air, return air and relief air dampers for proper position that simulates minimum outdoor air conditions.
        b) Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
        c) Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
        d) If a reliable Pitot-tube traverse is not possible, measure airflow at terminals and calculate the total airflow.
    2. Measure fan static pressures as follows:
        a) Measure static pressure directly at the fan outlet or through the flexible connection.
        b) Measure static pressure directly at the fan inlet or through the flexible connector.

c) Measure static pressure across each component that makes up the air handling system, including final filters, duct heaters, etc.
d) Report any artificial loading of filters at the time static pressures are measured.

3. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, sub-main ducts, and major branch ducts to indicated airflows.
1. Measure airflow of sub-main and branch ducts.
2. Adjust sub-main and branch duct volume dampers for specified airflow.
3. Re-measure each sub-main and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.
1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure airflow at all inlets and outlets.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after all have been adjusted.

D. Verify final system conditions.
1. Re-measure and confirm minimum outdoor air, return and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust, if necessary. Measure and record all operating data.

3.7 Procedures for Variable-Air-Volume Systems:

A. Adjust the variable-air-volume systems as follows:
1. Verify that the system static pressure sensor is located 2/3 of the distance down the duct from the fan discharge.
2. Verify that the system is under static pressure control.
3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control setpoint so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:
a) Adjust controls so that terminal is calling for maximum airflow.
b) Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.
c) When maximum airflow is correct, balance the air outlets downstream from terminal units.
d) Adjust controls so that terminal is calling for minimum airflow.
e) Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.

5. After all terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.
   a) Set outside air, return air and relief air dampers for proper position that simulates minimum outdoor air conditions.
   b) Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow so that connected total matches fan selection and simulates actual load in the building.
   c) Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
   d) Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
   e) If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
6. Measure fan static pressures as follows:
   a) Measure static pressure directly at the fan outlet or through the flexible connection.
   b) Measure static pressure directly at the fan inlet or through the flexible connection.
   c) Measure static pressure across each component that makes up the air-handling system.
   d) Report any artificial loading of filters at the time static pressures are measured.
7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
   a) Balance the return-air ducts and inlets the same as described for constant-volume air systems.
   b) Verify all terminal units are meeting design airflow under system maximum flow.
8. Re-measure the inlet static pressure at the most critical terminal unit and adjust the system static pressure setpoint to the most energy-efficient setpoint to maintain the optimum system static pressure. Record setpoint and give to controls contractor.
9. Verify final system conditions as follows:
   a) Re-measure and confirm minimum outdoor air, return and relief airflows are within design. Readjust to design if necessary.
   b) Re-measure and confirm total airflow is within design.
   c) Re-measure all final fan operating data, rpms, volts, amps, static profile.
   d) Mark all final settings.
   e) Test system in economizer mode. Verify proper operation and adjust, if necessary. Measure and record all operating data.
   f) Verify tracking between supply and return fans.
10. Record final fan-performance data.

3.8 General Procedures for Hydronic Systems:

A. Prepare test reports for pumps, coils and heat exchangers. Obtain approved submittals and any manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger gpms with pump design flow rate.

B. Verify that hydronic systems are ready for testing and balancing:
   1. Check liquid level in expansion tank.

2. Check that makeup water has adequate pressure to highest vent.
3. Check that control valves are in their proper positions.
4. Check that air has been purged from the system.
5. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
6. Verify that motor starters are equipped with properly sized thermal protection.

3.9 Procedures for Constant-Flow Hydronic Systems:

A. Adjust pumps to deliver total design gpm.
   1. Measure total water flow.
      a) Position valves for full flow through coils.
      b) Measure flow by main flow meter, if installed.
      c) If main flow meter is not installed determine flow by pump total dynamic head (TDH) or exchanger pressure drop.
   2. Measure pump TDH as follows:
      a) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
      b) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
      c) Convert pressure to head and correct for differences in gauge heights.
      d) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
      e) With all valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
   3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.

B. Adjust flow measuring devices installed in mains and branches to design water flows.
   1. Measure flow in main and branch pipes.
   2. Adjust main and branch balance valves for design flow.
   3. Re-measure each main and branch after all have been adjusted.

C. Adjust flow measuring devices installed at terminals for each space to design water flows.
   1. Measure flow at all terminals.
   2. Adjust each terminal to design flow.
   3. Re-measure each terminal after all have been adjusted.
   4. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
   5. Perform temperature tests after all flows have been balanced.

D. For systems with pressure-independent valves at the terminals:
   1. Measure differential pressure and verify that it is within manufacturer's specified range.
   2. Perform temperature tests after all flows have been verified.

E. For systems without pressure-independent valves or flow measuring devices at the terminals:
   1. Measure and balance coils by either coil pressure drop or temperature method.
   2. If balanced by coil pressure drop, perform temperature tests after all flows have been verified.

F. Verify final system conditions as follows:
   1. Re-measure and confirm that total water flow is within design.

2. Re-measure all final pump operating data, TDH, volts, amps, static profile.
3. Mark all final settings.

G. Verify that all memory stops have been set.

3.10 Procedures for Variable-Flow Hydronic Systems:

A. Adjust the variable-flow hydronic system as follows:
   1. Verify that the differential pressure (DP) sensor is located per the contract documents.
   2. Determine if there is diversity in the system.

B. For systems with no diversity:
   1. Follow procedures outlined in section 3.8 for constant-flow hydronic systems.
   2. Prior to verifying final system conditions, determine the system DP setpoint.
   3. The pump discharge valve shall be used to set total system flow with VFD at 60 Hz and the VFD shall control system with respect to the DP setpoint.
   4. Mark all final settings and verify that all memory stops have been set.

C. For systems with diversity:
   1. Determine diversity factor.
   2. Simulate system diversity by closing required number of control valves, as approved by the design engineer.
   3. Follow procedures outlined in section 3.8 for constant flow hydronic systems.
   4. Open control valves that were shut. Close a sufficient number of control valves that were previously open to maintain diversity, and balance the terminals that were just opened.
   5. Prior to verifying final system conditions, determine the system DP setpoint.
   6. The pump discharge valve shall be used to set total system flow with VFD at 60 Hz and the VFD shall control system with respect to the DP setpoint.
   7. Mark all final settings and verify that all memory stops have been set.

3.11 General Procedures for Electric Heat Systems:

A. Prepare test reports for electric duct, VAV and / or unit heaters. Obtain approved submittals and any manufacturer-recommended testing procedures.

B. Verify that electric heat systems are ready for testing and balancing:
   1. Check air flow proving switch.
   2. Check heater kW, voltage and amp draw.
   3. Check that control dampers are in their proper positions for heating CFM.
   4. Check safety limits and controls.
   5. Check entering and leaving temperatures.
   6. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
   7. Verify that motor starters are equipped with properly sized thermal protection.

3.12 Tolerances:

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
   1. Supply, Return, and Exhaust Fans: Plus or minus 10 percent.
   2. Air Outlets and Inlets: Plus or minus 10 percent.
   3. Minimum Outside Air: Zero to plus 10 percent.
   4. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.
   5. Heating-Water Flow Rate: Plus or minus 10 percent.
   6. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.13 Final Test & Balance Report:

A. The report shall be a complete record of the HVAC system performance, including conditions of operation, items outstanding, and any deviations found during the T&B process. The final report also provides a reference of actual operating conditions for the owner and/or operations personnel. All measurements and test results that appear in the reports must be made on site and dated by the AABC technicians or test and balance engineers.

B. The report must be organized by systems and shall include the following information as a minimum:

1. Title Page:
   a) Company Name
   b) Company Address
   c) Company Telephone Number
   d) Project Identification Number
   e) Location
   f) Project Architect
   g) Project Engineer
   h) Project Contractor
   i) Project Number
   j) Date of Report
   k) AABC Certification Statement
   l) Name, Signature, and Certification Number of AABC TBE
2. Table of Contents:
3. AABC National Performance Guaranty
4. Report Summary
   a) The summary shall include a list of items that do not meet design tolerances, with information that may be considered in resolving deficiencies.
5. Instrument List
   a) Type
   b) Manufacturer
   c) Model
   d) Serial Number
   e) Calibration Date
6. T&B Data
   a) Provide test data for specific systems and equipment as required by the most recent edition of the AABC National Standards.

C. One copy of the final test and balance report shall be sent directly to the engineer of record. Provide five (5) additional copies to the contractor.

END OF SECTION 23 05 91

SECTION 23 07 10 - DUCTWORK INSULATION

PART 1 - GENERAL

1.1 Related Documents:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Summary:

A. Perform all Work required to provide and install ductwork insulation and jackets indicated by the Contract Documents with supplementary items necessary for proper installation.

1.3 Reference Standards:

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

D. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

1. ASTM C168 - Terminology Relating to Thermal Insulation Materials.
2. ASTM C518 - Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
3. ASTM C553 - Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
4. ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.
5. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
6. ASTM C1104 - Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
7. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
8. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
9. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
10. ASTM E84 - Surface Burning Characteristics of Building Materials.
11. ASTM E96 - Water Vapor Transmission of Materials.
12. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
13. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
14. NFPA 255 - Surface Burning Characteristics of Building Materials.
15. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
16. UL 181- Standard for Factory-Made Air Ducts and Air Connectors.
17. UL 723 - Surface Burning Characteristics of Building Materials.

18. ASTM E2336 - Standard for Grease Ducts.
19. ASTM D5590 - Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay

1.4 Quality Assurance:

A. All ductwork requiring insulation shall be insulated as specified herein and as required for a complete system. In each case, the insulation shall be equivalent to that specified and materials applied and finished as described in these Specifications.

B. All insulation, jacket, adhesives, mastics, sealers, etc., utilized in the fabrication of these systems shall meet NFPA for fire resistant ratings (maximum of 25 flame spread and 50 smoke developed ratings) and shall be approved by the insulation manufacturer for guaranteed performances when incorporated into their insulation system, unless a specific product is specified for a specific application and is stated as an exception to this requirement. Certificates to this effect shall be submitted along with Contractor's submittal data for this Section of the Specifications. No material may be used that, when tested by the ASTM E84-89 test method, is found to melt, drip or delaminate to such a degree that the continuity of the flame front is destroyed, thereby resulting in an artificially low flame spread rating.

C. Application Contractor Qualifications: Contractor performing the Work of this Section must have minimum five (5) years experience specializing in the trade. Insulation Contractor must be separate from the Mechanical Contractor.

D. All insulation shall be applied by mechanics skilled in this particular Work and regularly engaged in such occupation.

E. All insulation shall be applied in strict accordance with these Specifications and with factory printed recommendations on items not herein mentioned. Unsightly, inadequate, or sloppy Work will not be acceptable.

1.5 Submittals:

A. Product Data:
   1. Provide product description, list of materials, "k" value, "R" value, mean temperature range, and thickness for each service and location.

B. Operation and Maintenance Data:
   1. Samples: When requested, submit three (3) samples of any representative size illustrating each insulation type.
   2. Manufacturer's Installation Instructions: Indicate procedures that ensure acceptable standards will be achieved. Submit certificates to this effect.

1.6 Delivery, Storage and Handling:

A. Deliver, store, protect, and handle products to the Project Site under provisions of Division 01.

B. Deliver materials to Site in original factory packaging, labeled with manufacturer's identification including product thermal ratings and thickness.

C. Store insulation in original wrapping and protect from weather and construction traffic. Protect insulation against dirt, water, chemical, and mechanical damage.

Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics and insulation cements.

PART 2 - PRODUCTS

2.1 General:

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 Manufacturers:

A. CertainTeed Corporation.
B. Johns Manville Corporation.
C. Knauf Corporation.
D. Owens-Corning.
E. Armacell North America.
F. Unifrax 1 LLC. (FyreWrap)
G. 3M Fire Protection Products (Fire Barrier Duct Wrap 615+)

2.3 Insulation Materials:

A. Type D1: Flexible glass fiber; ASTM C553 and ASTM C1290; commercial grade; 'k' value of 0.25 at 75°F; 1.5 lb/cu ft minimum density; 0.002 inch foil scrim kraft facing for air ducts.
B. Type D2: Rigid glass fiber; ASTM C612, Class 1; 'k' value of 0.23 at 75°F; 3.0 lb/cu ft minimum density; 0.002 inch foil scrim kraft facing for air ducts.
C. Type D3: Ductliner (ONLY to be used when indicated on the Drawings), Closed Cell Flexible Elastomeric Insulation equal to AP Armaflex; 1 inch thick material that has a service temperature range from –297°F to 220°F. This outdoor duct insulation meets ASTM C 534 and shall have minimum 'k' value of 0.25 Btu-in. / hr-ft2- °F at minimum density measurement at 75°F. The insulation shall be resistant to mold growth, ASTM G 21/C 1338 resistant to fungi, and resistant to bacteria growth per ASTM G 22.
D. Type D4: Fire Rated Grease Duct Insulation (High Temperature Flexible Blanket); 1-1/2-inch thick refractory grade fibrous fire barrier material with minimum service temperature design of 2,000°F; aluminum foil laminated on both sides; with a minimum 'k' value of 0.25 and a minimum density of 6 lbs/cu ft; containing no asbestos. Listed by a nationally recognized testing laboratory (NRTL) UL to meet ASTM E 2336, ASTM E119, and with flame spread/smoke minimum rating of 25 / 50 when tested as per ASTM E84/UL 723.
E. Type D5: Outdoor Duct Insulation (Closed Cell Flexible Elastomeric Insulation); 2 inch thick material that has a service temperature range from –297°F to 220°F. This outdoor duct insulation meets ASTM C 534 and shall have minimum 'k' value of 0.25 Btu-in. / hr-ft2- °F at minimum density measurement at 75°F. The insulation and outside surface must be protected with a white Thermo Plastic Rubber Membrane formulated to:
    1. Be resistant to UV, and ozone, acid rain, and physical elements produced from outdoor weather per ASTM E 96 Procedure A.
    2. Have a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with the test method for surface burning in ASTM E 84.
    3. Show no evidence of continued erosion, delaminating, cracking, flaking, or peeling when tested in accordance with the test method for erosion resistance in

UL181. Be resistant to mold growth resistance, ASTM G 21/C 1338 resistant to fungi, and resistant to bacteria growth per ASTM G 22.

2.4 Insulation Accessories:

A. Adhesives: Waterproof vapor barrier type, meeting requirements of ASTM C916; Childers CP-82 or Foster 85-20.
B. Weather Barrier: Breather Mastic: Childers CP-10/CP-11 or Foster 46-50 White.
C. Vapor Barrier Coating: Permeance - ASTM E 96, Procedure B, 0.08 perm or less at 45-mil dry film thickness, tested at 100F and 50%RH; Foster 30-65 or Childers CP-34.
    1. When higher humidity levels may be of concern, only specify the following fungus/mold resistant coating: Foster 30-80 AF (anti-fungal). Coating must meet ASTM D 5590 with 0 growth rating.
D. Reinforcing Mesh: 10x10 or 9x8 glass mesh; Foster Mast a Fab or Childers #10.
E. Jacket: Pre-sized glass cloth, minimum 7.8 oz/sq yd.
F. Type D4 Insulation Adhesive: Fire resistive to ASTM E84, Childers CP-82 or Foster 85-20.
G. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad.
H. Joint Tape: Glass fiber cloth, open mesh.
I. Tie Wire and Wire Mesh: Annealed steel, 16 gage.
J. Stainless Steel Banding: 3/4-inch wide, minimum 22 gage, 304 stainless.
K. Armaflex 520, 520 BLV, or Foster 85-75 contact adhesive.
L. Armatuff 25 white seal seam tape.

PART 3 - EXECUTION

3.1 Preparation:

A. Verify that ductwork has been tested before applying insulation materials.
B. Verify that surfaces are clean, foreign material removed, and dry.
C. Maintain required ambient temperature during and after installation for a minimum period of 24 hours.

3.2 Installation:

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
B. All installation shall be in accordance with manufacturer's published recommendations.
C. Extend duct insulation without interruption through walls, floors, and similar penetrations, except where otherwise indicated.
D. Provide external insulation on all round ductwork connectors to ceiling diffusers and on top of diffusers as indicated in the Ductwork Insulation Application and Thickness Schedule and the Drawings. Secure insulation to the top of ceiling diffusers with adhesive that meets NFPA 90A and 90B 25/50 requirements, and vapor barrier or tape to match jacket. Do not insulate top of ceiling diffuser if it is used in ceiling return air plenum or in an open space with no ceiling.
E. Flexible and Rigid fiberglass insulation (Types D1 and D2) application for exterior of duct:

1. Secure insulation jacket joints with vapor barrier adhesive or tape to match jacket.
2. Install without sag on underside of ductwork. Use 4-inch wide strips of adhesive on 8-inch centers and mechanical fasteners where necessary to prevent sagging. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
3. Insulate standing seams and stiffeners that protrude through the insulation with 1-1/2 inch thick, unfaced, flexible blanket insulation. Cover with reinforcing mesh and coat with vapor barrier finish coating.
4. On circumferential joints, the 2-inch flange on the facing shall be secured with 9/16 inch outward clinch steel staples on 2-inch centers, and taped with minimum 3-inch wide strip of glass fabric and finish coating.
5. Vapor seal all seams, joints, pin penetrations and other breaks with vapor barrier coating reinforced with reinforcing mesh.

F. Duct Liner (Type D3):
1. Follow the manufacturer's installation requirements including the duct preparation for adhesive.
2. Secure insulation with 100 percent coverage of duct liner manufacturer's adhesive, pins and clips not more than 18 inches on center.
3. Secure bottom of duct insulation using alternate single and double clips. The first pin will secure the insulation and the second clip will be used to secure the cladding. Isolate the exterior clip from the cladding by using two 1/8 inch closed cell neoprene (Armaflex) washers on either side of the cladding. Predrill holes in cladding and avoid contact with pin during installation.
4. For joints and overlaps, fold cladding to form a double thickness hem 2 inches minimum. Seal with a non-shrink, non-hardening sealing compound.

G. Insulation (Type D4) application for exterior of grease ducts:
1. External duct wrap system requires two (2) 1.5-inch layers of lightweight, flexible wrap overlapped to provide an effective fire barrier. The barrier is installed in 24-inch or 48-inch wide sections. Insulation pins are welded in certain locations to maintain the fire barrier material up against the duct.
2. Grease duct doors to be installed so the door can be removed and re installed and meet code requirements.
3. Install duct wrap as tested per manufacturer's instructions to assure the duct wrap is mechanically attached per the manufacturer's spacing of bands or weld pins.
4. Vertical and horizontal members of the support hanger system shall be wrapped with one layer of the insulation. Vertical and horizontal portions shall be wrapped independent of one another. The horizontal hanger shall be removed from the vertical support rods and wrapped and then immediately replaced so that an adjacent horizontal support can be removed, wrapped, and reinstalled. The end of the threaded vertical rod shall extend 6-inch past the horizontal member at the beginning of the installation.
5. Penetrations: Where ducts penetrate fire rated walls, floors and roofs, the duct wrap shall be used in conjunction with a firestop system that is listed by a nationally recognized laboratory and rated for penetration of a rated wall or floor by the fire rated grease duct system used.

H. Insulation (Type D5) application for outdoor ducts:

1. Horizontal ductwork located outdoors shall be sloped at a minimum 2-degree angle to prevent the accumulation of water on top of the finished insulated duct. Support members that connect directly to the ductwork are to be insulated with this same material. Keep compression or sharp creases of outdoor insulation to a minimum by distributing the weight of the duct resting on horizontal duct support members.
2. Follow the insulation manufacturer's installation instructions and procedures to assure the ductwork is properly insulated and that the insulation will meet the manufacturer's warranty requirements.

I. All ductwork, accessories, and all plenums including metal and masonry, gypsum construction, etc., shall be insulated as indicated on the Drawings, as specified herein and as required for a complete system. In each case, the insulation shall be equal to that specified and materials applied and finished as described in these Specifications.

J. Flexible ductwork connections to equipment shall be insulated.

K. Where vapor barriers are required, the vapor barrier shall be on the outside. Extreme care shall be taken that the vapor barrier is unbroken. Joints, etc., shall all be sealed. Where insulation with a vapor barrier terminates, it shall be sealed off with the vapor barrier being continuous to the surface being insulated. Ends shall not be left raw.

L. Extreme care shall be taken in insulating high and medium pressure ductwork including all ductwork between the fan discharge and all mixing boxes to ensure the duct is not pierced with sheet metal screws or other fasteners. All high and medium pressure ducts in these Specifications are classified as high velocity ductwork.

M. Where canvas finish is specified use lagging adhesive/coating to prevent mildew in securing canvas. Do not use wheat paste. Use only anti-fungal lagging adhesive that adheres to ASTM D 5590 with 0 growth rating. (Foster 30-60, Childers CP-137AF). In addition, cover all exterior canvas-covered insulation with a fire retardant weather barrier mastic.

N. Flexible round ducts shall be factory insulated.

3.3 Inspection:

A. Visually inspect the completed insulation installation per manufacturers recommended materials, procedures and repair or replace any improperly sealed joints.

B. Where there is evidence of vapor barrier failure or "wet" insulation after installation, the damaged insulation shall be removed, duct surface shall be cleaned and dried and new insulation shall be installed.

3.4 Ductwork Insulation Application and Thickness Schedule:

Ductwork System	**Application**	**Insulation Type**	**Insulation Thickness**
Supply Air (Hot, Cold, Combination)	Outside of Mechanical Rooms	D1	2"
	Inside of Mechanical Rooms	D2	1-1/2"
Return Air, Relief Air, and Exhaust Air	All	D1	2"
Outside Air	Treated and Untreated	D1	2"
Supply, Return and Outside	Concealed Outside	D1	3"

Ductwork System	Application	Insulation Type	Insulation Thickness
Air	Building Insulation Envelope (i.e. Attic)		
Kitchen Grease Hood Exhaust Air	All	D4	3"
Duct mounted coils	Inside of Mechanical Rooms	D2	2"
Terminal Unit Heating Coils	All	D1	2"
Air Diffusers, Grilles, Registers	Top of Device	D1	2"
Supply Air Duct	Outdoor Environment	D5	2"
Return, Exhaust Air Duct	Outdoor Environment	D5	1-1/2"

END OF SECTION 23 07 10

SECTION 23 07 38 - INSULATION FOR REFRIGERANT PIPING

PART 1 - GENERAL

1.1 Related Documents:
- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all materials, labor, administration, equipment and services required for complete installation of all insulation for refrigerant piping indicated on Drawings and specified in this section.
- B. Work of this section shall include providing the thermal insulation for mechanical systems and shall include the following principal items:
  1. Refrigerant vapor line on all systems.
  2. Liquid lines where required by the manufacturer.
- C. This work shall be performed by an insulation contractor whose primary business is the installation of insulation systems, who has been in this business for a minimum of five years and has successfully completed two projects of similar size and scope.

1.3 Submittals:
- A. Submit product literature for each insulation type and finish indicating the equipment served.
- B. Provide submittals on method of installation for each type of insulation utilized.

PART 2 - PRODUCTS

2.1 Thermal Insulation:
- A. All insulating systems shall be tested on a composite basis in accordance with NFPA and UL 723 and shall have a maximum flame spread rating of 25 and a maximum smoke developed rating of 50 under ASTM E-84.

2.2 Insulation Types:
- A. Closed cell, flexible elastomeric thermal insulation, black in color, supplied in unslit tubing. Equal to Armaflex AP 2000.
- B. Closed cell, elastomeric thermal insulation tape. Tape shall be manufactured with reinforced fibers equal to Armaflex insulation tape. Tape shall only be used for insulation of small devices.

2.3 Adhesives:
- A. Equal to Armstrong 520 adhesive, air drying contact adhesive specifically designed for joining seams and ends of Armaflex AP-2000.

2.4 Finishes:
- A. A white, elastomeric, UL classified outdoor grade, vinyl mastic for finished outdoor insulation. Water based latex enamel. Equal to WB Armaflex finish.

PART 3 - EXECUTION

3.1 Workmanship:

A. All materials shall be applied by craftsmen skilled in this trade. Unsightly work shall be cause for rejection.
B. All joints shall be mitered. No exceptions.
C. Materials shall be applied only after systems have been tested and all surfaces are clean and dry.
D. Cellular glass block supports or other suitable non-compressible insulation material equal in thickness to the insulation and four times the pipe diameter in length shall be installed at hangers to eliminate through-metal conductance. Provide 18 gauge, 180°, galvanized sheet metal saddles same length as block supports.

3.2 Application:

A. Insulation shall be butted together and adhered in place with joint adhesive. All joints and seams shall be sealed with contact adhesive. Insulation shall be butted firmly to equipment and adhesive applied. Insulation shall be slipped on without slitting where possible.
B. Paint all exposed insulation with a minimum of two coats of Armaflex white paint.
C. Provide sheet metal saddles for all insulated refrigerant piping at pipe supports.

3.3 Insulation Thickness:

A. Provide 3/4" thick insulation materials for all refrigerant vapor line, liquid line piping and hot gas piping.

END OF SECTION 23 07 38

SECTION 23 07 40 - INSULATION FOR CONDENSATE DRAINS

PART 1 - GENERAL

1.1 Related Documents:
- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description Of Work:
- A. Provide all materials, labor, administration, equipment and services required for complete installation of all insulation for condensate drains indicated on Drawings and specified in this section.

1.3 Contractor's Qualifications:
- A. This work shall be performed by a skilled insulation contractor whose primary business is the installation of insulation systems and who has been in this business for a minimum of 5 years and has successfully completed 2 projects of similar size and scope.

1.4 Submittals:
- A. Submit product literature for each insulation type, finish type and equipment served. Provide submittals on method of installation for each type of insulation used.

PART 2 - PRODUCTS

2.1 Thermal Insulation:
- A. All insulating systems shall be tested on a composite basis in accordance with NFPA and UL 723 and shall have a maximum flame spread rating of 25 and a maximum smoke developed rating of 50 under ASTM E-84.

2.2 Insulation Types:
- A. Closed cell, flexible elastomeric thermal insulation, black in color, supplied in unslit tubing. Equal to Armaflex AP 2000.
- B. Closed cell, elastomeric thermal insulation tape. Commonly supplied in 2" x 1/8" thick. Equal to Armaflex insulation tape.

2.3 Adhesives:
- A. Equal to Armstrong 520 adhesive, air drying contact adhesive specifically designed for joining seams and ends of Armaflex AP-2000.

2.4 Finishes:
- A. A white, elastomeric, UL classified outdoor grade, vinyl mastic for finished outdoor insulation. Water based latex enamel. Equal to WB Armaflex finish.

PART 3 - EXECUTION

3.1 Workmanship:

A. All materials shall be applied by craftsmen skilled in this trade. Unsightly work shall be cause for rejection.
B. All joints shall be mitered. No exceptions.
C. Materials shall be applied only after systems have been tested and all surfaces are clean and dry.
D. Cellular glass block supports or other suitable non-compressible insulation material equal in thickness to the insulation and four times the pipe diameter in length shall be installed at hangers to eliminate through-metal conductance. Provide 18 gauge, 180°, galvanized sheet metal saddles same length as block supports.

3.2 Application:

A. Insulation shall be butted together and adhered in place with joint adhesive. All joints and seams shall be sealed with contact adhesive. Insulation shall be butted firmly to equipment and adhesive applied. Insulation shall be slipped on without slitting where possible.
B. Paint all exposed insulation with a minimum of two coats of Armaflex white paint.
C. Provide sheet metal saddles for all insulated condensate piping at pipe supports.

3.3 Insulation Thickness:

A. Provide 1/2" thick insulation materials for all condensate piping.

END OF SECTION 23 07 40

SECTION 23 11 23 - FUEL GAS PIPING

PART 1 - GENERAL

1.1 Related Documents:
- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all administration, labor, materials, equipment and services required for complete installation of all natural gas piping indicated on Drawings and specified herein.
- B. Gas service, specialties and piping to all gas appliances.

1.3 References:
- A. All installation and fabrication shall be in accordance with current applicable State and Local Gas Codes, adopted International Building, International Fuel Gas Code and governing code for this project.

1.4 Submittals:
- A. Submit manufacturer's catalog data for all of the following materials and equipment:
  1. Submit catalog data and shop drawings for all materials listed under this section.
  2. All materials, devices and appliances shall be new, without defect, first line quality unless specified otherwise.
  3. The supplier, by submitting, certifies the materials and equipment to be satisfactory for the application involved.
  4. Materials, valves, hangers or equipment installed without review or after rejection shall be replaced by this contractor with acceptable items at the Engineer's direction.
  5. Contractor agrees that if deviations, discrepancies or conflicts between submittals and specifications are discovered either prior to or after submittals are processed by the Engineer, the Contract Documents shall control and be followed.
  6. Contractor's certification and State gas cards. Contractor shall indicate project's Master Gas Fitter and Journeyman Fitter. Project shall be supervised, on site, by the Master Gas Fitter.
  7. Pressure test shall be signed by the project's Master Gas Fitter.

PART 2 - PRODUCTS

2.1 Piping:
- A. Above Grade:
  1. Steel pipe: ASTM A53, Schedule 40 black.
  2. Fittings: ANSI/ASME B16.3, malleable iron, or ASTM A234, forged steel welding type.
  3. Joints: Screwed for pipe 2" and under; ANSI/AWS D1.1, welded, for pipe over 2".

B. Below Grade:
   1. MDPE pipe conforming to ASTM D 2513. Pipe shall be marked "GAS" and "ASTM D 2513". Verify pipe preference of local utility. Provide yellow indicator tape with an insulated copper tracer wire the continuous pipe length. The wire shall terminate above ground at each end of nonmetallic piping. The tracer wired shall not be less than 18 AWG and the insulations type shall be suitable for direct burial.
   2. Steel Pipe: Schedule 40, black, per ASTM A-53 may be substituted for MDPE outside underground pending written approval by the Engineer 10 days prior to bid. Piping shall be factory coated with a fusion bonded epoxy coating equal to 3M Scotchkote 6233.
      a) Fittings: Malleable iron per ASTM A-105 or forged steel welding type per ASTM A-234.
      b) Joints: Welded per ANSI/AWS D1.1 for all pipe sizes.
      c) Fittings and joints shall be covered with multiple layers of protective tape to provide protection equal to factory applied coatings. Tape shall be Kendall Company "Polyken #900" or equal by Tapecoat, 3M or Steelcoat.

C. High Pressure System (containing 1 psig or greater) pipe shall meet specifications listed above.
   1. Fittings: Forged steel welding type per ASTM A234.
   2. Joints: All sizes shall be welded. Where nonferrous pipe is brazed, the brazing materials shall have a melting point in excess of 1,000°F. Brazing alloys shall not contain more than 0.05% phosphorus.

D. Flexible Connectors: Flexible connectors for connecting gas utilizing equipment to building gas piping shall conform to ANSI Z21.45. Flexible connectors for movable food service equipment shall conform to ANSI Z21.69.
   1. All flexible connectors shall be commercial grade construction.

E. All welded joints on above grade piping 2" and larger shall be butt welds. 1-1/2" piping and smaller may be socket welds.

2.2 Fuel Gas Specialties:

A. Pressure Regulators:
   1. Pressure regulators for individual service shall be of iron or steel body, shall be suitable in all respects for the indicated conditions and shall be adjustable for changing the downstream pressure. The regulator shall be adjustable with automatic loading, and shall have automatic pressure relief. The regulator shall be adjusted for an outlet pressure as scheduled on plans. The outlet pressure shall not vary more than 1/2 inch of the water column from the setting point at the connected-load capacity for the regulator. The pressure relief shall be diaphragm-operated, spring-loaded type with vent for relief of excess pressure on the low-pressure side of each main service regulator. Regulators shall be Maxitrol, Equimeter, American, and Fisher or approved equal.
   2. Pressure regulators shall be configured where the vent is oriented as required by the manufacturer.
   3. Pressure regulators installed inside the building shall have the vents routed to the exterior. Piping used shall be sized for the vent connection and as required by the regulators manufacturer with relation to overall equivalent length. The vent piping shall be leak tested at 25psig of air for a minimum of 4 hours.
   4. Increasers installed on the low pressure side of the pressure regulator shall be installed immediately after the regulator. A full port ball valve and union, rated for

gas utility and applicable pressure, shall be installed at the inlet and out let of the regulator.

5. Testing procedures shall not include testing thru or to a gas pressure regulator. The Mechanical Contractor shall install a short of piping with the same length in place of the regulator. The regulator shall be installed after the test is approved. The regulator shall be pressure tested with soap bubbles or approved electronic leak detector after installation.

B. Stop Cock Valves:
   1. Stop cock valves shall carry an ASME B16.33 rating. Valves shall be equal to Kitz model # 58 with a vented ball and blowout proof stem.

PART 3 - EXECUTION

3.1 General:
   A. Work shall be roughed-in so that all exposed piping will be straight and true without bends or off-sets.

3.2 Fuel Gas Piping System:
   A. Provide a complete system of gas piping including interior and exterior work as indicated on the drawings. All pressure gauges shall be installed with a gauge cock and damper device. Gauges shall be installed in such a position to be easily read.
   B. Pressure testing procedure:
      1. High pressure piping (> ½" psig): Gas pipe shall be tested with nitrogen at 50 psig or 1.5 times the system's working pressure for 12 hours and measured with a pressure measuring device designed and calibrated to read, record and indicate a pressure loss due to pipe leakage during the pressure test period. Any reduction of test pressure as indicated by the device shall be deemed to indicate the presence of a leak. Any leaks shall be located by means of a spray liquid & soap solution, or an equivalent nonflammable solution. The piping shall be rinsed with water after soap and water testing. Any leaks shall be repaired by this Contractor and the system re-tested in the prescribed manner. The 12 hour chart readout shall be submitted to the Engineer with a verification of the time, date and witness of the testing procedures.
      2. Low pressure piping (½" < psig): Gas pipe shall be tested with 10 psig nitrogen pressure for 12 hours and measured with a pressure measuring device designed and calibrated to read, record and indicate a pressure loss due to pipe leakage during the pressure test period. Any reduction of test pressure as indicated by the device shall be deemed to indicate the presence of a leak. Any leaks shall be located by means of a spray liquid & soap solution, or an equivalent nonflammable solution. The piping shall be rinsed with water after soap and water testing. Any leaks shall be repaired by this Contractor and the system re-tested in the prescribed manner. The 12 hour chart readout shall be submitted to the Engineer with a verification of the time, date and witness of the testing procedures.
   C. This Contractor shall make final connections to each piece of equipment furnished by the Contractor or by others unless noted otherwise. Provide a full size shut-off cock, union and 4" dirt leg at each individual appliance connection. Any reduction in gas pipe size for equipment connection shall be made within 6" of the factory connection.

Regulators shall be installed at each piece of equipment or at branch intervals where required and indicated on the Drawings.

D. Gas piping shall not be installed in any inaccessible concealed and unventilated space.

E. Install piping with a minimum 48" clearance from other buried metallic piping or equipment.

F. Unless otherwise specified herein, final connections shall be made with rigid metallic pipe and fittings. Final connection to kitchen ranges, (and other equipment where moving for cleaning purposes is required) shall be made using flexible connectors not less than 40" long and not more than 72" long and shall comply with ANSI Z21.69. In addition to cautions listed in instruction required by ANSI Standards for flexible connectors, ensure that flexible connectors do not pass through equipment cabinets. Provide accessible gas shutoff valve and coupling for each gas equipment connection.

G. Exterior piping above grade and concealed from normal view shall be coated with a rust inhibiting primer and two coats of yellow exterior grade paint. For exposed gas piping in normal view, piping shall be primed as previously listed and painted with a color similar to nearest structure or as directed by the Architect / Engineer.

H. Whenever gas pipe transitions from below grade to above grade, the transition shall be made with an isolating union to electrically isolate the gas distribution systems. A DC voltage reading shall be made to test the effectiveness of the isolating unions. A minimum reading of 0.2 volts (measured across the union) shall be required. Repair or replace unions until this voltage can be obtained.

I. The condition of the pipe coating, the effectiveness of the isolation shall be tested and approved by the Engineer.

J. All underground piping shall be buried a minimum of 24 inches, have a pipe marker located 6 inches below finish grade, and shall be laid in a minimum of 4 inches of sand with sand extending to 6 inches above pipe. Provide a conduit of wrought iron, plastic pipe or steel pipe, designed to withstand superimposed loads, below all concrete sidewalks, roadways or concrete pads. Sleeve shall be a minimum of 2 pipe sizes larger than gas line. Sleeves shall be sealed and vented if installed under the building. Vents shall be routed as detailed and shown on the drawings.

END OF SECTION 23 11 23

SECTION 23 21 14 - CONDENSATE DRAIN PIPING SYSTEMS

PART 1 - GENERAL

1.1 Related Documents:
- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all materials, labor, administration, equipment and services required for complete installation of all condensate drain piping systems indicated on Drawings and specified herein.

1.3 References:
- A. American National Standards Institute (ANSI).
- B. American Society of Mechanical Engineers (ASME).
- C. American Society of Testing and Materials (ASTM).

1.4 Submittals:
- A. Submit manufacturer's catalog data for all materials listed under this section.

PART 2 - PRODUCTS

2.1 Piping:
- A. Condensate drain piping shall be one of the following:
  1. Type L hard drawn copper per ASTM B-88. Fittings are to be wrought copper or cast brass. Joints are to be soldered with lead free, tin-silver solder.
  2. PVC Pipe and Fittings: Schedule 40 per ASTM D-1785 / ASTM D-2466. Joints: Solvent weld per ASTM D-2855 with solvent per ASTM D-2564.

2.2 Overflow Drain Pans:
- A. Contractor shall provide a condensate pan under all equipment capable of producing condensation. An overflow pan shall be provided in the case of furnaces upstream of an evaporator coil. Overflow pans shall extend 2 inches on all sides of a furnace and evaporator coil combination.
- B. Condensate overflow drain pans are to be fabricated from minimum 24 gauge galvanized steel and shall have joints welded water tight. Folded corners will not be allowed. The use of silicone to seal joints will not be allowed.
- C. Drain pan minimum dimensions shall be two inches deep and shall be two inches larger on all sides than the piece of equipment it is under. All drain pans with any dimension greater than 24" shall be cross broken. The top of the pan shall be hemmed on all sides to remove all exposed sharp edges.
- D. All condensate pans shall be equipped with a liquid sensing switch either integrated into the system served and / or building controls system.

PART 3 - EXECUTION

3.1 General:

A. Piping shall be run as directly as possible, avoiding all unnecessary fittings and joints. Changes in routing of piping due to field conditions shall be at the expense of this Contractor. Coordinate with all Trades.

B. Piping shall be cut to site specific measurements, worked into place without forcing, located as indicated on the Drawings and supported per piping manufacturer's and Code requirements. Piping shall be supported as high as possible. Piping shall be concealed unless otherwise noted.

C. Provide chrome plated steel escutcheon plates at each exposed piping penetration of walls and ceilings. Escutcheon plates for insulated piping shall be sized for the insulation diameter.

3.2 Condensate Drain Piping:

A. Slope piping at a uniform slope of at least 1/4" inch per foot to ensure proper drainage.

B. Provide a vent on the trap if the discharge height is ten feet or greater.

C. Provide condensate drain trap with a depth at least two inches greater than the fan total static pressure as measured from the invert of unit connection to the discharge invert. Pre-formed traps will be allowed. Provide threaded cleanouts at the top and bottom of the trap.

D. Condensate drain lines shall be adequately supported to prevent low points which could cause double trapping. Piping shall be supported at minimum intervals specified in other sections or per the pipe manufacturer's requirements, whichever is greater.

E. Condensate drain lines indicated to be terminated at floor drains shall either be turned down through / past the floor drain grate or be provided an indirect waste funnel for the floor drain.

3.3 Drain Pans:

A. Drain pans shall be installed under every piece of equipment that produces condensate.

B. Equipment shall be held up off the bottom of the drain pans with rubber in shear isolators. The isolators shall be located above rigid supports beneath the pan. Provide additional supports as needed for required trap depth.

C. All drain pans shall be equipped with a liquid sensing switch either integrated into the system served and / or building controls system.

END OF SECTION 23 21 14

SECTION 23 23 10 - REFRIGERANT PIPING SYSTEMS

PART 1 - GENERAL

1.1 Related Documents:
- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all materials, labor, administration, equipment and services required for complete installation of all refrigerant piping systems indicated on Drawings and specified herein.

1.3 References:
- A. American National Standards Institute (ANSI).
- B. American Society of Mechanical Engineers (ASME).
- C. American Society of Testing and Materials (ASTM).

1.4 Submittals:
- A. Submit manufacturer's catalog data for all materials listed under this section.

PART 2 - PRODUCTS

2.1 Piping:
- A. Refrigerant Piping shall be ACR copper tubing Type L hard drawn per ASTM B280 and shall be cleaned, dehydrated, charged with gaseous nitrogen and sealed. Fittings shall be forged or wrought copper.

2.2 Piping Appurtenances:
- A. Filter Dryers:
  1. The dryer shall be constructed so that no desiccant will pass into the refrigerant lines.
  2. A filter dryer shall be provided in the liquid line to each evaporator. Pressure drop through the dryer shall not exceed 2 psig when operating at full connected evaporator capacity.
     a) Filter dryers smaller than 1/2" shall be the hermitically sealed.
     b) Filter dryers 1/2" and larger shall be the full-flow, replaceable-core type. Cores shall be of a suitable desiccant that will not plug, cake, dust, channel, or break down but shall remove water, acid, and foreign material from the refrigerant. The filter dryer shall be piped with two brass isolation valves.
- B. Liquid Sight Glasses: Sight glasses shall be double glass, see-through type, with cover cap(s). Glass shall be furnished with a color-change-type moisture indicator. Sight glass shall be provided in liquid line immediately preceding each expansion valve and any filter dryer.
- C. Shutoff Valves: Shutoff valves shall be brass ball valve, bi-directional, full port. Valve pressure drop shall not exceed 2 psig.

D. Solenoid Valves: Valves shall be brass body, packless type, with corrosion-resistant steel trim, rated for continuous-duty service, direct-or pilot-operated, provided with manual lift stems, and designed for use with type of refrigerant used. The valve capacities shall be sufficient for the requirements of the installation at a pressure drop not in excess of 2 psig.
E. Expansion Valves: Shall be thermal-expansion hard shut off type to suit specific system refrigerant, designed to fit coil distributors, and capable of operating from 40 to 100% of full load at system head pressure without hunting or liquid hammer. Valves shall have external equalizer connections and external superheat adjustments with seal caps. Superheat setting shall be per equipment manufacturer's requirements. Each valve shall be provided with external strainer.

PART 3 - EXECUTION

3.1 General:
A. Piping shall be cut to site measurements. Piping shall be worked into place without forcing. Piping shall be supported as high as possible. Piping shall be concealed unless noted otherwise.
B. Piping shall be run as directly as possible avoiding all unnecessary fittings and joints. Changes in routing of piping due to field conditions shall be at the expense of this Contractor.
C. Provide sleeves for all piping penetrations of floors and walls.
D. Provide chrome plated steel escutcheons at each exposed piping penetration of walls and ceilings.

3.2 Refrigerant Piping Systems:
A. All refrigerant piping shall be ACR Type L hard drawn tubing.
B. All refrigerant lines shall be sized in accordance with the equipment manufacturer's requirements with respect to system capacity and line set length and lift.
C. All elbows in refrigerant piping systems shall be long radius elbows.
D. Joints shall be brazed using a continuous flow of nitrogen inside the piping with a flow regulator.
E. All piping shall be supported.
F. Provide filter driers, sight glasses, moisture indicators, shutoff valves, solenoid valves and expansion valves when not provided as standard or as an option on equipment. Components shall be specifically designed for refrigeration service.
G. Test each piping system at 150 psig using dry nitrogen for 24 hours. Joints that leak shall be removed and replaced with new. Pressure test shall be repeated until all joints pass. Contractor shall graph pressure test and submit a copy of the test to the Engineer.
H. Vacuum test each piping system after pressure test is completed. Piping shall be drawn to 500 microns and tested for 12 hours without additional pumping. If piping system fails, the system shall be retested for leaks and another vacuum pulled on the system as described.
I. Charge each system per manufacturer's requirements.

END OF SECTION 23 23 10

SECTION 23 31 10 - GALVANIZED SHEET METAL DUCTWORK

PART 1 - GENERAL

1.1 Related Documents:
- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all material fabrication, labor, administration, equipment and services required for complete installation of all galvanized sheet metal ductwork indicated on Drawings and specified herein.

1.3 References:
- A. American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE).
- B. National Fire Protection Association (NFPA).
- C. Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
- D. Air Diffusion Council (ADC).
- E. Air Movement and Control Association (AMCA).
- F. Underwriters Laboratories, Inc. (UL).

1.4 Submittals:
- A. Submit catalogue data and shop drawings for all materials and equipment listed under this section.

PART 2 - PRODUCTS

2.1 Fabrication:
- A. All sheet metal ductwork shall be fabricated and installed in accordance SMACNA standards unless more stringent requirements are stated herein.

2.2 Galvanized Sheet Metal Ductwork:
- A. Sheet Metal Ductwork:
  1. Galvanized steel ductwork shall be carbon steel, of lock-forming quality, hot dip galvanized, with regular spangle-type zinc coating, conforming to ASTM A-527/A527M-G90.
  2. Sheet metal gauges and reinforcement shall conform to the latest edition SMACNA HVAC duct construction standards. 26 gauge will be the lightest gauge allowed for all ductwork.
  3. All ductwork, including hangers, drives, flanges, accessories, etc., exposed in occupied areas shall also have a paint grip finish.

2.3 Ductwork Sealant:
- A. Sealant shall be non-flammable when wet, fire resistive when dry, and suitable for use in high velocity ductwork. Shall meet NFPA 90A and 90B and be UL classified.

Sealant shall have a maximum 25 flame spread and 50 smoke developed compound specifically for sealing ductwork.

B. Duct Tape will not be allowed.

2.4 Ductwork Accessories:

A. General: Provide duct accessories as indicated on the drawings and as required for proper system operation and balance.

B. Flexible Duct Connections: Flexible duct connections shall be UL listed fire retardant neoprene coated woven glass fiber fabric connections, shall conform to NFPA 90A and 90B and have a maximum flame spread rating of 25 and a maximum smoke development rating of 50. Flexible duct connectors shall be factory insulated equal to DuroDyna IDC-343 Insulflex.

C. Manual Balancing Dampers:

1. Dampers in rectangular ductwork shall be equal to shall be Ruskin model CD-60, opposed blade type, complete with concealed linkage and extended shaft for the damper quadrant or motorized operator, 16 gauge frame and double skin airfoil blades with the equivalent thickness of 14 gauge. The axle is to be 1/2" plated hex steel with stainless steel or oil impregnated bearings. Blades shall have neoprene edge seals and compression jamb seals. Dampers listed as 8" x 10" or smaller shall be single blade.
2. Dampers in round ductwork shall be equal to Ruskin model CDRS25, single blade. Blade shall be two layers of galvanized steel with the equivalent thickness of 14 gauge. A neoprene seal shall be sandwiched between the two blades. The damper axle shall be 1/2" diameter and extend 6" beyond the frame for the damper quadrant or motorized operator and shall be installed in stainless steel or oil impregnated bronze bearings.

D. Damper Quadrants: Damper quadrants shall have indicators showing open, incremental and closed positions.

E. Motorized Dampers: Motorized dampers shall be the same as the manual dampers with the addition of a motorized operator, specified as follows:

1. Two Position Motorized dampers shall be controlled with Belimo model NF24-S-US, 24 volt, 60 in-lb torque with 75 second run time, spring return and built in auxiliary switch. Actuators shall be factory mounted to the dampers.
2. Fully Modulating Motorized dampers shall be controlled with Belimo model NF24-SR-S-US, 24 volt, 60 in-lb torque, spring return and built in auxiliary switch. Actuators shall be factory mounted to the dampers.

F. Turning Vanes: All turning vanes shall be single thickness with a 2" radius, installed on runners with 2-1/8" blade spacing. Blades shall be 26 gauge.

G. Adjustable Splitter and Volume Dampers: Rectangular duct mounted splitter dampers and adjustable volume extractors shall be fabricated form 16-gauge steel with a hemmed leading edge. The trailing edge shall be pivoted on a rod or hinges. Install in accordance with the latest edition a SMACNA's Low Velocity Manual and as detailed on the drawings. Secure rod to leading edge of damper and extend rod through side of ductwork using Ventlock 603 ball joint bracket with set screw.

H. Access Doors:

1. Duct Access Doors shall be UL labeled, galvanized steel, double panel construction, internally insulated with minimum 1-inch thick fiberglass insulation complete with gaskets.

a) Rectangular, Low Pressure Duct: Ductmate Industries, 24 gauge with hinged frame connection and cam lock closures. Doors shall be 16"x16" or as large as possible.
b) Rectangular, High Pressure Duct: Ductmate Industries FDHPC, 24 gauge galvanized panel, 22 gauge frame with 16 gauge camlock closures on all sides. Provide safety chain(s).
c) Round, Low and High Pressure Duct: Ductmate Industries, 22 gauge, spiral compression with conical springs and hand knobs.

2. The location of the access doors shall be coordinated for easy access to the fire damper fusible links.

2.5 45 Degree, Square-To-Round Takeoff Fittings:

A. All branch duct takeoffs to a single air distribution device, shall be made using a rectangular, 45 degree takeoff that transitions to the round duct size shown on the plans. Branch ducts from a round main shall be the same as above with the exception that the rectangular portion shall match the curvature of the main.
B. The takeoff shall be fabricated from G-90 galvanized steel, 4" W.G. construction.
C. Takeoff shall have a 1" wide gasketed flange with pre-drilled screw holes.
D. All sizes shall be fabricated with a damper handle insulation standoff.
E. Take off shall be Flexmaster STOD-BO3 for rectangular duct and AirFlow #63RATD-2 for round duct or equal.

2.6 Insulated Flexible Ductwork:

A. Insulated flexible duct shall be listed under UL standard 181 as Class 1 air duct and shall comply with NFPA standards 90A and 90B. The duct shall be 25/50 rated for flame spread/smoke developed.
B. The duct shall be constructed with an acoustically transparent CPE film mechanically locked to a corrosion resistant galvanized steel wire helix.
   1. The duct shall be insulated with a factory applied fiberglass blanket. Insulation R-value for duct shall be R-8.0.
C. The vapor barrier shall be a fire retardant, reinforced, metalized outer jacket with a permeance of 0.05 perm.
D. Flexible ductwork shall be rated for 10 inwg. positive pressure and 5 inwg. negative pressure through 16" diameter. Flexible duct on sizes greater than 16" shall not be used however a flex connector shall be used to separate the sheet metal duct from the unit or grille connection. The rated temperature range shall be –20 to 250°F. The UL rated velocity shall be 6000 fpm.
E. Insulated flexible duct shall be Flexmaster Type 1M.
F. Flex duct shall have a 20 year factory warranty.

2.7 Duct Supports:

A. General:
   1. Duct supports shall be placed within four feet on every side of each branch intersection and within two feet on either side of an elbow.
   2. If spacing of the building structural members is greater than the maximum allowed for duct supports, additional structural members, adequate to support duct and insulation, shall be placed to span the building structural members to provide support for the ducts.
B. Rectangular Ductwork:

1. Rectangular ductwork shall be supported at a maximum of every four (4) feet using a pair of 1" straps fabricated from 20 gage sheet metal or two 3/8" diameter all thread rods. The supports shall be attached to the duct and the building structure in accordance with SMACNA standards. This shall apply to all rectangular ducts up to a maximum half of duct perimeter of 120".
2. For ducts with a half of duct perimeter greater than 120", the gauge of the support straps and size of the rods shall be in accordance with SMACNA standards.

C. Round Ductwork:
1. Round ductwork up to 36" diameter shall be supported at a maximum of every eight (8) feet using a single 1" strap fabricated from 20 gage sheet metal or 3/8" rod. The supports shall be attached to the duct and the building structure in accordance with SMACNA standards.
2. Round ducts greater than 36" diameter, shall be supported by straps or rods sized in accordance with SMACNA standards.

D. Flexible Ductwork:
1. Flexible duct shall be supported by single 1" strap fabricated from 26 gage sheet metal.

PART 3 - EXECUTION

3.1 Galvanized Sheet Metal Ductwork:

A. Sheet Metal Ductwork shall be fabricated and installed per the latest edition of the SMACNA HVAC duct construction standards and the ASHRAE Handbook.

B. All ductwork shall be supported in accordance with SMACNA standards. All threaded rod supports shall be double nutted.

C. Duct transitions shall be fabricated and installed per SMACNA standards and shall not choke flow or reduce the free area of the duct.

D. All rectangular duct elbows shall be fabricated in accordance with either of the following:
1. Radius Elbow: All radius elbows shall have a centerline radius equal to 1.5 times the width of the duct. This results in an inside radius equal to the width of the duct. Under no circumstances will radius elbows with a centerline radius of 0.5 times the duct width and an inside radius of 0.0 (90 degrees angle throat and radius heel) be allowed.
2. Mitered Elbow: All mitered elbows with an angle over 45 degrees shall be provided with turning vanes.

E. All duct sizes shown on plans are net free area. Contractor shall allow for insulation thicknesses.

3.2 Duct Sealant:

A. All duct systems shall be sealed to meet SMACNA Seal Class B. All transverse and longitudinal seams in all ducts shall be sealed.

3.3 Field Quality Control:

A. Duct Cleanliness – Installation of ductwork under this section shall comply with the "Intermediate" requirements defined within the SMACNA "Duct Cleanliness for New Construction Guidelines" (2000). It is the responsibility of the installing contractor to wipe down the interior of the duct prior to installation and to cap all open duct ends once installed.

B. Leakage Tests:
   1. Leakage tests shall be performed on all systems.
   2. Testing methods shall be in accordance with the SMACNA HVAC Duct Leakage Test Manual. The scope of testing will exceed the recommendations of the Manual.
   3. Representative sections totaling no less than 25% of the total installed duct area for the designated pressure class shall be tested. Should any portion fail to achieve the designated leakage rate, an additional 25% percent of the total installed duct area shall be tested. Should any portion of this additional duct fail to achieve the designated leakage rate all duct must be tested.
   4. All sections shall be selected by the building owner or the designated representative of the building owner.
   5. Positive pressure leakage testing is acceptable for negative pressure ductwork.
   6. Any duct failing the pressure test will be resealed and retested, at no extra expense to the owner, until the appropriate leakage rate is achieved.

3.4 Ductwork Accessories:
A. Flexible duct connections shall be installed on all ductwork required to be attached to motor driven equipment.
   1. The ends of the flexible connection shall be overlapped and sealed, to prevent air leakage, per the manufacturer's recommendations.
B. Manual Balancing, Splitter and Quadrant Dampers:
   1. All dampers shall be installed so that damper blades have a full range of movement without interference or binding. Damper quadrant shall be located to provide easy access.
   2. Provide reinforcement to damper as required so that damper remains stable in the airstream without rattling.
C. Turning Vanes:
   1. Turning vanes shall be installed in all mitered elbows with an angle greater than 45 degrees.
   2. The trailing edge of the turning vanes shall be installed tangent to the air stream.
   3. All individual vanes shall be installed on vane rails.

3.5 Rectangular-To-Round Take-Offs:
A. Rectangular-to-round take-offs shall be installed in accurately cut openings in the sheet metal duct work.
B. Rectangular-to-round take-offs shall be sealed for the pressure class required.
C. The quadrant damper shall be checked for free movement and left in the full open position after the take-off and insulation is installed. Test and Balance Contractor shall set final damper position.

3.6 Insulated Flexible Ductwork:
A. The length of flexible duct work shall not exceed 5 feet. For lengths of duct required over 5 feet, the remainder shall be galvanized steel round duct.
B. Flex ducts shall be connected in the following manner:
   1. Flex inner duct shall be duct taped, with standard gray tape, first then duct draw band strap applied.
   2. Flex duct insulation shall be butted to connection over flex inner duct. Duct draw band strap shall be applied then taped over with FSK duct tape.

C. Bends in flexible duct shall be made with not less than 1 duct diameter centerline radius. Extend flexible duct beyond end of sheet metal connection before bending.

END OF SECTION 23 31 10

SECTION 23 33 10 - FIRE DAMPERS

PART 1 - GENERAL

1.1 Related Documents:
- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all materials, labor, administration, equipment and services required for complete installation of all fire dampers indicated on Drawings and specified herein.

1.3 References:
- A. Underwriters Laboratories, Inc. (UL).
- B. National Fire Protection Association (NFPA).
- C. Air Movement and Control Association (AMCA).
- D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA).

1.4 Submittals:
- A. Submit catalogue data, shop drawings and manufacturer's approved installation instructions for each damper type and application. Submit any supplemental instructions that are required for the installation of the dampers. The installation instructions shall be specific as to the size, quantity and type of all materials required for a UL approved installation.

PART 2 - PRODUCTS

2.1 Fire Dampers:
- A. Fire dampers shall be factory assembled and shall bear the U.L. label for the fire resistant rating required at each location. Each damper shall be constructed, tested and labeled in compliance with U.L. Standard 555. Each damper shall have been tested per AMCA 500, to prove closure under the static pressure and dynamic air flow conditions indicated on the drawings. Each damper shall bear an U.L. approved label identifying its classification as a "Dynamic Rated Fire Damper".
- B. Fire dampers shall be the curtain type with interlocking galvanized steel blades folded out of the air stream.
- C. Dampers shall have stainless steel closure springs for positive closure and latch mechanism to maintain the closed position until manually reset.
- D. Fusible links shall separate at 165°F.
- E. Provide low resistance type frames. Frames shall provide free area equal to or exceeding the cross-sectional area of the connecting ductwork when the damper is in the open position. Frame styles shall be as required for duct shape and system velocity.
- F. All fire dampers shall be equipped with an integral sleeve welded to the fire damper. Damper sleeve shall extend a minimum of 4" on each side of finished wall.
- G. Provide retaining angle frames conforming to manufacturer's UL listing.

H. Fire dampers shall be as follows:
   1. 3 Hr.: Ruskin Series DIBD23 or approved equal.
   2. 1-1/2 Hr.: Ruskin Series DIBD20 or approved equal.
   3. Slim Line, 1-1/2 Hr.: Ruskin Series DIBDT-A or approved equal.

I. Fire Dampers for Storm Shelters shall be 1-1/2 Hr. Ruskin IBD2/OW or approved equal.

J. Product submittals shall include complete manufacturer's installation instructions.

2.2 Access Doors:

A. Duct Access Doors shall be UL labeled, galvanized steel, double panel construction, internally insulated with minimum 1-inch thick fiberglass insulation complete with gaskets.
   1. Rectangular, Low Pressure Duct: Ductmate Industries, 24 gauge with hinged frame connection and cam lock closures. Doors shall be 16"x16" or as large as possible.
   2. Rectangular, High Pressure Duct: Ductmate Industries FDHPC, 24 gauge galvanized panel, 22 gauge frame with 16 gauge camlock closures on all sides. Provide safety chain(s).
   3. Round, Low and High Pressure Duct: Ductmate Industries, 22 gauge, spiral compression with conical springs and hand knobs.

B. The location of the access doors shall be coordinated for easy access to the fire damper fusible links.

PART 3 - EXECUTION

3.1 Fire Dampers:

A. Fire dampers shall be installed in conformance with the manufacturer's installation instructions, UL 555, NFPA 90A and SMACNA.

3.2 Access Doors:

A. Provide duct access doors where fire damper fusible links are not accessible. Location and size shall be sufficient to reset fire dampers and replace fusible links. Locations and size of each access panel shall be approved by the Engineer.

END OF SECTION 23 33 10

SECTION 23 34 10 - CEILING AND CABINET FANS

PART 1 - GENERAL

1.1 Related Documents:
- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all materials, labor, administration, devices, equipment and services required for complete installation of all ceiling and cabinet fans indicated on Drawings and specified in this section.

1.3 References:
- A. Air Diffusion Council (ADC).
- B. Air Movement and Control Association (AMCA).
- C. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
- D. National Fire Protection Association (NFPA).
- E. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
- F. Underwriters Laboratories, Inc. (UL).

1.4 Submittals:
- A. Submit catalog data and shop drawings for all materials and equipment listed under the section.

PART 2 - PRODUCTS

2.1 Ceiling and Cabinet Fans:
- A. Cabinet Mounted Centrifugal Fans shall be UL listed and bear the AMCA Seal for air and sound performance.
- B. Housings shall have an integral backdraft damper, be acoustically insulated, convertible to either horizontal or vertical discharge and equipped with a white powder coated aluminum grille.
- C. Fan wheel shall be direct driven, dynamically balanced, forward curved type. Motors shall have internal thermal overload protection, compatible with speed controllers, mounted on vibration isolators and factory wired with quick connect for easy disconnection for inspection and service.
- D. Fans shall be equipped with mounting brackets readily adapted to various mountings.
- E. The following accessories shall be provided when indicated in the fan schedule:
  1. Vibration Isolation.
  2. Speed Control mounted to fan.
  3. Switch or breaker type lock-out type disconnect.
  4. Deluxe aluminum architectural grille.
- F. Cook is specified to establish quality of equipment.

2.2 General:

A. Provide and install fans and accessories as scheduled on the Drawings and specified in this Section.
B. Fan air performance ratings shall be in accordance with AMCA Standard 210.
C. Fan sound performance ratings shall be in accordance with AMCA Standard 300 and shall not exceed specified level at specified air delivery conditions.
D. Provide fans capable of accommodating static pressure variations of plus or minus 10 percent.
E. Statically and dynamically balance fans to eliminate vibration or noise transmission to occupied areas of the building.

PART 3 - EXECUTION

3.1 Ceiling and Cabinet Fans:

A. Set and install fans as specified and indicated on the drawings and per manufacturer's requirements.
B. Equipment installation shall be such that filters, motors, bearings can be easily serviced.
C. Provide flexible connectors at inlet and outlet of fans.
D. All fans shall be checked for proper rotation and be lubricated before start up.

END OF SECTION 23 34 10

SECTION 23 62 11 - ROOF TOP PACKAGED GAS AIR CONDITIONING UNITS LARGER CAPACITY

PART 1 - GENERAL

1.1 Related Documents:
A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
A. Provide all materials, labor, administration, equipment and services required for complete installation of all variable packaged air conditioning units with gas heat indicated on Drawings and specified herein.

1.3 System Description:
A. Unit is an outdoor rooftop mounted, electrically controlled heating and cooling unit utilizing fully hermetic scroll compressors with on demand crankcase heaters for cooling duty and induced draft gas combustion for heating duty. Supply air shall be discharged downward or horizontally, as shown on contract drawings. Units shall be of ultra high cooling efficiency and utilize environmentally friendly R-410A refrigerant.

1.4 Submittals:
A. Submit catalog data, shop drawings and installation instructions prior to commencement of work for all materials and equipment incorporated into the drawings and specified under this section.

PART 2 - PRODUCTS

2.2 Equipment:
A. General:
1. The units shall be convertible airflow. The cooling operating range shall be between 115°F and 0°F as standard from the factory for units with microprocessor controls. Operating range for units with electromechanical controls shall be between 115°F and 40°F. Cooling performance shall be rated in accordance with ARI testing procedures. All units shall be factory assembled, internally wired, fully charged with R-410A, and 100% run tested to check cooling operation, fan and blower rotation, and control sequence before leaving the factory. Wiring internal to the unit shall be colored and numbered for simplified identification. Units shall be cULus listed and labeled, classified in accordance for Central Cooling Air Conditioners. Units shall be Trane YSH series or prior approved equal.
B. Unit Cabinet:
1. Unit casing shall be constructed of zinc coated, heavy gauge, galvanized steel.
2. Exterior surfaces shall be cleaned, phosphatized, and finished with a weather-resistant baked enamel finish.
3. Unit's surface shall be tested for 672 hours in a salt spray test in compliance with

ASTM B117.

4. Service panels shall have lifting handles and be removed and reinstalled by removing two fasteners while providing a water and air tight seal.
5. All exposed vertical panels and top covers in the indoor air section shall be insulated with a cleanable foil-faced, fire-retardant permanent, odorless glass fiber material. The base of the unit shall be insulated with 1/8 inch, foil-faced, closed-cell insulation. All insulation edges shall be either captured or sealed.
6. The unit's base pan shall have no penetrations within the perimeter of the curb other than the raised 1 1/8 inch high downflow supply/return openings to provide an added water integrity precaution, if the condensate drain backs up.
7. The top cover shall be one piece construction or, where seams exist, it shall be double-hemmed and gasket-sealed. The ribbed top adds extra strength and enhances water removal from unit top.

C. Fans:
   1. Indoor Fan:
      a. Belt driven, FC centrifugal fans with adjustable motor sheaves. All motors shall be thermally protected.
      b. Unit shall be equipped with variable speed direct drive motors.
      c. All indoor fan motors must meet the U.S. Energy Policy Act of 1992 (EPACT).
   2. Condenser Fans:
      a. The outdoor fan shall be direct-drive, statically and dynamically balanced, draw-through in the vertical discharge position. The fan motor shall be permanently lubricated and shall have built-in thermal overload protection.

D. Compressor(s):
   1. All units shall have direct-drive, hermetic, scroll type compressors with centrifugal type oil pumps. Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate voltage. Internal overloads shall be provided with the scroll compressors. All models shall have phase monitors, low and high pressure controls.

E. Coils:
   1. Internally finned, 5/16" copper tubes mechanically bonded to a configured aluminum plate fin shall be standard.
   2. The condenser coil shall be microchannel type. Coils shall be leak tested at the factory to ensure the pressure integrity.
   3. The evaporator coil and condenser coil shall be leak tested to 600 psig.
   4. The assembled unit shall be leak tested to 465 psig.
   5. A removable, reversible, double-sloped condensate drain pan with through the base condensate drain shall be provided.

F. Heating Section:
   1. The heating section shall have a drum and tube heat exchanger using stainless steel components.
   2. A forced draft combustion blower shall be provided premixed fuel to a single burner.
   3. The heater shall use hot surface ignition system.
      a. On initial call for heat, the combustion blower shall purge the heat exchanger for 45 seconds before ignition. After three unsuccessful ignition attempts, the entire heating system shall be locked out until manually reset.
   4. Units shall be suitable for use with natural gas or propane (field-installed kit).

G. Refrigerant Components:

1. Each refrigerant circuit shall be provided with thermal expansion valve(s) as standard. Service pressure ports, and refrigerant line filter driers shall be factory-installed as standard.

H. Filter Section:
   1. Standard filter section shall consist of factory installed 2-in. thick disposable fiberglass filters and shall be on a dedicated slide out track to easily facilitate access and replacement.
   2. Filter section shall use standard size filters and be of common sizes within cabinet sizes.
   3. Optional MERV-8 pleated filters of commercially available sizes shall be provided.
   4. Standard 2-in. filter rack shall be field convertible to 4-in. by removing a spacer.

I. Controls and Safeties:
   1. Controls:
      a. Unit shall be completely factory-wired with necessary controls and contactor pressure lugs or terminal block for power wiring.
      b. Unit shall provide an external location for mounting a fused disconnect device.
      c. The resident control algorithms shall make all heating, cooling, and/or ventilating decisions in response to electronic signals from sensors measuring indoor and outdoor temperatures. The control algorithm shall maintain accurate temperature control and minimizes drift from set point.
      d. A centralized microprocessor shall provide anti-short cycle timing and time delay between compressors to provide a higher level of machine protection.
   2. Safeties:
      a. Phase monitor shall provide 100% protection for motors and compressors against problems caused by phase loss, phase imbalance, and phase reversal. Phase monitor shall be equipped with an LED that provides an ON or FAULT indicator. The module shall automatically reset from a fault condition.
      b. Unit shall be equipped with high and low head pressure control and safety lockout.

J. Special Features:
   1. Convenience Outlet:
      a. Factory installed powered convenience outlet shall be internally mounted with an externally accessible 115-v, 2-plug female receptacle with hinged cover. Shall include 15 amp GFI with independent fuse protection and service receptacle disconnect. The convenience outlet is powered from the unit main power wiring through a factory-installed step down transformer. The power wiring for the transformer needs to be field connected per local codes. This may mean wiring before the disconnect switch or after.
   2. Integrated Economizer:
      a. Fully modulating 0-100% motor and dampers.
      b. Low-leakage, opposing dampers.
      c. Capable of introducing up to 100% outdoor air for minimum ventilation as well as free cooling.
      d. Economizer outdoor hood shall be prepainted and fully assembled.
   3. Barometric Relief Damper Package:

a. Package shall include damper, seals, hardware, and hoods to relieve excess internal pressure.
b. Integrated barometric relief capabilities on economizer.
c. Damper shall close due to gravity upon unit shutdown.

4. Differential Enthalpy Sensor:
   a. For use with economizer only.
   b. Capable of comparing heat content (temperature and humidity) of outdoor air and indoor air and controlling economizer cut-in point at the most economical level.
5. Non--Fused Disconnect Switch:
   a. Shall be factory-installed, internally mounted, NEC and UL approved. Non-fused switch shall provide unit power shutoff. Shall be accessible from outside the unit and shall provide power off lockout capability.
6. MERV-8 Pleated Return Air Filters:
   a. The filters shall be MERV-8 efficient. The filters shall be 2-in., pleated filters.
7. Hail Guard, Condenser Coil Grille:
   a. Shall protect the condenser coil from hail, flying debris, and damage by large objects without increasing unit clearances.
8. Phase Loss Protection:
   a. Shall provide unit shutdown when an electrical phase loss is detected. Shall be automatic reset type.
9. CO2 Sensing:
   a. The CO2 sensor shall monitor space occupancy levels within the building and modulate the return and outside air dampers accordingly.

2.2 Start-Up and Warranty:

A. The manufacturer shall provide a factory-trained representative to perform the start-up procedures as outlined in the Start-up, Operation and Maintenance manual provided. Start-up representative will provide all necessary set-up and configuration of the unit controls to ensure that the unit operates and communicates properly.

B. Standard unit warranty shall include a complete unit parts, labor and refrigerant warranty for a minimum of 1 year after substantial completion. Manufacturer shall coordinate with the Contractor and be aware of the anticipated construction timeframe for the project and provide allowance for warranty. The manufacturer shall provide an original factory warranty certificate for each unit listing model number, serial number and warranty coverage as specified. Warranty labor shall be performed only by manufacturer certified technicians. In addition, manufacturer shall include a 5 year replacement compressor parts warranty and 15 year replacement heat exchanger parts warranty for stainless steel heat exchangers.

PART 3 - EXECUTION

3.1 General:

A. Roof mounted package air conditioning units shall be mounted on a factory furnished insulated curb. Top of curb shall be level, flashed and counter-flashed water tight. Contractor shall coordinate with equipment / curb provider to ensure proper slope of curb base. Set unit on curb and provide all final connections as specified herein and indicated on the drawings. Unit and curb shall be secured in compliance to IMC wind loading requirements.

B. Slab mounted packaged air conditioning units shall be set on 8" high concrete base; adhere to manufacturer's spacing requirements.
C. Roof top mounted equipment shall be set on 18" tall roof curb sloped to match roof pitch.

END OF SECTION 23 62 11

SECTION 23 62 20 - AIR-COOLED SPLIT-SYSTEM HEAT PUMPS

PART 1 - GENERAL

1.1 Related Documents:
- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all labor, materials, equipment and services required for complete installation of all air-cooled split-system heat pumps indicated on Drawings and specified herein.
  1. 1 - 5 ton single-phase units. Outdoor mounted, air-cooled, split system heat pump unit suitable for ground or rooftop installation. Unit consists of a hermetic compressor, air cooled coil, propeller type condenser fan and controls box. Unit discharge air shall be upward. Unit will be used in a refrigeration circuit to match up to a packaged fan coil or coil assembly of the same manufacturer.

1.3 Quality Assurance:
- A. Unit shall be rated in accordance with the latest edition of AHRI Standard 240.
- B. Unit shall be certified for capacity and efficiency and listed in the latest AHRI directory.
- C. Unit construction will comply with the latest editions of ANSI/ASHRAE and with NEC.
- D. Unit will be constructed in accordance with UL standards and will carry the UL label of approval.
- E. Unit cabinet will be capable of withstanding Federal Test Method Standard No. 141 500hr salt spray test.
- F. Air cooled condenser coils shall be pressure tested and unit assembly leak tested.

1.4 Submittals:
- A. Submit catalog data, Shop Drawings and installation instructions prior to commencement of work for all materials and equipment incorporated into the drawings and specified herein.

PART 2 - PRODUCTS

2.1 1-5 Ton Single-Phase Split-System Heat Pumps:
- A. Equipment: Factory assembled, single piece, air cooled heat pump unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, compressor and refrigerant charge of R-410A.
- B. Unit Cabinet: Unit cabinet will be constructed of galvanized steel, bonderized and coated with powder coat paint.
- C. Fans:
  1. Condenser fan will be direct drive propeller type discharging upward.
  2. Condenser fan motors will be totally enclosed, single phase with class B insulation and permanently lubricated bearings.
  3. Shafts will be corrosion resistant.
  4. Fan blades will be dynamically balanced.

5. Condenser fan openings will be equipped with coated steel wire safety guards.

D. Compressor:
   1. Compressor shall be hermitically sealed.
   2. Compressor shall be mounted on rubber vibration isolators.

E. Condenser Coil:
   1. Condenser coil shall be air cooled.
   2. Coil shall be constructed of aluminum fins mechanically bonded to copper tubes which are then cleaned, dehydrated and sealed.

F. Refrigerant Components: Refrigerant circuit components shall include liquid and vapor line shutoff valve with sweat connections, system charge of R-410A refrigerant, POE compressor oil, accumulator and reversing valve.

G. Fan discharge and unit arrangement shall be as indicated on the plans.

H. Units will feature the following as standard:
   1. Compressor crankcase heaters.
   2. Compressor internal overload protection.
   3. O.D. pressure taps for refrigerant pressure checks.
   4. Refrigerant service valves.
   5. Refrigerant filter dryer.
   6. Electronic defrost control.
   7. Outdoor temperature sensor.
   8. Reversing Valve.
   9. Hail Guards.
   10. Compressor time delay relay.
   11. High and low pressure protection.

I. Units will feature the following accessories when scheduled on the Drawings:
   1. Outdoor low ambient to 0°F.

J. Equal equipment will be considered pending an initial equipment review 10 days prior to the bid and compliance with the construction documents of being 'equal to or better than' the basis of design equipment. Equipment not submitted for prior approval will not be reviewed during the submittal phase and will not be allowed for the project.

2.2 Warranty:

A. Unit shall have a one (1) year parts and five (5) year compressor warranty. Warranty period shall not begin until after Substantial Completion.

PART 3 - EXECUTION

3.1 General:

A. All equipment shall be installed in accordance with the recommendations of the manufacturer.

B. Refrigerant line sizes shall be determined in accordance with the manufacturer's recommendations. This contractor is responsible for any changes or accessories required due to the specific requirements of a particular manufacturer. All refrigerant lines shall be sized by the manufacturer and approved by the engineer prior to any work.

C. Provide and install any accessories necessary for a complete and functioning system.

D. All condensers shall be set on 6" thick concrete slabs for on grade installations. Roof mounted condensers shall be installed on restrained spring isolation curbs to withstand 50lbs./sqft along any face of the unit. The curb shall be designed by a

Professional Engineer licensed in the project's state that has 5 years experience designing restrained curb systems. Installation instructions of how to mount the curb to the building's structure and the unit to the curb must be stamped by curb's design engineer and included in the submittals.

END OF SECTION 23 62 20

SECTION 23 85 12 - DUCTLESS MINI SPLIT WALL MOUNTED

PART 1 - GENERAL

1.1 System Description:
- A. Ductless split system wall mounted.

1.2 Quality Assurance:
- A. These units shall be listed by ETL and bear the ETL label.
- B. Units shall be rated in accordance to ARI standard 240HP and bear the ARI label.
- C. Units shall be manufactured in a facility that has met ISO 9002 and ISO 14001 international standards.
- D. A full charge of R-410A for a 25' line set shall be provided in the condenser section.
- E. A dry air holding charge will be provided in the evaporator section.
- F. System SEER shall meet or exceed 16 SEER.

1.3 Handling and Storage:
- A. The wireless remote shall be packaged inside the carton with the evaporator section.
- B. Wired remote if required shall be shipped as a separate accessory item.
- C. Unit shall be handled and stored according to manufacturer's specifications.

PART 2 - PRODUCTS

2.1 Indoor Unit:
- A. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, control circuitry and fan motor. The unit shall have a factory installed Plasma/Electrostatic filter to clean return air. The unit shall have self-diagnostic function, 3-minute time delay, an auto restart function, dirty filter indicator, an emergency operation manual run switch. Indoor unit refrigeration piping shall be charged with a dry air holding charge instead of R-410A.
- B. Cabinet:
  1. The cabinet shall have a white finish smooth easy to clean surface with and indicator lights to verify functioning and trouble shooting.
  2. Return air shall enter through the top of the cabinet.
  3. There will be a factory supplied separate back plate (if applicable) for securely mounting the evaporator on the wall.
- C. Fan:
  1. Evaporator fan shall be direct drive DC motor.
  2. Fan shall be dynamically balanced and run with permanently lubricated bearings.
  3. A motorized air louver (up/down) shall provide automatic changes in air direction to provide a more uniform pattern of air distribution.
  4. Indoor fan shall provide 3 (3) speeds, High, Medium, Low.
- D. Filter:
  1. Factory furnished and installed.

E. Coil:
   1. Evaporator shall be nonferrous construction with aluminum plate fins on copper tubing.
   2. All tubing shall be factory brazed and leak checked prior to packaging at the factory.

F. Electrical:
   1. Power requirement shall be 208/230/1/60.
   2. Indoor unit will not have and supplemental electric strip type heat.

G. Control:
   1. This unit shall have a wired controller to perform input function necessary for operation of unit.
   2. Wired control shall have controls for temperature and time set, master control, air clean, auto swing louver, start/stop, fan and timer, control up to 16 indoor units.
   3. Temperature changes shall be from 60^0F – 80^0F in one (1) degree increments.
   4. Microprocessor located in the indoor unit shall have the capability to sense return air temperature, coil temperature and process the commands from the remote to operate the outdoor unit as required. Unit shall be capable of automatic restart when power is returned after a power outage.
   5. Control signal shall be sent between the indoor unit and outdoor unit on the same wiring delivering voltage to the indoor unit.

2.2 Outdoor Unit:

A. The outdoor unit is designed specifically for the matching indoor unit. The unit is equipped with circuit board that interfaces with the indoor unit. Unit is to be factory assembled, wired, piped and run tested prior to leaving the factory.

B. Unit Cabinet:
   1. Cabinet will be constructed out of galvanized metal with a baked enamel finish.
   2. Fan guard will be louvered to prevent entrance of foreign objects.

C. Fan:
   1. Unit will have a direct drive propeller type fan.
   2. Motor for fan will be DC voltage permanently lubricated and balanced prior to assembly.
   3. Unit will have a horizontal discharge air flow.

D. Coil:
   1. Condenser coil shall be nonferrous construction with aluminum plate fin on copper tubing.
   2. Refrigerant flow leaving the condenser coil shall be controlled by a metering device.

E. Compressor:
   1. Compressor shall be a rotary type or scroll type mounted in such a way to prevent noise and vibration transmission outside the cabinet.
   2. Unit will be pre-charged with R410A refrigerant to accommodate a 25’ line set without the addition or removal for Freon.
   3. Unit will be capable of a maximum 165’ total line set with a height difference of no more than 65’ without the need to trap, change line sizes or add oil to the system.

F. Electrical:
   1. The unit electrical requirement shall be 208/230/1/60.
   2. The outdoor unit shall be controlled by a microprocessor.

3. Control voltage to and from the indoor unit shall occur on the same wiring delivering power.

PART 3 - EXECUTION

3.1 Start-Up and Warranty:

A. The manufacturer shall provide a factory-trained representative to perform the start-up procedures as outlined in the Start-up, Operation and Maintenance manual provided. Start-up representative will provide all necessary set-up and configuration of the unit controls including communication to the BAS control system to ensure that the unit operates and communicates properly.

B. After the above services have been performed, the same factory-trained representative shall be available for a period of classroom instruction not less than 2 hours and to exceed 8 hours to instruct the owner's personnel in the proper operation and maintenance of the unit.

C. Standard unit warranty shall include a complete unit parts, labor and refrigerant warranty for a minimum of 1 year after substantial completion. Manufacturer shall coordinate with the Contractor and be aware of the anticipated construction timeframe for the project and provide allowance for warranty. The manufacturer shall provide an original factory warranty certificate for each unit listing model number, serial number and warranty coverage as specified. Warranty labor shall be performed only by manufacturer certified technicians. In addition, manufacturer shall include a 5 year replacement compressor parts.

END OF SECTION 23 85 11

SECTION 26 00 00 — ELECTRICAL

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:

A. This section of the specifications is coordinated with and complimentary to certain sections of the General Specifications. Specifically, the Contractor shall refer to "Instructions", "General Conditions", "Special Conditions", and all other relevant divisions of work. Applicable provisions of the General Conditions shall govern work under this heading as if written in full herein.

B. The Electrical Specifications shall be considered to be all inclusive in their individual divisions of work and shall refer to and be a part of all applicable parts of the General Specifications whether bound with these Specifications or whether handled as a separate document.

C. These Specifications are intended to provide for a complete electrical system. Any item(s) indicated on the Drawings and not specified or vice-versa, or any detail omitted which is necessary for the proper installation of the system, shall be supplied and installed by the Contractor without additional cost.

D. The Drawings and Specifications shall be considered complimentary one to the other so that materials or labor indicated, called for or implied by one and not the other shall be supplied as though called for by both.

E. The Electrical Contractor shall keep clean plans on the job and mark all changes (changes by addenda, change orders, re-routing of conduits or circuits to meet field conditions, etc.) made in the field. These changes shall be marked on the plans when they are made and not when the job is finished. This set of plans shall be turned over to the Architect or the Engineer through the General Contractor to be included in as-built plans.

1.3 Scope, Work Included:

A. The Electrical Contractor shall purchase and furnish all materials, wire, fixtures and equipment shown on the Electrical Drawings and covered by this section of the Specifications. The General Contractor or another subcontractor shall not be used to purchase materials with the intent to circumvent bid laws or to overcome poor credit on the part of the Electrical Contractor.

B. The Contractor shall:

1. Install complete system of electrical wiring to each lighting fixture, receptacle and switch outlet.
2. Install all lighting fixtures and other electrical equipment covered by this section of Specifications and Electrical Drawings.
3. Install empty conduit for thermostat and control circuits as shown on mechanical or electrical drawings and/or specified under Division 23 of the Specifications.
4. Install all power wiring and make electrical connections to heating, air conditioning, ventilation and other electric consuming equipment that is furnished and installed

by other trades. Proper starter(s) and interior controls, including control wiring, shall be furnished with equipment with all wiring brought out to terminal block or junction box.

5. Install a new fire alarm system as shown and specified on plans.
6. Install empty conduit for a video intercom, access control, and surveillance systems as shown and specified on plans.
7. Install empty conduit for computer outlets as shown.
8. Install empty conduit for cable television outlets as shown.
9. Install the cable tray as indicated.

1.4 Work By Others:

A. All patching and finishing, painting of conduits, equipment and panel trim.
B. All furring for spaces in which conduit and other electrical work may be installed.
C. All heating, air conditioning, ventilation and other electric consuming equipment covered by other sections of the Specifications and associated control wiring.

1.5 Codes, Laws and Ordinances:

A. All material and workmanship shall comply with National Electrical Code (2014), state laws, local ordinances.
B. In cases of differences between building codes, state laws, local ordinances and utility regulations and the Contract Document, the most stringent shall govern. The Contractor shall promptly notify the Engineer and/or Architect in writing of any such difference. Should the Contractor perform any work that does not comply with such requirements, he shall bear all costs arising in correcting the deficiencies.

1.6 Experience of Bidders:

A. Electrical contracting shall be the primary business of bidders under this section of the Specifications, and the bidder shall have installed at least three (3) similar type and size projects.
B. The bidder shall submit proof of similar projects when requested by the Architect or Engineer. Proof shall include all of the following:
    1. Name of project
    2. Date of completion
    3. General description of electrical work
    4. Approximate dollar value of electrical installation
    5. Name of electrical design and inspecting engineer.
C. The bidder shall have an active license by the Alabama Electrical Contractors Board as an Electrical Contractor and shall submit proof of license when requested. A local business permit or local electrical contracting license will not be considered sufficient. The required Alabama license shall not have “provisional” limitations and any such limitations will cause the licensee to be rejected from the project.
D. Regardless of the bidding amount, the Electrical Contractor shall be actively licensed by the State of Alabama as a General Contractor with specialty in Electrical. An Electrical Contractor who is licensed only as a sub-contractor type “S” license is limited to bidding through a licensed Prime General Contractor.
E. The bidder shall have practiced electrical contracting under his current business name for a minimum of three (3) consecutive years.
F. The Electrical Contractor shall provide substantiating proof of these requirements a minimum of 5 days prior to bid date to the Electrical Engineer. If substantiating proof

is not submitted and approved, the Electrical Contractor will not be allowed to bid or perform work on the project.

G. When pre-qualification of electrical sub-contractors are required prior to bidding, each potential sub-contractor shall enclose in his pre-qualification documents the Company's latest audited financial statement or a current letter of reference from his bank or primary lending institution indicating good financial standing.

H. The Engineer reserves the right to dismiss any contractor that he feels does not have sufficient experience or whose quality of work would not be in the best interest of the Owner.

1.7 Responsibility of Bidders:

A. Before submitting proposal, each Bidder shall examine all Drawings and Specifications, equipment space allocated, and site of work to determine character of work. No consideration will be given at a later date to alleged misunderstanding as to requirements of work, materials to be furnished, or conditions required by nature of site.

B. Items obviously omitted from Specifications and/or Drawings by oversight or error shall be called to the attention of the Engineer and/or Architect before submitting bids. After award of Contract, any changes in materials, fixtures, equipment, etc., or any rearrangement necessary to complete Contract, shall be at the expense of the Contractor.

C. This Contractor shall pay additional cost that may be incurred by other trades due to the installation of equipment or material, covered by this section of Specifications and Electrical Drawings, which differ from that specified even though such equipment or materials has been approved by the Architect and/or Engineer.

1.8 Fees and Permits:

A. This Contractor shall secure all licenses and permits, and pay all fees required for completion of work under this section of the Specifications.

B. This Contractor shall be licensed by the State of Alabama as an Electrical Contractor. A simple business license from the local municipality is not sufficient.

1.9 Supervision:

A. This Contractor shall be held strictly responsible for the proper installation of the complete electrical system. He shall keep a competent superintendent or foreman on the job site throughout the progress of the Work. The foreman shall not be removed or replaced from the project except by written approval from the Engineer.

B. The foreman shall, as a minimum, have 5 years of experience in similar type commercial projects and shall hold a 10-hour OSHA card for safety training. A minimum of 50% of the electrical laborers on the construction site shall each hold a 10-hour OSHA card for safety training.

1.10 Changes and Additional Work: No changes shall be made from the work as called for by these Specifications and Drawings, except on written order of the Architect. No charge for extra work will be allowed unless such extra work has been duly authorized by a written order of the Architect stating the change to be made.

1.11 Warranty:

A. In addition to the customary manufacturer's guarantee on materials, this Contractor shall guarantee all materials and equipment furnished by him and all workmanship incidental to the Electrical Contract for a period of one (1) year following the date of

final inspection and approval. Any defective material or workmanship which becomes apparent during the one year period shall be replaced by him without additional cost to the Owner.

B. Lamps that burn out from use by the Owner after date of final inspection and approval shall not be covered by the one (1) year warranty. The Contractor shall replace any light bulbs that have had excessive use during construction or before date that Owner accepts the building.

C. All ballasts shall be covered by the warranty and any ballast that fails during the first year shall be replaced by this Contractor at no cost to Owner.

1.12 Emergency Repairs: The Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding the Contractor's guarantee bond nor relieving the Contractor of his responsibility during the warranty period.

1.13 Submittal Data:

A. The Contractor shall prepare data for submitting to the Engineer based upon all equipment, panels, motors, etc., he proposes to furnish as specified and shown on the Drawings. Partial submittal will not be accepted.

B. Within twenty (20) days after award of the Contract, the Contractor shall submit THROUGH THE GENERAL CONTRACTOR, a minimum of six (6) sets of all engineering data pertaining to all equipment, materials, etc., he proposes to furnish for this project.

C. The Submittal Data shall include the following:
   1. On the exterior of the folder, the Contractor's name, address, telephone number and the job name.
   2. On the first page, a copy of the letter of transmittal from the Contractor to the Engineer listing each item of material and equipment contained therein (in the order they appear in the Specifications) the make, vendor, where used and number sets being transmitted.

D. The data shall include the following: Operational Data, Shop Drawings, Dimension Drawings of Equipment and Structures, Fixture Data, Voltage, Speed and Catalog Engineering Data Sheets, Rough-In Drawings, and any other data required to verify compliance with the Specifications.

E. Each item shall be clearly marked to indicate its use and to show any deviation from the Specifications.

F. Submittals shall include at least the following items:
   1. Lighting Fixtures
   2. Disconnect Switches
   3. Receptacles
   4. Toggle Switches
   5. Occupancy Sensors
   6. Device Plates
   7. Panelboards
   8. Transformers
   9. Surge Protective Devices
   10. Fire Alarm

1.14 Submittal Samples:

A. The Contractor shall submit THROUGH THE GENERAL CONTRACTOR a sample of each of the following items proposed for use on the project:

1. 18" of each type of wire to be used
2. 18" of each type of conduit to be used
3. One standard receptacle
4. One standard lighting toggle switch
5. One receptacle device plate

B. The Engineer will evaluate the samples and compare them to those specified. A written report will be prepared and forwarded to the Contractor. Submitted samples will not be returned.

C. The Engineer may choose to waive the sample requirement under the following circumstances:
   1. The Contractor submits appropriate catalog literature of intended devices that meet the Specification.
   2. The Contractor has submitted samples of the specified devices on a previous project to the Engineer.

1.15 Standard of Materials and Workmanship:

A. All materials, equipment and apparatus covered by this Specification shall be new, of current manufacture and shall bear the seal of approval of the Underwriters' Laboratories, Incorporated, (UL) wherever standards have been established by that agency. Where UL standards do not exist, consideration will be given to certified test reports of an adequately equipped, recognized independent testing laboratory qualified to perform such testing. Defective equipment and/or equipment damaged during installation or testing shall be replaced or repaired in a manner meeting with approval of the Engineer.

B. All work shall be executed in a workmanlike manner and shall present a neat and mechanical appearance when completed. Work shall be installed in accordance with NECA 1-2006, Standard for Good Workmanship in Electrical Contracting.

1.16 Inspections: All work shall be completely installed and tested as required by this section of the Specifications and by all codes and ordinances before inspection is requested. All tests shall be repeated to the satisfaction of those making the inspection. All work shall be subject to inspection by the Architect, Engineer or their representative at all times.

1.17 Coordination:

A. This Contractor shall coordinate his work with other trades, installing the system and equipment furnished by him in such a manner as to avoid interferences. All changes required in the work of the Contractor caused by his neglect to do so shall be made by him at his own expense.

B. Discrepancies between scale and dimensions or between architectural, structural, mechanical and/or electrical drawings shall be called to the Architect's attention immediately.

1.18 Grounding:

A. Grounding system shall meet all requirements of Article 250 of the National Electric Code and shall meet additional requirements as specified herein and on the Drawings.

PART 2 — PRODUCTS

2.1 Distribution Centers & Panelboards:

A. Provide distribution centers including main panel and local panelboards for power, light and appliances; complete with wired protective devices, accessories, enclosed in cabinets, as indicated and specified herein and on plans.
B. Wiring scheme, equipment, arrangement, and structure outline dimensions shall be substantially as indicated.
C. Incoming service shall be 480Y/277V, 3 phase, 4 wire.
D. Provide inside cabinet door of each panel a framed (typed) directory listing all circuits as connected to panel. Where a door is not provided on distribution panels, engraved micarta nameplates shall be located adjacent to breakers and firmly attached using screws.
E. Panelboard circuit numbers shall be permanently attached or embossed. Circuit breakers shall not be numbered with paper adhesive tape.
F. Each panel shall be furnished with an identification plate as specified in the "Equipment Identification" section of this specification. Identification plate shall be firmly attached using screws.
G. Adhesive cable tie mounts and plastic cable ties shall be used for wire management inside panelboards.
H. A sign shall be located at each panel warning of potential electric arc flash hazards per NEC 110.16 requirements.
I. Interrupting ratings shall be coordinated with the available short circuit current. Series rating is unacceptable.
J. All panels shall be provided with an equipment grounding bus similar to but isolated from the solid neutral bus. Provide bonding between the grounding bus and neutral bus in the service entrance equipment only.
K. The main service panel shall bear a UL label approving it as acceptable as service entrance equipment.
L. When a panelboard is two sections, both sections shall be equal in physical size and capable of having the same quantity of breakers.
M. Panel enclosures shall be furnished without knockouts. All knockouts shall be field cut.
N. Panels shall be carefully aligned and rigidly secured in place with the top of the cabinets located 78 inches above the finished floor.
O. Branch circuit protection devices shall be molded case circuit breakers bolt-on type. Multi-pole breakers shall be designed such that an overload in any phase will trip all poles simultaneously.
P. Schedule of distribution centers is indicated on plans and includes the following information:
    1. Identifying number or letter
    2. Location
    3. Circuit numbers
    4. Circuit breakers trip sizes
    5. Spare circuit breakers, number and rating
    6. Feeder circuit sizes
Q. Switchboards and panelboards shall be as manufactured by Square "D", Siemens, Cutler-Hammer, G.E. or approved equal. Brand and numbers given on plans are to establish standards of quality and requirements.

2.2 Conduit and Fittings:
A. Conduit in concrete or corrosive areas shall be plastic conduit equal to Carlon Type 40, PVC conduit shall meet and be installed in accordance with all requirements of Article 347 of the NEC. A ground wire must be installed in each conduit and proper

connections made at panels, receptacles, switches, lights, etc., to make a continuous grounding system. Where any circuit in non-metallic conduit extends above ground, a fitting shall be installed to convert to metallic conduit.

B. Conduit exposed to weather or in wet locations shall be rigid galvanized metal. PVC conduit shall not be used above ground.
C. Where conduit enters or exits the top of an exterior enclosure, a Myers type weatherproof hub shall be used.
D. Conduit from a junction box to lighting fixtures, motors, etc., inside the buildings may be flexible metal as provided for in Article 350 of NEC.
E. Conduit from a junction box or local disconnect switch to AC unit, etc., outside the buildings shall be Liquid-Tight Flexible Metal as provided for in Article 351 of NEC.
F. Any raceways that are installed exposed in finished areas shall be metallic Wiremold type raceways. Prior approval from the Architect is required for any exposed raceways.
G. All other conduit shall be galvanized or sherodized electrical metal tubing (thin wall).
H. Conduit within open-celled concrete blocks shall be EMT. When installed in pour filled blocks, EMT shall have corrosion protection and suitable for that condition.
I. Conduit sizes shall be as indicated; where not indicated, sizes shall meet NEC requirements for number of conductors to be accommodated. Do not install conduit smaller than 1/2".
J. Electrical Metallic Tubing shall be hot-dipped galvanized and manufactured in accordance with UL Standard #797 and installed according to Article 348 of the NEC.
K. All metallic fittings shall be constructed of steel. Cast fittings will be rejected.
L. Type MC and AC cable shall be used only as final connections to light fixtures from junction boxes in lengths of less than 6 feet or when fishing inside pre-existing walls. Light fixtures shall not be connected in a daisy-chain manner.
M. Plastic conduit bushings equal to Arlington Industries EMT series shall be used where conduits stub above ceilings without terminating into a box.

2.3 Conductors:

A. All conductors shall be copper of not less than 98% conductivity and sized based on Drawings. Conductors sized #6 and smaller shall be Type THHN or THWN. Conductors sized #4 and larger shall be Type RHW/USE, RHW-2 or XHHW. Aluminum conductors shall not be used.
B. Conductors #8 and larger shall be stranded. Conductors #10 and smaller shall be solid.
C. No conductor smaller than #12 will be allowed for branch circuits. Reduced size conductor tapping is prohibited.
D. All equipment grounding (ground) conductors shall be bare or have green covering.
E. Wiring shall be color coded as follows:
    1. 208 wye/120 volt, 3 phase, 4 wire solid neutral:
        a) Phase A Black
        b) Phase B Red
        c) Phase C Blue
        d) Neutral White
        e) Ground Green
    2. 480Y/277 volt, 3 phase, 4 wire solid neutral:
        a) Phase A Brown
        b) Phase B Orange
        c) Phase C Yellow
        d) Neutral Gray
        e) Ground Green

F. Phase conductors #10 and smaller shall have colored insulation. Phase conductors sized #8 and larger may have colored insulation or may have colored electrical tape wrapped on the outside of black insulation at every termination point. In no case shall colored tape be used to change the color coding of colored insulation.
G. Grounded conductors (neutrals) sized #6 and smaller shall have white or gray insulation per the voltage system as listed above and in accordance with N.E.C. section 200.6. Colored tape is not acceptable on neutral conductors sized #6 and smaller. Neutral conductors sized larger than #6 may have colored insulation or may have colored electrical tape wrapped on the outside of black insulation at every termination point.
H. The wiring system shall be color coded as required by the Specification in each junction box, pull box, outlet box, safety switch, panel, etc., and at each termination or splice.
I. Where a building has more than one voltage characteristic (such as 480/277 volt AND 208/120 volt), a legend of wire color code shall be posted at every panelboard.
J. Adhesive cable tie mounts and plastic cable ties shall be used for wire management inside panelboards.

2.4 Pull or Junction Boxes:
A. Provide pull or junction boxes where indicated and where directed to facilitate the pulling of conductors.
B. For concealed conduit, make boxes flush with wall.
C. Make box covers accessible and easily removable.
D. Boxes shall have no opening except those through which conduit pass.
E. Where possible, use standard size junction boxes, conforming to NEC requirements.
F. For special size junction boxes, fabricate of galvanized steel as indicated.

2.5 Outlet Boxes:
A. Provide outlet boxes of galvanized stamped steel, malleable iron or of nonferrous metal for convenience outlet receptacles, wall switches, and other devices indicated or required as specified.
B. Outlet boxes shall be of approved design and manufacture. Each type shall be of form and dimensions adapted to specific location, device which it is to enclose, fixture it is to support, and type, number and arrangement of conduits connecting to it.
C. Where standard make boxes are not suitable, provide boxes of special design to fit space, other requirements, as approved.
D. Outlet boxes shall be of flush mounted design unless otherwise indicated or specified.
E. Outlet boxes exposed to weather or in damp locations shall be with threaded hubs for conduit connections; make cover water and air tight with gasket and bronze screws. Outlet box covers exposed to weather shall be rated for wet location when in use.
F. Outlet box supports shall be Steel City “SV” type or approved equal. All Caddy box supports other than Rigid Box Support are prohibited. Any support that depends on sheetrock for eliminating box movement is prohibited.
G. Open "knockouts" in outlet boxes only if required for inserting conduit.
H. Outlet boxes in concrete block walls shall be masonry boxes and shall be mounted flush with surface of the wall.
I. All outlet boxes shall be installed in accordance with Paragraph 314.20 of the NEC which reads as follows: "In walls or ceilings with a surface of concrete, tile, gypsum, plaster, or other non-combustible material, boxes employing a flush-type cover or faceplate shall be installed so that the front edge of the box, plaster ring, extension ring, or listed extender will not be set back of the finished surface more than ¼ inch."

J. Where outlets show movement due to wall over-cuts or errors in flush mounting of boxes, levelers as manufactured by Caddy or equivalent shall be used for additional bracing.
K. Outlet boxes that are for future devices shall be provided with a blank cover plate as specified below. At the end of project construction, any rough-in boxes that have not been used shall be considered as intended for future devices and shall have blank cover plates installed.

2.6 Wiring Devices:
A. Switches, receptacles and other wiring devices shall be as manufactured by General Electric, Hubbell, Leviton, P & S or approved equal. All devices and associated wall plates shall have a color as selected by the Architect. Devices shall be commercial specification grade.
B. Receptacles and Outlets:
1. Unless otherwise shown, manufacturer's catalog numbers specified for receptacles refer to Hubbell. The phrase "or approved equal" is understood to be appended to each number.
2. Receptacles shall be duplex, specification grade, 20 amp 120 volt; capable of receiving either standard 2-prong or 3-prong polarized plugs to fit their outlet boxes and cover plates; No. CR20(*).
3. Where required, tamper resistant receptacles shall be used and shall be equal to Hubbell CR20(*)TR.
4. At every location where the receptacle is automatically controlled, the receptacle shall be permanently labeled in accordance with NEC and ASHRAE 90.1 requirements. Receptacles shall be equal to Hubbell BR20C2(*).
C. Wall Switches:
1. Fasten switches to outlet boxes firmly; do not depend on cover plate to pull them tight.
2. Wall switches shall be 20 amp 120-270 volt, a.c., tumbler type with operating mechanism totally enclosed; Hubbell or approved equal:
a) 1 pole, 20 amp #CS120(*)
b) 3 way, 20 amp #CS320(*)
c) 4 way, 20 amp #CS420(*)
d) Keyed, 1 pole, 20 amp #HBL1221L(*)
3. Dimmer switches shall be slide type with minimum ratings equal to the load connected. Dimmers shall be properly de-rated when ganged together. Low voltage dimmers (0-10 volts) shall be used where necessary and shall be selected to operate with the specific intended light fixtures. Dimmers shall be fully compatible with their associated light fixtures. Unless otherwise noted, dimmers shall reduce their associated light levels to 1% or less of full brightness.
4. Where more than one switch is indicated in one location, or a switch and convenience outlet are indicated together, mount in gangs under common plate.
D. Occupancy Sensors:
1. Passive infrared and dual technology occupancy sensors shall be installed where shown. Power packs shall be included as necessary for an operational system. Sensors shall be appropriately selected for the room size and type intended.
2. Wall mounted switch sensors shall be equal to Watt-Stopper WA-200 series.
3. Ceiling mounted sensors shall have 360 degree coverage, shall be dual technology infrared and ultrasonic, and shall be equal to Watt-Stopper DT-300 series.

4. All sensors shall be set to turn off lights if movement is not detected for 30 minutes.
5. Sensors shall be field located for best detection of movement within the space intended.
6. Line voltage occupancy sensors shall not be used.
7. Each ceiling mounted sensor shall include an auxiliary low voltage contact for use by the mechanical energy management system. If an auxiliary contact is not available with a ceiling mounted sensor, the power pack shall include the additional contact.

E. Plates:
1. Plates for convenience outlets and wall switches shall be specification grade smooth nylon or stainless steel as selected by the Architect.
2. Plates for empty junction boxes that occur in a finished area shall match above. Use device straps on boxes as required to install these plates.
3. Covers for outdoor receptacles shall be rated for wet location when in use. Hinges shall be installed on top.

2.7 Lighting Fixtures:

A. Furnish and install lighting fixtures, including proper lamps, as specified in Fixture Schedule on the Drawings.
B. All recessed fixtures shall be complete with appropriate frames and installed in complete cooperation with the air conditioning and ceiling contractors so as to secure a completely coordinated installation.
C. If lighting fixtures are ordered with factory mounted fixture whips, those whips shall be #12 AWG copper conductors minimum in lengths of 72 inches or less. Fixture whips made in the field shall also be #12 copper minimum.
D. All lamps shall have a color rating of 4000 degrees Kelvin unless noted otherwise on the fixture schedule.
E. All lamps shall have a minimum color rendering index of 82 unless noted higher on the fixture schedule.
F. The lumen output and fixture wattage listed in the fixture schedule are the basis of design. When equal, alternative fixtures are SPECIFICALLY listed as considered in the fixture schedule notes, those alternative fixtures shall have a lumen output of between 95% and 110% of the specified fixture.
G. The Contractor shall furnish and install lamps with type and sizes shown in the Fixture Schedule. Lamps shall be General Electric, Sylvania, or Phillips.

2.8 Safety Switches:

A. Safety switches shall be Type "HD" (heavy duty) unless noted otherwise, fused or non-fusible as indicated with number of poles as shown or required. Safety switches for equipment may be non-fused only if equipment is UL tested with circuit breaker protection.
B. Switches shall be rated 250 volts or 600 volts as required.
C. Switch enclosures shall be of the NEMA configuration required (i.e. NEMA 1 for general purpose, NEMA 3R for raintight, etc., as required or shown).
D. Disconnect switches shall be provided for all motors and equipment indicated or required by the National Electric Code.
E. Safety switches shall be provided by the same manufacturers as the panelboards.

2.9 Dry-Type Transformers:

A. Dry-type transformers shall be furnished and installed as indicated on the drawings. Unless indicated otherwise, transformers shall be rated for 150 degree rise with aluminum windings. Lower temperature rise transformers and copper windings will be allowed.
B. Provide sufficient clearance around each transformer as required by the manufacturer. Provide sufficient working space clearance as required by the NEC.
C. Where grounded wye transformers are used, the neutral conductor and the equipment grounding conductor shall be bonded as a separately derived system. Provide a grounding electrode conductor as indicated on the drawing.
D. Final conduit connections to transformers shall be with flexible conduit to allow for transformer vibration.
E. When transformers are located in areas of potential water accumulation on the floor, concrete housekeeping pads shall be provided.
F. When transformers are wall mounted, provide sufficient bracing necessary.
G. Transformers shall be provided by the same manufacturer as the panelboards.

2.10 Motors, Controls, and Control Wiring:
A. All motors shall be furnished and installed under Division 23, MECHANICAL, but shall be electrically connected for correct rotation under this section.
B. Controllers shall be furnished under Division 23, MECHANICAL, unless noted otherwise herein or on the Drawings, but shall be mounted and electrically connected for correct operation under this section (except starters which are included as an integral part of the specific equipment).
C. All control wiring shall be furnished and installed under Division 23, MECHANICAL, unless noted otherwise herein or on the Drawings.
D. Provide empty conduit from thermostats to mechanical units. Provide outlet box for thermostat mounting. Coordinate with mechanical for locations.
E. Manual starters (motor snap switches) shall be provided under this section for all fractional motors 1/8 HP or greater. Starters shall include thermal overload element for motor protection and shall be equal to Square D Type F.

2.11 Relays, Contactors, Timeclocks, and Photocells:
A. Relays and contactors shall be electrically operated, electrically or mechanically held as necessary. They shall be mounted in a NEMA-1 enclosure ad shall be of the rating and type as indicated on the Drawings. They shall be capable of switching inductive and resistive loads.
B. Timeclocks shall be digital with battery backup.
C. Photocells shall be rated for a minimum of 1800 watts, rated for the voltage and fixture type connected, shall be hardwired and shall be equal to Intermatic model K4136M.

2.12 Surge Protective Devices
A. Provide surge protective devices (SPD) as shown on the drawings and specified herein.
B. Surge protection devices shall be installed in accordance with the National Electrical Code. Products shall be configured for parallel installation - series designs are not acceptable. Products shall be mounted as close as possible to the associated panel with minimum wire lengths and no sharp wire bends.

C. Service entrance surge suppression shall have a maximum single withstand rating per phase of 200,000 amps. The suppression unit shall be rated 120/208 volt, 3 phase, 4 wire Wye and shall have a UL1449 clamping level of 400 volts. The SPD and associated hardware shall be listed to UL 1449 (3rd Edition), as defined by ANSI/NFPA 70. The SPD shall be mounted in a NEMA 1 enclosure.
D. Branch circuit surge suppression (480 volt) shall be rated for a minimum of 160,000 amps peak current per phase at 277/480 volts, shall have voltage protection levels of 1200V (L-N) and 1200V (N-G) for ANSI/IEEE C62.41-1991 B3/C1 test category, shall have EM1/RFI filtering, and shall be UL 1449, Third Edition listed.
E. Branch circuit surge suppression (208 volt) shall be rated for a minimum of 80,000 amps peak current per phase at 120/208 volts, shall have voltage protection levels of 800V (L-N) and 700V (N-G) for ANSI/IEEE C62.41-1991 B3/C1 test category, shall have EM1/RFI filtering, and shall be UL 1449, Third Edition listed.
F. Unless noted otherwise, surge protective devices shall be mounted external to the associated panelboard.
G. Standard size overcurrent protection has been shown for connecting the surge protective devices. If a specific manufacturer requires something other than the standard that is shown, the appropriately sized breaker shall be installed.
H. Suppressors shall be as manufactured by Wiremold, Innovative Technologies, Cutler-Hammer, Intermatic, Mersen (Ferraz-Shawmut), Square D, General Electric, APT, Siemens, LEA, Surge Suppression Incorporated, or approved equal.

2.13 Telephone/Data Systems

A. Provide outlet boxes and conduit stub-outs as shown for telephone/data outlets.
B. Cabling will be provided by the Owner under separate contract.
C. Provide plastic bushings on conduit ends.
D. Conduit shall be 3/4" EMT minimum.

2.15 Cable Tray System:

A. Install the Owner supplied steel wire basket type cable tray as indicated. The parts being supplied by the Owner do not include any supports or connectors.
B. Provide proper supports and splice connectors as needed to provide a rated load of 26 pounds/foot.
C. Provide ground bonding using split bolt connectors for each isolated section of tray. Provide connection plates between tray sections that act as bonding jumpers.
D. Provide a bolted connection to every conduit stub-out.
E. Where the tray is field cut for bends or obstructions, provide additional supports as necessary to maintain structural integrity.
F. Where a tray run is interrupted by a fire rated wall, steel conduits shall be installed through the wall. Conduits shall be sized to provide equivalent capacity of the tray fill.
G. Provide appropriate ground bonding of each run of metallic cable tray.

PART 3 — EXECUTION

3.1 Grounding:

A. Grounding system shall meet all requirements of Article 250 of the National Electrical Code. In general, a ground wire shall be installed in every conduit. The conduit installation itself shall serve as an additional grounding means.

B. All grounding conductors shall be copper. Sizes No. 10 AWG and smaller shall be provided with a green colored insulation. Sizes No. 8 AWG and larger shall be marked with green tape. Grounding conductors shall be marked at each pull box, enclosure, starter, disconnect switch, panelboard, etc.

C. The main service ground shall consist of a grounding electrode conductor, protected by rigid galvanized conduit as needed, and sized as shown on the Drawings. Service grounding shall be as follows:
   1. The grounding electrode conductor shall extend from the main ground bus in the service entrance equipment to the main metallic cold water pipe (where available). Water pipe connection shall be with a ground fitting that bonds both conduit and conductor to the water pipe. Pipes shall be thoroughly cleaned before ground fittings and clamps are installed.
   2. The grounding electrode shall be connected to the building structural steel.
   3. The grounding electrode shall also be bonded to the building sprinkler system (where available). The sprinkler system is not intended to be considered a bonding electrode.
   4. In addition to the ground system described above, a supplementary ground system shall be installed consisting of a copper conductor, sized the same as the main grounding conductor, extending from the main ground bus to two (2) 5/8" x 10' copper clad steel ground rods spaced a minimum of 6’ apart.
   5. The grounded conductor (neutral) bus and the equipment ground bus shall be connected at the supply side of the main secondary circuit breakers in accordance with the National Electrical Code. The service entrance panel shall be provided with a neutral disconnecting means and a separate bonding strap on the line side of the neutral.

D. Provide grounding for entire electric installation as indicated and specified herein. Following are included as requiring grounding:
   1. Conduits and other conductor enclosures.
   2. Neutral or identified conductor of interior wiring system at each service and at each separately derived system.
   3. Lighting panel boards, control centers, etc.
   4. Non-current-carrying metal parts of fixed equipment such as motors and lighting fixtures.
   5. Grounding screw for every receptacle and switch.

E. The required grounding conductor shall be installed in the common conduit with the related phase and neutral conductors. Where there are parallel feeders installed in more than one raceway, each raceway shall have a ground conductor.

F. Where metallic conduits terminate without mechanical connection (i.e. locknuts and bushings) to service entrance equipment and for all sizes of metallic conduit (rigid or flexible) terminating in concentric or eccentric knockouts, the following procedure shall be followed: Each conduit shall be provided with an insulating ground bushing and each bushing connected with a bare copper conductor to the ground bus in the electrical equipment. The ground conductor shall be in accordance with the article on Grounding of NEC.

3.2 Interior Wiring:

A. General:
   1. Interior wiring shall include electrical conduits, conductors, wiring devices, supports, other materials and their installation, required to distribute electric current from distribution centers for all purposes, as indicated and specified.

2. Conduit runs as indicated are diagrammatic; exact routing of conduit shall suit job conditions. Where conduits are exposed, they shall be installed in a neat manner.
3. Roughing-in dimensions of electrically-operated units will be furnished by trades supplying the same. Set conduit boxes for connecting to units only after receiving approved dimensions and after checking locations with Contractors.
4. All wiring shall be protected from painting. Any wiring where the color coding is unreadable due to paint shall be cleaned before final inspection
5. When installing receptacle outlets, devices shall be oriented with the grounding prong in the same direction throughout the project. Local jurisdiction requirements shall apply to orientation.
6. Back-wiring of receptacles is not acceptable. Connections must be made to screw posts. The grounded conductor (neutral) shall not depend on the connection of a receptacle to complete the circuit (i.e. The two screws of a receptacle neutral shall not be used to splice the neutral).
7. All wiring shall be tested with Meggar-type equipment before final inspection. Testing shall consist of applying 1000 volts across each conductor to check for short circuits and torn insulation.
8. Junction boxes shall be solidly fastened to the building structure. Boxes shall not be solely supported by conduit.
9. Low voltage cabling that is routed above the ceiling and not within conduit shall be properly supported so that it does not lay on a ceiling grid or ceiling tiles.

B. Interior Conduit Installation:
1. Extend conduits from distribution center through pull and junction boxes, panelboards to outlet boxes; bond throughout to make each circuit continuous from service to outlet.
2. Install conduits in wall, above ceilings, or under floors as shown.
3. Locate conduits in partitions accurately so as to conceal them completely; do not expose conduit bends at floor.
4. Install conduit in walls and partitions as nearly vertical as possible; horizontally only where unavoidable; never diagonally.
5. Make field bends and offsets uniform and symmetrical, without flattening conduit or scarring conduit finish; of minimum radius not less than six (6) times the diameter of the conduit.
6. Where plastic (PVC) conduit is used, all field bends must be made with Hotbox type bends. A torch shall not be used to heat conduit for bending.
7. Install conduit with minimum number of joints; join with approved couplings and fittings; make joints butted.
8. Cut conduit with hacksaw or approved pipe cutter using cutting knives; ream ends to remove burrs and sharp edges.
9. In damp locations, install conduit, fittings, boxes of type and manner to prevent moisture from entering conduit system.
10. Cap or plug conduit ends during construction; cap or plug ends of conduit that are to remain empty after test; make watertight.
11. Locate conduits at least 6" from steam pipes, hot water pipes, or other hot surfaces.
12. Do not pull wires before conduit and outlet boxes are permanently secured in place or before building roof is installed.
13. Support each conduit within 36 inches of junction and outlet boxes. Fastening of unbroken lengths of EMT shall be permitted to increase to 60 inches where structural members do not readily permit fastening within 36 inches.

14. Any conduit that stubs above ceiling without termination into a junction box shall have a plastic bushing permanently installed.
15. All empty conduits shall have a nylon pull cord.
16. Provide a minimum of two (2) spare ¾" conduit stub-ups from each recessed panelboard.
17. Provide metallic conduit sleeves for all low voltage cables that penetrate fire rated barriers.
18. Where raceways contain 4 AWG or larger conductors, insulated fittings shall be used at every cabinet, box, or enclosure in accordance with NEC 300.4(G) requirements.
19. Flexible conduit and MC cable shall be properly supported in such a way that it does not lay on the ceiling grid or ceiling tiles.

3.3 Outlet Locations:

A. Indicated outlet locations are approximate. Consult details, sections, and elevations of Contract Drawings and roughing-in drawings of electric consuming equipment in order to determine exact locations.
B. In locating outlets, allow for overhead pipes, ducts, other obstructions; also, for variations in thickness of fire-proofing, sound-proofing, plastering.
C. Where rows of ceiling outlets occur, align them carefully.
D. Take care in locating wall outlets with regard to paneling, door and window trim; center them accurately.
E. Where switch is indicated at door, locate its outlet at strike side of door, unless specified otherwise.
F. Locate wall outlets of same type at same level above floor except where otherwise directed.
G. Locate outlets at following distances from finished floor to center of outlet, unless otherwise indicated:
   Wall switches: 4'-0" (to center of box, maximum).
   Convenience outlets in finished rooms: 1'-6" or as shown.
   Thermostat: As shown on HVAC plans.
   1. Note: Where outlet or switch boxes are to be installed in concrete block wall, adjust height, if necessary, to make top of box be in mortar joint.
H. Outlets shall be connected to branch circuits as indicated on drawings by circuit number adjacent to outlet symbols. No more outlets than are indicated shall be connected to a circuit unless authorized in writing by the project Engineer.

3.4 Identification:

A. Equipment identification shall be made using engraved laminated phenolic or Micarta plates (indented tape labels will not be permitted). Characters shall be white on a black background and 1/4" high minimum. Plates shall be secured to the panels by means of screws or metal pressure pins. Cement, by itself, will not be acceptable. All nameplates shall be mounted on the outside surface of the piece of equipment.
B. Panelboards shall be identified indicating panel designation from the Drawings, electrical characteristics and source in accordance with NEC 408.4(B). For example, a 120/208 volt 3 phase panel designated "LPA" and served from panel “MPA” shall be labeled as follows:

   LPA
   120/208V, 3 PH

Fed from MPA

C. Service entrance panels and distribution panels without doors shall also have each circuit identified as to circuit number, load, and electrical characteristics of loads. For example, a 5 Ton, 208 volt, 3 phase condensing unit number 3 would be labeled as follows with the plate attached adjacent to the circuit:

CU-3
5 Ton, 208V, 3 PH

D. Each junction box cover shall be labeled with a permanent "magic" marker or other means to identify the circuits within. For example, a junction box containing lighting circuits 21, 23, 25 from panel "L2A" would be labeled "L2A-21, 23, 25". Telephone junction boxes shall be labeled "T". Fire alarm, public address, and other system junction boxes shall be labeled accordingly.

E. All conductors shall be color coded as identified in Paragraph "Conductors". Branch circuit conductors in lighting and appliance panels shall be marked with circuit number.

3.5 Fireproofing: All conduit and boxes passing through or installed within fire walls and smoke walls shall be installed so as to maintain the integrity of the wall through which it passes. Fire barrier penetrations shall be made in accordance with a UL listed assembly. Boxes shall be installed within 1/4" of wall surface. Metallic conduit sleeves shall be provided for every cable penetration through a fire rated barrier.

3.6 Clean-up: When the job is complete in every detail and building is ready for occupancy, the Contractor shall make a careful examination of all areas and see that all are in first class condition, all equipment working properly, and that all equipment and fixtures are properly cleaned, leaving all apparatus in first class condition. He shall remove all boxes, trash, etc., pertaining to his contract from the job site.

END OF SECTION 26 00 00

SECTION 28 31 00 — FIRE ALARM AND DETECTION SYSTEM

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work: Provide all labor, materials, equipment and services required for complete installation of fire alarm and detection system indicated on Drawings and specified herein.

1.3 System Description:

A. System shall be an addressable, supervised, non-coded automatic fire alarm system consisting of control panel, power supplies, addressable alarm initiating devices, alarm indicating devices, and off-site communicating devices.

B. Class “B” signaling line circuits and Class “B” indicating device circuits including end-of-line devices.

C. Performance Requirements:

1. Operation of manual station or automatic activation of any smoke detector shall:
   a) Cause system evacuation devices to operate.
   b) Indicate device in alarm on control panel.
   c) Initiate off-site alarm notification system.
   d) Shut-down appropriate air handling units.
2. System shall return to normal when operated device is returned to normal and control panel is manually reset, except alarms may be silenced as specified below.
3. Strobe light flash rate shall be synchronized.
4. Alarm may be silenced by switch in control panel.
   a) Ring Back Feature: When silenced, this shall not prevent the resounding of subsequent alarms if another zone should alarm.
5. When alarms are silenced, device indicating display on control panel shall remain on until operated device is returned to normal and control panel is manually reset.
6. Green pilot LED shall normally be on indicating that system is receiving normal power. Failure of normal power shall cause this LED to extinguish.
7. Amber trouble LED and trouble alarm, operating together, shall signal trouble condition.
   a) Following conditions shall signal trouble condition:
      (1) Failure of normal power.
      (2) Opens or short circuits on indicating circuits.
      (3) Disarrangements in system wiring.
      (4) Control panel circuit board removal.
      (5) Ground faults.
8. Trouble silencing switch shall silence trouble alarm which shall be arranged so trouble LED shall remain lit until system is restored to normal. As ring-back feature, trouble alarm shall resound as reminder to return silencing switch to normal position. Supervisory display, separate from trouble LED, and alarm, operating together, shall

signal operation of supervisory device, such as control valve tamper. Alarm silence switch shall operate in same manner as trouble alarm.
a) Following conditions shall signal supervisory trouble condition:
(1) Carbon Monoxide Detection.

1.4 Submittals:
A. Shop Drawings:
1. Shop drawings shall be prepared by authorized factory representative and include:
a) Wiring floor plan of system showing cable requirements and routing.
b) Manufacturer's original catalog data and descriptive information on each piece of equipment to be used.
c) Manufacturer's data on integral surge protection.
B. Instruction Manual: Provide instruction manual from Manufacturer which explains what is to be done in the event of various indications.

1.5 Quality Assurance:
A. Regulatory Requirements:
1. The system shall by installed by Certified Alarm Company as a sub-contract to the Electrical Contractor.
2. Equipment, devices, and cable shall be UL or Factory Mutual listed for use in fire alarm systems.
3. The installing Contractor shall have an active Certified Fire Alarm Contractor Permit as issued by the State of Alabama Department of Insurance Fire Marshal's Office.
4. The system shall be installed in accordance with the Alabama Certified Fire Alarm Act.

1.6 Owner's Instructions: Instruct Owner's representative in proper operation and maintenance procedures.

PART 2 — PRODUCTS

2.1 Approved Manufacturers:
A. Bosch

2.2 Components:
A. Equipment and accessories furnished under terms of this Specification shall be standard products of single manufacturer or include written statement by Control Panel Manufacturer confirming compatibility of components and inclusion of these components under system warranty.
B. Control Panel:
1. Listed under UL standard 864.
2. Solid state modular design with flush or semi-flush mounting.
3. Control functions shall be behind locked door with annunciating devices visible through the door. Single key shall operate all keyed functions in system including manual pull-stations. Provide a minimum of three keys.
4. Each device shall be electrically supervised in accordance with wiring style specified.
5. Provide integral surge protection.
6. Make provisions for connection to off-site alarm notification system. Provide separate dry contacts for alarm and supervisory/trouble alarms.

7. Power Supply:
    a. Provide green LED indication of normal power supply.
    b. Loss of normal power shall activate trouble alarm.
    c. Meet requirements of and size in accordance with UL Standard 1481 and NFPA 72.
    d. Include standby batteries, charger, and automatic transfer equipment.
8. Visual Annunciation:
    a. Separate indication on each device for alarm, trouble, or supervisory conditions.
    b. Visual indication shall be by crystal display or other easily identifiable method.
    c. Device names, not numbers, shall be programmed into the control panel in a logical manner.
    d. Fault or trouble condition on any zone shall not affect any other zone.
9. Audible Horn Alarm Annunciation:
    a. Provide separate and distinct alarm signals for alarm and trouble conditions.
    b. Alarm signal shall also operate strobe lights.
    c. Provide alarm silence switches at control panel.
    d. Trouble alarm shall be horn integral to control panel.
    e. Supervisory alarm may be same audible alarm as trouble alarm, but with separate visual annunciation.

C. Remote Annunciation:
1. Provide remote annunciation and control panels where indicated. Provide a power supply as needed.
2. The annunciator(s) shall indicate devices that are in alarm and shall be capable of re-setting the system.

D. Off-Site Alarm Notification System:
1. Provide Halo radio communication as an off-site monitoring method.

E. Alarm Initiating Devices:
1. Automatic Smoke and Heat Detectors:
    a. Photoelectric type duct smoke detectors shall be provided here but installed by persons skilled in that trade under Division 23.
        (1) Each duct mounted smoke detector shall have a remote indicating and test plate. Test plates shall be mounted flush with the ceiling or wall in an accessible location.
        (2) Duct smoke detectors installed for supply air systems shall be carefully installed such that condensation will not cause system faults.
        (3) Duct mounted smoke detectors shall be powered through the fire alarm system and shall either provide an alarm signal or a supervised trouble signal as allowed by the local Authority Having Jurisdiction.
        (4) HVAC unit shutdown wiring shall be provided under Division 23. All other wiring for duct smoke detectors shall be provided under this specification section.
    b. Ceiling mounted smoke detectors shall be provided and installed here. Ceiling mounted detectors shall be photoelectric type.
    c. Smoke detectors associated with elevator recall shall have auxiliary contacts or relays as necessary for elevator recall and shall be appropriately connected. Coordinate with the elevator installer.
    d. Ceiling mounted heat detectors shall be rate-of-rise type.
    e. Heat detectors associated with early activation prior to elevator shaft sprinkler heads shall be rated with lower temperature threshold than the sprinkler heads.

Where indicated, heat detectors shall have auxiliary contacts or relays as necessary to shunt power to the elevator and shall be appropriately connected.

f. Smoke detectors located within elevator shafts shall be appropriately rated for dirty environments and shall not require periodic cleaning as frequently as normal ceiling mounted detectors.

2. Manual Fire Alarm Boxes:
   a. Non-coded and double-action requiring two actions to initiate alarm. Breakable glass type are not approved.
   b. Box shall mechanically latch when actuated and require key to reset. Key shall match control panel door lock.
3. Carbon Monoxide Monitoring:
   a. Provide Carbon Monoxide alarm connections as indicated.
   b. The detectors shall be powered and supervised by the fire alarm system.
   c. Detectors shall operate in accordance with the mechanical Sequence of Operation.

F. Alarm Indicating Devices:
1. Combination Horn/Strobe:
   a. Wall mounted flush or semi-flush.
   b. Non-coded audible output of 90 dB minimum at 10 feet.
   c. Integrally mounted flashing light unit with block letters 'FIRE'. Minimum light intensity of 75 candela and flash rate between one and three Hertz.
   d. Listed under UL Standards 464 and 1971 and compliant with A.D.A. requirements.
   e. Mount 6’-8” above finished floor, or 6” below ceiling, whichever is lower.
   f. Audio & visual devices installed outdoors shall be rated for wet location.
2. Strobe:
   a. Same as requirements above for Combination Horn/Strobe but without audible requirements. Mount 6'-8" above finished floor, or 6" below ceiling, whichever is lower.

G. Transient Voltage Surge Suppression:
1. Provide surge suppression on each end of every conductor routed outside the building walls. Bond the surge suppression to the nearest grounded structure (building steel, metal conduit, or panelboard ground bus).
2. Surge suppression shall be made accessible.
3. Surge suppression shall be equal to those manufactured by Ditek.

PART 3 — EXECUTION

3.1 Installation:

A. Install fire alarm and detection systems as indicated, in accordance with equipment manufacturer's written instructions, and complying with applicable portions of NEC, NFPA and NECA's "Standard of Installation".

B. Program addressable point indicators in control unit indicating location and type of initiating device, i.e., HEAT PUMP #1 SMOKE, WAITING ROOM PULLSTATION, BREAKROOM SMOKE, etc.

C. Provide conduit stub-outs for wall mounted equipment and any location where cables are exposed (such as equipment rooms). Provide conduit sleeves where cables penetrate walls. Plenum rated cables may be used above ceilings.

1. Fire alarm system conductors from different devices may be combined in common conduit. Make certain that raceway size and wire quantity, size, and type are suitable for equipment supplied and is within NEC standards.
2. Label pull and junction boxes “F” with permanent marker.
3. All cable splices shall be located within junction boxes.

D. Well grounded Ditek type surge protection shall be installed on every conductor that connects to a device outside the building walls.
E. Loop wires through each device on zone for proper supervision. Tee-taps are not permitted unless specifically allowed in writing by the manufacturer.
F. Provide dust protection for installed smoke detectors until finish work is completed and building is ready for occupancy.
G. Protect conductors from cuts, abrasion and other damage during construction.
H. Minimum conductor size shall be 14 AWG unless otherwise specified or recommended by the manufacturer.
I. Do not install manual fire alarm boxes close to light switches.
J. Post copy of wire identification list inside fire alarm panel door or other area accessible to fire alarm service personnel.

3.2 Field Quality Control:

A. Manufacturer's Field Service:
   1. Provide factory trained representative to perform complete system testing in presence of Owner's representative and local fire department personnel upon completion of installation.
      a) Test each initiating and annunciating device for proper operation.
      b) Test operation of trouble annunciation on each circuit.
      c) Perform complete testing of control panel functions.
   2. Provide one (1) can of testing smoke to the project electrical engineer.

B. Certification and Warranty:
   1. Manufacturer’s technician shall provide written certification that the system is operational and meets requirements of NFPA 72 and the specifications. NFPA 72 “Record of Completion” form shall be used and submitted.
   2. Provide one (1) year on-site warranty of the system installed under this contract. Warranty shall include all parts, labor, and travel.

END OF SECTION 28 31 00

SECTION 31 10 00 — SITE CLEARING

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:

A. Provide all labor, materials, equipment and services required to complete all site clearing indicated on Drawings and specified herein.
   1. Clearing and grubbing.
   2. Stripping and stockpiling topsoil.
   3. Removing above- and below-grade site improvements.
   4. Disconnecting, capping or sealing, and abandoning site utilities in place.
   5. Temporary erosion and sedimentation control measures.

B. Related Work Specified Elsewhere: Section 31 20 00 – Earth Moving.

1.3 Definitions:

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 Material Ownership:

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 Submittals:

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

B. Record drawings, according to Division 1 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 Quality Assurance:

A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.7 Project Conditions:
- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
  1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
  1. Do not proceed with work on adjoining property until directed by Architect.
- C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place and if required by site size, an NPDES Permit.

PART 2 — PRODUCTS (Not Applicable)

PART 3 — EXECUTION

3.1 Preparation:
- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
  1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 Utilities:
- A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
  1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
  1. Arrange with utility companies to shut off indicated utilities.
  2. Owner will arrange to shut off indicated utilities when requested by Contractor.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  1. Notify Architect not less than two days in advance of proposed utility interruptions.
  2. Do not proceed with utility interruptions without Architect's written permission.
- D. Excavate for and remove underground utilities indicated to be removed.
- E. Removal of underground utilities is included in Division 2 Sections covering site utilities.
- F. If possible, relocated utilities should be in place and on line prior to removal of existing conflicting utilities.

3.3 Clearing and Grubbing:

A. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.

3.4 Topsoil Stripping:

A. Remove sod and grass before stripping topsoil.
B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.
C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Limit height of topsoil stockpiles to 96 inches.
   2. Do not stockpile topsoil within tree protection zones.
   3. Dispose of excess topsoil as specified for waste material disposal.
   4. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.
   5. Stockpiles are to be surrounded by Silt Fence.

3.5 Site Improvements:

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
   2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.6 Disposal:

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
   1. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

3.7 Temporary Erosion and Sedimentation Control:

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control Drawings and in accordance with requirements of authorities having jurisdiction, whichever is more stringent.
B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END OF SECTION 31 10 00

SECTION 31 20 00 — EARTH MOVING

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all labor, materials, equipment and services required for complete installation of all earth moving indicated on Drawings and specified herein.
- B. Summary: This Section includes the following:
  1. Preparing of subgrade for building slabs, walks, and pavements.
  2. Excavating and backfilling of trenches within building lines.
- C. Related Work Specified Elsewhere: Section 31 10 00 - Site Clearing.

1.3 Definitions:
- A. Excavation consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.
- B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be at Contractor's expense.
  1. Under footings, fill unauthorized excavation by extending indicated bottom elevation of footing to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Architect.
- C. Additional Excavation: When excavation has reached required subgrade elevations, notify Architect, who will make an inspection of conditions. If Architect determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by Architect. The Contract Sum may be adjusted by an appropriate Contract Modification.
- D. Subgrade: The undisturbed earth or the compacted soil layer immediately below drainage fill, building pads or traffic areas.
- E. Structure: Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.
- F. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

1.4 Submittals:
- A. Test Reports: Submit the following reports directly to Architect from the testing services, with copy to Contractor:
  1. Test reports on borrow material.
  2. Verification of suitability of each footing subgrade material, in accordance with specified requirements.

3. Field reports; in-place soil density tests.
4. One optimum moisture-maximum density curve for each type of soil encountered.

1.5 Quality Assurance:

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

B. Testing and Inspection Service: Contractor shall employ and pay for a qualified independent geotechnical testing laboratory to perform soil testing and inspection service during earthwork operations.

C. Testing Laboratory Qualifications: To qualify for acceptance, the geotechnical testing laboratory must demonstrate to Architect's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct required field and laboratory geotechnical testing without delaying the progress of the Work. The testing laboratory shall employ on staff at least one registered engineer with experience in geotechnical engineering. The laboratory will provide a soils technician who has ACI and NRC certification. The laboratory will have a currently employed soils technician who is N.I.C.E.T. certified and has experience in asphalt testing.

1.6 Project Conditions:

A. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.

1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
2. Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Architect and then only after acceptable temporary utility services have been provided.

B. Use of Explosives: Do not bring explosives onto site or use in work without prior written permission from authorities having jurisdiction.

C. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

1. Operate warning lights as recommended by authorities having jurisdiction.
2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

PART 2 — PRODUCTS

2.1 Soil Materials:

A. Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT.

B. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP.

C. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, and natural or crushed sand.

D. Backfill and Fill Materials: Satisfactory soil materials free of clay, rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.

PART 3 — EXECUTION

3.1 Excavation:

A. Excavation Classifications: The following classifications of excavation will be made when rock is encountered.
   1. Earth excavation includes excavation of pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as rock or unauthorized excavation.
   2. Rock excavation for trenches and pits includes removal and disposal of materials and obstructions encountered that cannot be excavated with a track-mounted power excavator. Trenches in excess of 10 feet in width and pits in excess of 30 feet in either length or width are classified as open excavation.
   3. Rock excavation in open excavations includes removal and disposal of materials and obstructions encountered that cannot be dislodged and excavated with modern, track-mounted, heavy-duty excavating equipment without drilling, blasting, or ripping.
      a) Typical of materials classified as rock are boulders 1/2 cu. yd. or more in volume, solid rock, rock in ledges, and rock-hard cementitious aggregate deposits.
      b) Intermittent drilling, blasting, or ripping performed to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation.

B. Do not perform rock excavation work until material to be excavated has been cross-sectioned and classified by Architect. Such excavation will be paid on basis of Contract Conditions relative to changes in work.

C. Rock payment lines are limited to the following:
   1. Two feet outside of concrete work for which forms are required, except footings.
   2. One foot outside perimeter of footings.
   3. In pipe trenches, 6 inches below invert elevation of pipe and 2 feet wider than inside diameter of pipe, but not less than 3 feet minimum trench width.
   4. Outside dimensions of concrete work where no forms are required.
   5. Under slabs on grade, 6 inches below bottom of concrete slab.

3.2 Stability of Excavations:

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.

B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progress.

3.3 Dewatering: Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.

3.4 Storage of Excavated Materials: Stockpile excavated materials acceptable for backfill and fill where directed. Place, grade, and shape stockpiles for proper drainage.

3.5 Excavation for Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection.

A. Excavations for footings and foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.

3.6 Trench Excavation for Pipes and Conduit: Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches of clearance on both sides of pipe or conduit.

3.7 Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.8 Backfill and Fill:

A. General: Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials specified in Part 2 of this Section.
   1. Under walks and pavements, use subbase material, satisfactory excavated or borrow material, or a combination.
   2. Under steps, use subbase material.
   3. Under piping and conduit and equipment, use subbase materials.
   4. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.

B. Backfill excavations as promptly as work permits, but not until completion of the following:
   1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
   2. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.
   3. Removal of concrete formwork.
   4. Removal of trash and debris from excavation.
   5. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.9 Placement and Compaction:

A. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.
   1. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize,

moisture-condition to optimum moisture content, and compact required depth and percentage of maximum density.

B. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

C. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures by carrying material uniformly around structure to approximately same elevation in each lift.

D. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Architect if soil density tests indicate inadequate compaction.

1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density, in accordance with ASTM D 698 (Standard Proctor):
   a) Under structures, building slabs and steps, and pavements, compact top 12 inches of subgrade and each layer of backfill or fill material at 98 percent maximum density. Compact top 6 inches under pavements to 100% maximum density.
   b) Under lawn or unpaved areas, compact top 6 inches of subgrade and each layer of backfill or fill material at 85 percent maximum density.
   c) Under walkways, compact top 6 inches of subgrade and each layer of backfill or fill material at 95 percent maximum density.
2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material.
   a) Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

3.10 Grading:

A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes.

C. Grading Surface of Fill Under Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation.

3.11 Field Quality Control:

A. Quality Control Testing During Construction: Allow testing service to inspect and approve each subgrade and fill layer before further backfill or construction work is performed.
   1. Perform field density tests in accordance with ASTM D 2922-81 (Nuclear method).

B. Footing Subgrade: For each strata of soil on which footings will be placed, perform at least one test each 10 linear feet of footing and one test per isolated footing to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata when acceptable to Architect. Testing is to be done as per ASTM STP 399 - Cone Pentrometer.

C. Paved Areas and Building Slab Subgrade: Perform at least one field density test of subgrade for every 2,000 sq. ft. of paved area or building slab.
   1. In each compacted fill layer, perform one field density test for every 2,000 sq. ft. of overlaying building slab or paved area.
   2. If in opinion of Architect, based on testing service reports and inspection, subgrade or fills that have been placed are below specified density, perform additional compaction and resting until specified density is obtained.

3.12 Erosion Control: Provide erosion control methods in accordance with requirement of authorities having jurisdiction.

3.13 Maintenance: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

3.14 Disposal of Excess and Waste Materials: Removal from Owner's Property: Remove excess excavated material, waste materials, trash, and debris, and dispose of it legally off Owner's Property.

END OF SECTION 31 20 00

SECTION 31 31 16 — TERMITE CONTROL

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work: Provide all labor, materials, equipment and services required for termite control herein specified.

1.3 Submittals:
- A. Product Data: Treatments and application instructions, including EPA-Registered Label.
- B. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- D. Soil Treatment Report: After application of termiticide is completed, submit report for Owner's records information, including the following as applicable:
  1. Date and time of application.
  2. Moisture content of soil before application.
  3. Brand name and manufacturer of termiticide.
  4. Quantity of undiluted termiticide used.
  5. Dilutions, methods, volumes, and rates of application used.
  6. Areas of application.
  7. Water source for application.
- E. Warranties: Special warranties specified in this Section.

1.4 Quality Assurance:
- A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.
- B. Regulatory Requirements: Formulate and apply termiticides according to the EPA-Registered Label.
- C. In addition to requirements of these Specifications, comply with manufacturer's instructions and recommendations for work, including preparation of substrate and application.

1.5 Project Conditions:
- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

1.6 Coordination:
A. Coordinate soil treatment application with excavating, filling and grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

1.7 Warranty:
A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
B. Special Warranty: Written warranty, signed by applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
1. Warranty Period: Five years from date of Substantial Completion.

1.8 Maintenance Service: Provide a proposal for continuing service, including monitoring, inspection, and retreatment for occurrences of termite activity, from applicator to Owner, in the form of a standard yearly (or other period) continuing service agreement, starting on the date of Substantial Completion. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 — PRODUCTS

2.1 Manufacturers: Subject to compliance with requirements, provide termiticide products by one of the following:
A. BASF Corporation, Agricultural Products; Termidor.
B. Bayer Environmental Science; Premise 75.
C. FMC Corporation, Agricultural Products Group; Dragnet FT.
D. Syngenta; Demon TC.

2.2 Soil Treatment:
A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.
B. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five (5) years against infestation of subterranean termites.

PART 3 — EXECUTION

3.1 Examination: Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.
A. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 Preparation:

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer.

1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 Application, General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 Applying Soil Treatment:

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute the treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Adjacent soil including soil along entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers, piers, and chimney bases; and along entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
3. Crawlspaces: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platforms, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
4. Masonry: Treat voids.
5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 31 31 16

SECTION 32 12 16 — ASPHALT PAVING

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all labor, materials, equipment and services required for complete installation of asphalt paving indicated on Drawings and specified herein.
- B. Related Work Specified Elsewhere: Section 31 10 00 - Site Clearing and Section 31 20 00 – Earth Moving.

1.3 Job Conditions:
- A. Weather Limitations:
  1. Apply prime and tack coats when ambient temperature is above 40 degrees F. and when temperature has not been below 35 degrees F. for twelve hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.
  2. Construct asphalt concrete surface course only when atmospheric temperature is above 40 degrees F and when base is dry. Base course may be placed when air temperature is above 35 degrees F and rising.
- B. Grade Control: Establish and maintain required lines and elevations.

1.4 Quality Assurance:
- A. Installer Qualifications: Engage an experienced Installer ("Paver") to perform asphalt concrete paving work who has a minimum of 5 years experience in the installation of asphalt concrete paving work similar in size and scope to that required for this project. Hot-mix asphalt to be manufactured in an asphalt plant inspected and approved by the State of Alabama Department of Transportation.
- B. The Contractor will provide a certification that all asphalt mix applied meets or exceeds the project Specifications.
- C. Installers Equipment Requirements:
  1. Bituminous Spreaders: Shall be a motorized self-propelled paver with a free floating 10' screed with hydraulic screed extensions that are heated and vibratory, that extend 15' or greater.
  2. Compaction Equipment: The asphalt compactor shall be a self-propelled double drum vibratory steel wheel roller a minimum of 8-10 tons with a drum size of 57" wide.

PART 2 — PRODUCTS

2.1 Base: Furnish crusher-run limestone as indicated on the Drawings and conforming to Alabama Department of Transportation Specification No. 825B. See typical sections on Civil and Site Development Drawings.

2.2 Hot-Mix Asphalt Binder Course: Intimate mixture of course and fine mineral aggregate and asphalt cement incorporated together in accordance with Alabama Department of Transportation Specification No. 424B. See typical sections on Site Development Drawings.

2.3 Hot-Mix Asphalt Surface Course: Intimate mixture of course and fine mineral aggregate and asphalt cement incorporated together in accordance with Alabama Department of Transportation Specification No. 424A. See typical sections on Site Development Drawings.

PART 3 — EXECUTION

3.1 Examination:
- A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.
- B. Proof-roll aggregate base using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- C. Notify Architect in writing of any unsatisfactory conditions. Do not begin paving installation until these conditions have been satisfactorily corrected.

3.2 Surface Preparation: Immediately before placing base material, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving base.

3.3 Base Course:
- A. Provisions shall be made by the Contractor for furnishing water at the site of the work by equipment of ample capacity and of such design as to assure uniform application.
- B. Grade control shall be by means of grade stakes, steel pins or other accepted means of good practice, and at intervals sufficiently close that strong lines or check boards may be placed between them.
- C. The base material shall be uniformly blended during crushing operations or mixed in an approved plant. The plant shall blend and mix materials to meet these specifications and to the proper moisture content for compaction.
- D. Placing: Place aggregate base course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations. Place material in maximum 6" layers.
- E. Compacting: After spreading, the base course shall be compacted with a power roller weighing not less than ten tons and rolling shall continue until base material has been compacted to not less than 100 percent density as determined by test method AASHO T-99.
- F. Base Tolerance: Surface of base course shall not vary from the specified grade more than one-half inch (1/2") in twenty-five feet (25') measured in any direction.

3.4 Hot-Mix Asphalt Placing:
- A. General: Place asphalt concrete mixture on prepared surface, spread and strike-off. Spread mixture at minimum temperature as per Alabama Department of Transportation Specifications. Place inaccessible and small areas by hand. Place each course to

required grade, cross-section, and compacted thickness. Construction shall meet all requirements of Alabama Department of Transportation Specification 424B for hot-mix asphalt binder course and 424A for hot-mix asphalt surface course.

B. Paver Placing: Place in consecutive strips not less than 10' wide, except where infill edge strips of a lesser width are required. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete base course for a section before placing surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.5 Joints:

A. Construct joints to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.

B. Offset longitudinal joints in successive courses a minimum of 6 inches (150mm).

C. Offset transverse joints in successive courses a minimum of 24 inches (600 mm).

D. Construct transverse joints by bulkhead method or sawed vertical face method as described in AI's "The Asphalt Handbook".

E. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.

F. Compact asphalt joints to a density within 2 percent of specified course density.

G. Where paving ties to cold asphalt, the edge of the cold asphalt shall be tacked and heated for proper bonding.

3.6 Compaction:

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers. Complete compaction before mix temperature cools to 185 deg F. (85 deg C).

B. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling for indicated crown, grade, and smoothness. Repair surfaces by loosening displaced material, filling with hot-mix asphalt, and rerolling to required elevations.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling, while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 94 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 92 percent nor greater than 96 percent.

D. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials. Remove paving course over area affected and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.
I. Do not paint stripping until Asphalt has cured 14 days.

3.7 Installation Tolerances:
A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
1. Base Course: Plus or minus 1/2 inch (13 mm).
2. Surface Course: Plus 1/4 inch (6 mm), no minus.
B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:
1. Base Course: 1/4 inch (6mm).
2. Surface Course: 1/8 inch (3 mm).
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

END OF SECTION 32 12 16

SECTION 32 93 00 — PLANTS

PART 1 — GENERAL

1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Description of Work:
- A. Provide all labor, materials, equipment and services required for complete installation of all plants indicated on Drawings and specified herein.
- B. Related Work Specified Elsewhere: Section 31 10 00 – Site Clearing and Section 31 20 00 – Earth Moving.

1.3 Quality Assurance:
- A. The following specifications and standards of the issues listed and referred to in this section form a part of this specification to the extent required by reference thereto:
  1. Standardized Plant Names, Second Edition, American Joint Committee on Horticultural Nomenclature, 1942.
  2. American Standard for Nursery Stock, American Association of Nurserymen, Inc., 1973 (ANSI Z 60.1).
- B. Trees and Shrubs: Provide trees and shrubs grown in a recognized nursery in accordance with good horticultural practice. Provide healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sunscald, injuries, abrasions, or disfigurement. Provide trees and shrubs of sizes shown or specified. Trees and shrubs of larger size may be used if acceptable to Architect, and if sizes of roots or balls are increased proportionately.
- C. Manufacturers Qualifications: Provide underground irrigation system as a complete unit produced by a single acceptable manufacturer, including heads, valves, controls, and accessories.

1.4 Submittals:
- A. Maintenance Instructions: Submit typewritten instructions recommending procedures to be established by Owner for maintenance of landscape work for one full year. Submit prior to expiration of required maintenance period(s).

1.5 Delivery, Storage and Handling:
- A. Sod: Time delivery so that sod will be placed within 24 hours after stripping. Protect sod against drying and breaking of rolled strips. Do not bend or bind-tie trees or shrubs in such manner as to damage bark, break branches or destroy natural shape. Provide protective covering during delivery.
- B. Deliver trees and shrubs after preparations for planting have been completed and plant immediately. If planting is delayed more than 6 hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage and keep roots moist.
- C. Do not remove container grown stock from containers until planting time.

1.6 Job Conditions:

A. Proceed with and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required.
B. Utilities: Determine location of underground utilities and perform work in a manner that will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.
C. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Architect before planting.
D. Planting Time: Plant or install materials during normal planting seasons for each type of landscape work required. Correlate planting with specified maintenance periods to provide maintenance from date of substantial completion.
    1. Planting Seasons
        a) Bermuda Sod and Seed: April 1 – September 30
        b) Holly Shrubs: November 1 - March 31
        c) Trees: November 1 - March 31
        d) Other periods subject to Architect's approval.
E. Coordination with Lawns: Plant trees and shrubs after final grades are established and prior to planting of lawns, unless otherwise acceptable to Architect. If planting of trees and shrubs occurs after lawn work, protect lawn areas and promptly repair damage to lawns resulting from plant operations.

1.7 Special Project Warranty:
A. Warranty lawns through specified maintenance period, and until final acceptance.
B. Warranty trees and shrubs through specified maintenance period, and until final acceptance.
C. Remove and replace trees, shrubs, or other plants found to be dead or in unhealthy condition during warranty period. Make replacements during growth season following end of warranty period. Replace trees and shrubs that are in doubtful condition at end of warranty period; unless, in opinion of Architect, it is advisable to extend warranty period for a full growing season.

PART 2 — PRODUCTS

2.1 Topsoil:
A. Any topsoil previously stripped and stored on site will be used by the General Contractor in his work; the layer of topsoil indicated below shall be brought to the site from off-site sources by the Landscape Contractor.
B. Provide 4" depth over all areas to be sodded and 12" depth over all areas to receive plants. Topsoil shall be fertile, natural soil of suitable loamy character obtained from naturally well-drained sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from bogs or marshes. It shall contain a normal amount of decomposed matter, but be free of heavy clay, stones, roots and plants, and have a pH of 6 to 6.5. Furnish a soil test report prior to application.
C. Rough grading by the General Contractor will be held down approximately 4" below the indicated grades (12" at planted areas). The Landscape Contractor shall verify and accept the condition, and thereafter level out, dress smooth, remove and dispose of excess soil, so as to produce the proper bed to receive the topsoil, sod and planting materials specified.

2.2 Soil Amendments:

A. Fertilizer: Fertilizer shall conform to the applicable State fertilizer laws, and shall be 13-13-13 analysis. The fertilizer shall be delivered to the site in the original containers, unopened and bearing a guaranteed analysis fulfilling the requirements of the specifications.
B. Topsoil Mixture at Planting Beds: Prepare soil with one part topsoil, one part sand, one part organic matter, and one part pre-mix soil mixture.
C. Water: The Owner shall furnish water to the Landscape Contractor. The Landscape Contractor shall furnish all necessary hose, equipment, attachments and accessories for the adequate irrigation of planted areas as may be necessary to complete the work as specified. If water is needed for maintenance of planting areas after the Owner takes occupancy, the Owner will furnish water to the Landscape Contractor.

2.3 Plant Materials:
A. Quality and Size: Plants shall be in accordance with American Standard for Nursery Stock. All plants shall have normal habit of growth and shall be sound, healthy, vigorous and free from insect infestations. Any tree with a weak or thin trunk not capable of supporting itself when planted in the open will not be accepted. The minimum acceptable size of all plants, measured before pruning with branches in normal position, shall conform to dimensions as shown in the Plant List. Larger plants of equal quality may be accepted at no additional cost to the Owner.
B. Balled Plants: Plants designated "B&B" in the Plant List shall be adequately balled with firm, natural balls of soil in sizes as set forth in the American Standard for Nursery Stock. Balls shall be firmly wrapped with jute burlap weighing not less than 7.2 ounces per square yard (or other approved strong cloth of equal strength and resistance to tearing) and then laced with a suitable heavy twine. No balled plant shall be planted if the ball is cracked or broken either before or during the process of planting.
C. Container Grown Plants: All plants designated container grown in the Plant List shall be healthy, vigorous, well rooted and established in the container in which they are sold. They shall have tops that are of good quality and shall be in a healthy growing condition. An established container grown plant shall be a plant transplanted into a container and grown in the container sufficiently long for the new fibrous roots to have developed so that the root mass will retain its shape and hold together when removed from the container. The container shall be sufficiently rigid to hold the ball shape protecting the root mass during shipping. No root bound container grown plants, as determined by the Architect, will be permitted.

2.4 Grass Materials:
A. Sod: Provide strongly rooted sod, not less than 2 years old and free of weeds and undesirable native grasses. Provide only sod capable of growth and development when planted (viable, not dormant). Sod shall be 419 Bermuda as specified on the Drawings.
1. Sod Allowance: Include in the Base Bid the quantity of 500 SY of 419 Bermuda Sod. If the actual quantity of Sod required should be more or less than the abovementioned quantity, there shall be a corresponding adjustment made in the Contract price per Unit Price quoted in the Bid.
B. Grass Seed: Provide fresh, clean, new Yukon Dwarf Bermuda seed complying with tolerance for purity and germination established by Official Seed Analysts of North America. Provide seed mixture composed of grass species, proportions and minimum percentages of purity, germination and maximum percentage of weed seed, as specified.

1. Seed Allowance: Include in the Base Bid the quantity of 100 lbs. of Yukon Dwarf Bermuda Seed to cover the estimated 2,500 SY Bermuda seeding required. If the actual quantity of Seed required should be more or less than the above mentioned quantity, there shall be a corresponding adjustment made in the Contract price per Unit Price quoted in the Bid.

2.5 Ground Cover: Provide plants established and well-rooted in removable containers or integral peat pots and with not less than minimum number and length of runners required by ANSI Z60.1 for the pot size shown or listed.

2.6 Miscellaneous Landscape Materials:

A. Stakes and Guys: Provide stakes and deadmen of sound new hardwood, treated softwood, or redwood free of knot holes and other defects. Provide wire ties and guys of 2-strand, twisted, pliable galvanized iron wire not lighter than 12 gauge with zinc-coated turnbuckles. Provide not less than 1/2" hose, cut to required lengths to protect tree trunks from damage by wires.

B. Mulch: Pine needles, 4" deep.

C. Steel Edging: ASTM A 569 (ASTM A 569M), rolled edge, standard steel edging, fabricated in sections with loops stamped from or welded to face of sections approximately 30 inches apart to receive stakes.

1. Edging Size: 3/16 inch (4.8mm) wide by 4 inches (102 mm) deep.
2. Stakes: Tapered steel, 15 inches (381 mm) long.
3. Accessories: Standard tapered ends, corners, and splicers as required.
4. Tree Rings: Provide 3'-0" diameter steel edging tree rings at all trees and treeform shrubs
5. Finish: Standard paint finish, green color.

PART 3 — EXECUTION

3.1 Preparation:

A. Layout individual tree and shrub locations and areas for multiple plantings. Stake locations and outline areas and secure Architect's acceptance before start of planting work. Make minor adjustments as may be requested.

B. Preparation for Planting Lawns:

1. Loosen subgrade of lawn areas to a minimum depth of 6". Remove stones over 1-1/2" in any dimension and sticks, roots, rubbish and other extraneous matter. Limit preparation to areas that will be planted promptly after preparation.
2. Spread topsoil to minimum depth required to meet lines, grades and elevations shown, after light rolling and natural settlement.
3. Grade lawn areas to smooth, even surface with loose, uniformly fine texture. Roll, rake and remove ridges and fill depressions, as required to meet finish grades. Limit fine grading to areas that can be planted immediately after grading.
4. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.

C. Preparation of Planting Beds:

1. Loosen subgrade of planting bed areas to a minimum depth of 6" using a cultimulcher or similar equipment. Remove stones over 1-1/2" in any dimension, and sticks, roots, rubbish and other extraneous matter.

2. Spread planting soil mixture to minimum depth required to meet lines, grades and elevations shown, after light rolling and natural settlement. Place approximately 1/2 of the total amount of planting soil required. Work into top of loosened subgrade to create a transition layer, than place remainder of the planting soil.

3.2 Planting:

A. Planting Trees and Shrubs:
   1. Prepare pits as specified and as shown on the Drawings prior to inserting plants. Set plants at the same relationship to finished grade as they were to the ground before being dug. Use topsoil mixture to backfill all plant pits. When plant pits have been backfilled approximately 2/3 full, water thoroughly before installing remainder of soil to top of pit.
   2. Set trees and shrubs plumb and brace rigidly in position until the planting soil has been tamped solidly around the ball and roots.
   3. Cut ropes or strings from top of balls after plant has been set. Leave burlap or cloth wrapping intact around balls. Turn under and bury top 1/2 of the burlap wrapping on the ball. Remove metal cage from root ball prior to planting.
   4. Ground cover shall be planted according to areas specified on plan in topsoil mixture as previously specified. All pits shall be adequate in depth and width to facilitate the root ball of the individual plant. Upon removing the containers, the soil should remain intact around the root system. Planting procedures should be followed as shown on the Drawings.
   5. Water all planting by hose immediately after planting.

B. Guying, Staking and Wrapping:
   1. Each tree over 1-1/4" in caliper shall be staked and tied with 12 gauge wire with reinforced garden hose material around tree trunk protecting the bark.
   2. Attention is directed to placement and number of guys, stakes, protecting hose sections, etc.

C. Pruning: All plant material shall be pruned as necessary at the site in accordance with standard modern horticultural practice as approved by the Architect. Cuts over 1/4" in diameter shall be painted with wood sealer. Additional pruning may be required as directed by the Architect.

3.3 Grassing (Sod):

A. Apply fertilizer uniformly at the rate of 4 lbs. per 1000 square feet to areas to be sodded.
B. Lay sod within 24 hours from time of stripping. Do not plant dormant sod or if ground is frozen.
C. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. Work from boards to avoid damage to subgrade or sod. Tamp or roll lightly to ensure contact with subgrade. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass.
D. Anchor sod on slopes with wood pegs to prevent slippage.
E. Water sod thoroughly with a fine spray immediately after planting.

3.4 Seeding New Lawns:

A. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.
B. Sow seed using a spreader or seeding machine. Do not seed when wind velocity exceeds 5 mi. per hr. Distribute seed evenly over entire area by sowing equal quantity in 2 directions at right angles to each other.

C. Sow not less than 5 lbs./1000 sq. ft. of seed specified.
D. Rake seed lightly into top 1/8" of soil, roll lightly, and water with a fine spray.
E. Protect seeded areas against erosion by spreading lawn mulch after completion of seeding operations. Spread uniformly to form a continuous blanket not less than 1-1/2" loose measurement over seeded areas.

3.5 Installation of Edgings:
A. Install steel edging where indicated according to manufacturer's recommendations. Anchor with steel stakes spaced approximately 30 inches (760 mm) apart, driven below top elevation of edging.
B. Install 3'-0" diameter steel edging tree ring at all trees and treeform shrubs.

3.6 Maintenance:
A. Begin maintenance immediately after planting.
B. Maintain trees, shrubs and other plants until final acceptance, but in no case less than 30 days after substantial completion of planting.
C. Maintain sodded lawns not less than 30 days after substantial completion.
D. Maintain lawns by watering, fertilizing, weeding, mowing, trimming and other operations such as rolling, regrading and replanting as required to establish a smooth, acceptable lawn, free of eroded or bare areas.

3.7 Cleanup and Protections:
A. During landscape work, keep pavements and walks clean and work area in an orderly condition.
B. Protect landscape work and materials from damage due to landscape operations, operations by other contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged landscape work as directed.

3.8 Inspection and Acceptance:
A. When landscape work is completed, including maintenance, Architect will, upon request make an inspection to determine acceptability.
B. Landscape work may be inspected for acceptance in parts agreeable to Architect, provided work offered for inspection is complete, including maintenance.
C. Where inspected landscape work does not comply with requirements, replace rejected work and continue specified maintenance until reinspected by Architect and found to be acceptable. Remove rejected plants and materials promptly from project site.

END OF SECTION 32 93 00