SPECIFICATIONS

FOR

RENOVATIONS TO CYPRESS LAKES CLUBHOUSE
FOR
CITY OF MUSCLE SHOALS

MUSCLE SHOALS, ALABAMA

JANUARY 31, 2018

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JOB NO. 1732 SET NO. _____

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SECTION 00 11 13 — ADVERTISEMENT FOR BIDS

Sealed proposals will be received by the City of Muscle Shoals, Alabama in the Muscle Shoals City Hall Conference Room, 2010 E. Avalon Ave., Muscle Shoals, Alabama, until 2:00 p.m., C.S.T., Thursday, March 1, 2018 for Renovations to Cypress Lakes Clubhouse for City of Muscle Shoals, Alabama in accordance with Drawings and Specifications dated January 31, 2018, prepared by Lambert Ezell Durham Architecture, LLC, Florence, Alabama, and then at said office publicly opened and read aloud.

A Pre-Bid Conference will be held at the Cypress Lakes Clubhouse, 1311 E. Sixth St., Muscle Shoals, Alabama on Tuesday, February 13, 2018 at 10:00 a.m. to receive questions from interested parties. Attendance is mandatory for all bidding General Contractors. Any required answers or response will be issued by Addendum.

A certified check or bid bond payable to City of Muscle Shoals, Alabama in an amount not less than five (5) percent of the amount of the Bid, but in no event more than $10,000, must accompany the bidder's proposal. Performance and Payment Bonds and evidence of insurance required in the bid documents will be required at the signing of the Contract.

Electronic images of the documents may be viewed on-line and printed by General Contractors, Subcontractors, and Suppliers by obtaining documents through the Architect's website, www.ledarchitecture.com by sending an email to info@ledarchitecture.com to obtain log-in information and password. Provide company name, address, telephone number, email address and GC license number in the email request. The Drawings and Specifications may also be examined at the Plan Rooms of DODGE Data & Analytics, Hot Springs, Arkansas; CMD Group, Norcross, Georgia, AGC Plan Room, Florence, Alabama, and at the office of the Architect.

Copies of 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 $100.00 per set payable to the Architect, which will be refunded in full on the first set issued to each General Contract Bidder submitting a bonafide bid, upon return of documents in good condition within ten days of bid date. Other sets for General Contractors, and sets for subcontractors and dealers, may be obtained with the same deposit, which will be refunded as above, less cost of printing, reproduction, handling, and distribution. Separate sheets of Drawings and Specifications are available from the Architect for $2.50 per print and $.15 per page of Specifications.

Bids must be submitted on proposal forms furnished by the Architect or copies thereof. All bidders bidding in amounts exceeding that established by the State Licensing Board for General Contractors must be licensed under the provisions of Title 34, Chapter 8, Code of Alabama, 1975, and must show evidence of license before bidding or bid will not be received or considered by the Architect; the bidder shall show such evidence by clearly displaying his or her current license number on the outside of the sealed envelope in which the proposal is delivered. The Owner reserves the right to reject any or all proposals and to waive technical errors if, in the Owner’s judgment, the best interests of the Owner will thereby be promoted.

City of Muscle Shoals, Alabama
David H. Bradford, Mayor

SECTION 00 21 13 – INSTRUCTIONS TO BIDDERS

1.1 Bid Date: Bids will be received until 2:00 p.m., C.S.T., Thursday, March 1, 2018 in the Muscle Shoals City Hall Conference Room, 2010 E. Avalon Ave., Muscle Shoals, Alabama and then at said office publicly opened and read aloud.

1.2 Pre-Bid Conference: A Pre-Bid Conference will be held at the Cypress Lakes Clubhouse, 1311 E. Sixth St., Muscle Shoals, Alabama on Tuesday, February 13, 2018 at 10:00 a.m. to receive questions from interested parties. Attendance is mandatory for all bidding General Contractors. Any required answers or response will be issued by Addendum.

1.3 Contract Documents:

A. Copies of the Drawings and Specifications may be obtained at the office of Lambert Ezell Durham Architecture/Interior Design, P.O. Box 934, 401 East College Street, Florence, Alabama 35631 upon deposit of $100.00 per set. 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 two (2) to General Contractors.

B. Electronic images of the documents may be viewed on-line and printed by General Contractors, Subcontractors, and Suppliers by obtaining documents through the Architect's website, www.ledarchitecture.com by sending an email to info@ledarchitecture.com to obtain log-in information and password. Provide company name, address, telephone number, email address and GC license number in the email request. The Drawings and Specifications may also be examined at the Plan Rooms of DODGE Data & Analytics, Hot Springs, Arkansas; CMD Group, Norcross, Georgia, AGC Plan Room, Florence, Alabama, and at the office of the Architect.

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 A201-2007, including Articles 1-15 inclusive and pages 1-39 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 A201-2007. 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 2: OWNER:

Delete Subparagraph 2.2.5 in its entirety and substitute the following:

2.2.5 The Contractor will be furnished free of charge ten (10) copies of Drawings and Specifications. Additional sets will be furnished at the cost of reproduction, postage and handling.

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 Interior Wood Shutters – Twenty Four Thousand Dollars ($24,000)

.2 “PL” Type Light Fixture – Ten Thousand Two Hundred Dollars ($10,200)

.3 Carpet Material Only – Thirty Dollars ($30) per square yard

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 9.3.1.

END OF SECTION 00 22 00

SECTION 00 42 00 – PROPOSAL FORM

City of Muscle Shoals
Muscle Shoals, Alabama
c/o Lambert Ezell Durham Architecture, LLC
P. O. Box 934
401 East College Street
Florence, Alabama 35631

Date:_____

Gentlemen:

We hereby submit our proposal for construction of "Renovations to Cypress Lakes Clubhouse for the City of Muscle Shoals, Muscle Shoals, Alabama" in accordance with Drawings and Specifications prepared by Lambert Ezell Durham Architecture + Interior Design dated January 31, 2018, 2018.

Having carefully examined all Conditions and Specifications entitled "Renovations to Cypress Lakes Clubhouse for the City of Muscle Shoals, Muscle Shoals, Alabama", dated January 31, 2018, similarly entitled Contract Drawings numbered A-1 through A-5, S1.0 through S3.1, M-1 through M-2, P-1, and E-1 through E-4 inclusive dated January 31, 2018; 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 ($_____).

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 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.

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 a material allowance in the amount of Twenty Four Thousand Dollars ($24,000.00) for the purchase, delivery, and installation of Interior Wood Shutters, including sales tax, indicated on the Drawings.

B. Allowance No. 2: Include in the Base Bid a material Allowance in the amount of Ten Thousand Two Hundred Dollars ($10,200.00) for the purchase and delivery of six (6) “PL” Type lighting fixtures, including sales tax, as indicated on the drawings.

C. Allowance No. 3: Include in the Base Bid a material allowance in the amount of Thirty Dollars ($30) per square yard for the carpet material only specified in Section 09 68 00 Carpeting.

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: Initially submit 4 blue/blackline prints for approval; submit 5 when consultant approval also required. A minimum of 2 copies will be returned. After approval, submit 2 prints of corrected shop drawings to Architect for file; 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 4 copies to Architect for review, 5 copies when consultant review 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 Telephone: Provide and maintain for the duration of the Contract a cellular telephone for the Superintendent's use.

1.2 Sanitary Facilities:
- A. Contractor will be permitted to use existing toilet facilities located in the kitchen.
- B. Contractor shall be responsible for sanitary maintenance of facilities during construction and will be required to thoroughly clean facilities at completion of the Work.

1.3 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.

1.4 Temporary Light and Power:
- A. The Owner will provide adequate electric service for all temporary light and power.
- 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.

1.5 Temporary Water Supply:
- A. The Owner will provide temporary water service.
- B. The Contractor shall provide any and all hose required to extend from the point of service to his work.

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

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

E. 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 02 41 19 — SELECTIVE STRUCTURE DEMOLITION

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. Extent of selective structure demolition work is indicated on Drawings. Structure demolition includes the selective removal and subsequent offsite disposal of the following:
   1. Portions of building structure indicated on drawings and as required to accommodate new construction.
   2. Removal of interior partitions as indicated on drawings.
   3. Removal of windows, doors and frames indicated "remove."
   4. Removal of built-in casework indicated "remove."

B. Related Work Specified Elsewhere:
   1. Remodeling construction work and patching is included within the respective sections of specifications, including removal of materials for reuse and incorporated into remodeling or new construction.
   2. Relocation of pipes, conduits, ducts, other mechanical and electrical work are specified by respective trades.

1.3 Submittals:

A. Schedule: Submit schedule indicating proposed methods and sequence of operations for selective demolition work to Owner's Representative for review prior to commencement of work. Include coordination for shut-off, capping, and continuation of utility services as required, together with details for dust and noise control protection.

B. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on site operations.

1.4 Job Conditions:

A. Occupancy: Owner will be continuously occupying areas of the building immediately adjacent to areas of selective demolition. Conduct selective demolition work in manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities that will severely impact Owner's normal operations.

B. Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished.

C. Partial Demolition and Removal: Items indicated to be removed but of salvable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed.

D. Storage or sale of removed items on site will not be permitted.

E. Protections: Provide temporary barricades and other forms of protection as required to protect Owner's personnel and general public from injury due to selective demolition work.
   1. Provide protective measures as required to provide free and safe passage of Owner's personnel and general public to and from occupied portions of building.
   2. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.
   3. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.
   4. Protect floors with suitable coverings when necessary.
   5. Construct temporary insulated solid dustproof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks if required.
   6. Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces, and installation of new construction to insure that no water leakage or damage occurs to structure or interior areas of existing building.

F. Damages: Promptly repair damages caused to adjacent facilities by demolition work at no cost to Owner.

G. Utility Services: Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.

H. Environmental Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations pertaining to environmental protection.

PART 2 — PRODUCTS

NOT APPLICABLE

PART 3 — EXECUTION

3.1 Inspection: Prior to commencement of selective demolition work, inspect areas in which work will be performed. Photograph existing conditions to structure surfaces, equipment or to surrounding properties which could be misconstrued as damage resulting from selective demolition work; file with Owner's Representative prior to starting work.

3.2 Preparation:

A. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain.

B. Cease operations and notify the Owner's Representative immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operation.

C. Cover and protect furniture, equipment and fixtures to remain from soiling or damage when demolition work is performed in rooms or areas from which such items have not been removed.

D. Erect and maintain dust-proof partitions and closures as required to prevent spread of dust or fumes to occupied portions of the building.

3.3 Demolition:

A. Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.
B. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.
C. Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors or framing.
D. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.
E. If unanticipated mechanical, electrical or structural elements which conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner's Representative in written, accurate detail. Pending receipt of directive from Owner's Representative, rearrange selective demolition schedule as necessary to continue overall job progress without delay.

3.4 Disposal of Demolished Materials:

A. Remove debris, rubbish and other materials resulting from demolition operations from building site. Transport and legally dispose of materials off site.
B. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling and protection against exposure or environmental pollution.
C. Burning of removed materials is not permitted on project site.

3.5 Clean-Up and Repair:

A. Upon completion of demolition work, remove tools, equipment and demolished materials from site. Remove protections and leave interior areas broom clean.
B. Repair demolition performed in excess of that required. Return structures and surfaces to remain to condition existing prior to commencement of selective demolition work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION 02 41 19

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.

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 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, ceramic or porcelain tile.

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

F. 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.

G. 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.

H. 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. 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, ceramic or porcelain tile) 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 Concrete Blocks:
A. Quality Standard: ASTM C 90.
B. Size: Manufacturer's standard units with nominal face dimensions of 16" long x 8" (15-5/8" x 7-5/8" actual), unless otherwise indicated.
C. Shall be Grade "N" constructed from Portland cement and aggregates of gravel, crushed stone, shale or blast furnace slag.

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.

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. Pattern Bond: Lay concrete block in stacked or running bond to match existing. Lay concealed masonry with all units in a wythe bonded by lapping not less than 2".

D. 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.

E. Lay-up walls plumb and true and with courses level, accurately spaced and coordinated with other work.

F. 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 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 Horizontal Joint Reinforcement:
A. General: Provide continuous horizontal joint reinforcement as indicated. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" on exterior side of walls, 1/2" elsewhere. Lap reinforcing a minimum of 6".
B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
C. Reinforce walls with continuous horizontal joint reinforcing unless specifically noted to be omitted.
D. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
E. Space horizontal joint reinforcement at 16" o.c. vertically, unless other indicated. For parapets, space reinforcement 8" o.c. vertically, unless otherwise indicated.
F. Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcement placed in 2 horizontal joints approximately 8" apart, immediately above the lintel and immediately below the sill. Extend reinforcement a minimum of 2'-0" beyond jambs of the opening except at control joints. In addition to wall reinforcement, provide additional reinforcement at openings as 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.

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

3.5 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 and Section 04 20 00 – Unit Masonry.

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 B.
C. Anchor Bolts: ASTM F1554 Grade 36 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 40 00 — COLD-FORMED 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: Provide all labor, materials, equipment and services required for complete installation of all cold-formed metal framing indicated on Drawings and specified herein.
   A. Related Work Specified Elsewhere: Section 09 21 16 - Gypsum Board Assemblies.

1.3 Submittals:
   A. Product Data: Submit manufacturer's product information and installation instructions for each time of cold-formed metal framing and accessories.
   B. Placement Drawings: Submit field use placement drawings including plans, elevations, and connection details at all load-bearing and curtain wall stud walls.

1.4 Delivery, Storage and Handling: Protect metal framing units from rusting and damage. Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Store off ground in a dry ventilated space or protect with breathable waterproof tarpaulins.

PART 2 — PRODUCTS

2.1 Manufacturers: Subject to compliance with requirements, provide products of one of the following:
   A. Alabama Metal Industries Co.
   B. Bostwick Steel Framing Co.
   C. Dale Industries, Inc.
   D. Milcor Division, Inryco, Inc.
   E. Marino Industries Corp.
   F. U.S. Gypsum Co.

2.2 Metal Framing:
   A. System Components: With each type of metal framing required, provide manufacturer's standard steel runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories as recommended by manufacturer's for applications indicated, as needed to provide a complete metal framing system.
   B. Materials and Finishes:
      1. For 18 gauge and lighter units, fabricate metal framing components of commercial quality steel sheet with a minimum yield point of 33,000 psi; ASTM A 653, A 1011, or A 1008.
      2. Provide galvanized finish to metal framing components complying with ASTM A 653 for minimum G 60 coating.

3. Fasteners: 1/2" Type S-12 pan head screws.

PART 3 — EXECUTION

3.1 Installation:

A. Manufacturer's Instructions: Install metal framing systems in accordance with manufacturer's printed or written instructions and recommendations, unless otherwise indicated.

B. Runner Tracks: Install continuous tracks sized to match studs. Align tracks accurately to layout at base and tops of studs. Secure tracks as recommended by stud manufacturer for type of construction involved and as indicated on drawings, except do not exceed 24" o.c. spacing for nail or power-driven fasteners, or 16" o.c. for other types of attachment. Provide fasteners at corners and ends of tracks.

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

D. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure.

E. Install supplementary framing, blocking and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards in each case considering weight or loading resulting from item supported.

F. Installation of Wall Stud System: Secure studs to top and bottom runner tracks by screw fastening at both inside and outside flanges.

G. Frame interior wall openings larger than 2'-0" square with double stud at each jamb of frame except where more than 2 are either shown or indicated in manufacturer's instructions. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of wall. Secure stud system wall opening frame in manner indicated.

H. Frame exterior wall openings as indicated in drawings.

I. Install horizontal stiffeners in stud system, spaced (vertical distance) at not more than 4'-0" o.c.

END OF SECTION 05 40 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 19% maximum moisture content at time of dressing.

2.2 Studs (2"-4" Thick, 2"-6" Wide, 10' and Shorter): Stud grade Western Spruce.

2.3 Structural Light Framing (2"-4" Thick, 2"-6" Wide): No. 2 Common Southern Yellow Pine.

2.4 Structural Joists and Planks (2"-4" Thick, 5" and Wider): No. 2 Common Southern Yellow Pine or other approved species.

2.5 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.

2.6 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 Wood Framing:
A. Provide framing 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.

D. Provide wood framing members of size and spacing indicated; do not splice structural members between supports. Firestop concealed spaces with wood blocking not less than 2" thick, if not blocked by other framing members.
E. Provide continuous row of horizontal 2" x 4" blocking at midpoint of all walls and partitions or where shown on the Drawings.
F. Studs, joists and rafters shall be 16" o.c. except where otherwise indicated. Double all top plates, double jambs and heads of all openings, triple all corners, unless noted otherwise.

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 (For Painted Finishes): FAS Clear Poplar or Clear White Pine manufactured to sizes and patterns (profiles) shown from First Grade lumber and complying with referenced woodworking standard.
  1. 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 Champion, 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 Standing and Running Trim and Rails:
A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Stagger joints in adjacent and related standing and running trim and rails. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane back of casings to provide uniform thickness across joints if required.
B. Match color and grain pattern across joints.
C. Drill pilot holes in hardwood prior to nailing or fastening to prevent splitting. Fasten to prevent movement or warping. Countersink nail heads on exposed carpentry work and fill holes. Fit exterior joints to exclude water. Apply flat grain lumber with bark side exposed to weather.

3.4 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.

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

3.6 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 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 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.

2.2 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.

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.

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. 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 Staved Core Wood Doors: Shall be Marshfield Door Systems DSC-1 Staved 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.

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.
   1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

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 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 91 00 - Joint Sealants and Section 08 14 16 – Flush Wood Doors.

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, non-removable 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 Tempered Plate Glass: 1/4" heat tempered plate or float glass equal to PPG "Herculite Clear Glass" with polished edges where noted on the Drawings.

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 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 1/2 and 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.

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 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 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) Celotex Celogrid
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, lightly textured, nodulated panel with no holes or fissures which meets ASTM E 84, Class A Flame Spread, Type III, Form 1, NRC range shall be .60 - .70, STC range shall be 35 - 39, light reflectance classification shall be LR1. Provide CertainTeed "Cashmere" CM-450, Narrow Reveal Edge, White with 15/16" CertainTeed Classic Grid, White.

C. 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 68 00 — CARPETING

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 the Floor Plans, Finish Plans, Room Finish Schedules, and Finish Schedule Notes.

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

1.3 Submittals:

A. Submit:
   1. Samples of each carpet specified to the Architect for color selection and/or verification and specification certification.
   2. Samples shall have a permanently affixed label on the back with Carpet Type #, Manufacturer's Name, Pattern Name / #, Color Name / #, Tile Size, and manufacturer approved installation methods (Quarter Turn, Ashlar, etc.)

B. Submit samples of each type carpet accessory, edge guard, etc. to the Architect for approval and color selection. Samples shall be labeled similar to A.2 above.

C. Submit schedule of door numbers and threshold type required at each location. (Only doors requiring thresholds must be listed.)

D. Submit floor plans of each space scheduled to receive carpet, indicating carpet seaming plans, location and type of transition strips, working points, etc.

E. Maintenance Data:
   1. Each carpet specified shall be included in maintenance manual specified in Division 1.
   2. Provide Architect's copy of warranty claim documentation as per Paragraph 3.1.G of this Section.

1.4 Quality Assurance:

A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing carpeting products similar to those required for this Project, on projects of similar scale and complexity, and with a record of successful in-service performance.

B. Source Limitations: Obtain each type, color, and pattern of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

1.5 Delivery and Storage:

A. General: Comply with instructions and recommendations of manufacturer and as herein specified.

B. All carpet materials must be ordered within two (2) weeks of issuance of final Color Finish Schedule by Architect. Orders for material issued on the schedule are not to

be postponed pending resolution of any single carpet selection not included or in question.

C. Do not store rolled goods in upright position. Maintain temperature in storage area above 40 degrees F.

1.6 Job Conditions:

A. Maintain constant minimum temperature of 60 degrees F. at areas of installation for at least 24 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.

C. The work is to be bid assuming the substrates and surface preparation are within the required tolerances. If the substrates are found to not be within those tolerances, it shall be the subcontractor's responsibility to submit in writing a list of the deficiencies to the General Contractor. It shall be the General Contractor's responsibility to correct the deficiencies and provide substrates and surfaces preparation compliant with the required tolerances and other criteria of this section.

D. Carpet 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.

1.7 Maintenance Stock: At the time as directed by the Owner, deliver stock of maintenance material to Owner. Furnish full size carpet tile matching carpet 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 carpet tile installed. Deliver to Owner remaining opened and unopened boxes of carpet tile after installation is completed.

PART 2 — PRODUCTS

2.1 Carpet Types (C-1, C-2, and C-3): Contractor is to allow Thirty Dollars ($30.00) per square yard for carpet material only. This allowance does not include installation materials or accessories, floor prep, labor, freight, sales taxes, or Contractor's overhead and profit. The Architect will select a carpet tile and installation method (Quarter Turn, Ashlar, Monolithic, etc.) and submit the manufacturer's product information on a Finish Schedule Legend to be submitted to the Contractor. If the actual cost of the carpet selected varies from this Allowance, an adjustment shall be made in the Contract Price accordingly.

2.2 Carpet Accessories:

A. Ceramic/Wood Carpet Transition: Shall be #160 Resilient Carpet transition strip manufactured by Flexco Company or approved equal. Color as selected by Architect from manufacturer's standard colors. Install at Architect approved locations only.

B. Installation Adhesives: Water-resistant type as recommended by carpet or cushion manufacturer, and which complies with flammability requirements for installed carpet.

PART 3 — EXECUTION

3.1 Installation:

A. Pre-Installation Meeting:

1. Two weeks (minimum) prior to the start of carpeting 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), Carpeting Contractor's Project Manager and Job Superintendent, and any other persons whom the Architect, General Contractor, Owner, or Carpeting Contractor request to attend.
2. Critical installation coordination issues (such as working points, tile installation method(s), pattern matches, code requirements, clearances, shop drawing notes, transitions strips, etc.) shall be reviewed.
3. "Job standards" for finished product and installation items (such as field cuts, pattern matches, glue removal, etc.) shall be reviewed.
4. Other coordination and scheduling items shall be discussed as required or requested by participants.

B. Clean surfaces to be carpeted; scrape up cementitious and resinous deposits; vacuum; apply sealer on concrete surfaces, adequate to prevent dusting.

C. Pre-plan installation for uniform direction of pattern and lay of pile, and proper sequencing with other work. Locate seams properly, centered under doors and without seams in direction of traffic doorways and similar traffic patterns. Extend carpet under removable obstructions and into closets and alcoves. Verify working points with Architect.

D. Provide a glue-down installation by trimming and fitting carpet widths into each space prior to application of adhesive. Apply adhesive, butter cut edges with seaming cement, butt edges tightly together, and roll lightly, unless otherwise instructed by carpet manufacturer.

E. Install edge guards at exposed edges. Submit type and location to Architect for approval and finish / color selection.

F. 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.

3.2 Cleaning and Protection:

A. Clean adhesive and cement from face of carpet promptly; replace carpet that cannot be cleaned.

B. Save carpet scraps, defined as carpet tiles larger than a half tile, and deliver to Owner's storage space as directed. Dispose of smaller pieces.

C. Vacuum completed carpet installation with beater-in-nozzle type commercial vacuum cleaner.

D. Protect installed carpet as recommended by carpet manufacturer.

E. Remove and replace work that cannot be successfully cleaned with vacuuming or hot water extraction (no additives) only and repaired to permanently eliminate evidence of damage.

F. All cleaning, repair, or "punch list" work is to be performed by the carpeting subcontractor.

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 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. 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.

E. 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.

F. 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.

2.2 Interior Paint Systems, General:

A. Individual colors may be used on more than one interior surface material.

B. Color selections will be made from the manufacturer's full product line, including deep tone tint bases.

C. 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 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 22 26 — OPERABLE PARTITIONS

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 operable partitions indicated on Drawings and specified herein.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  1. Concrete floor tolerances are specified in Division 3 Section "Cast-in-Place Concrete."
  2. Metal framing and supports are specified in Division 5 Section "Structural Steel Framing."
  3. Wood framing and supports are specified in Division 6 Section "Rough Carpentry."

1.3 Submittals:
- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of operable partition, component, and accessory specified.
- C. Shop Drawings: Show location and extent of operable partitions. Include plans, elevations, sections, details, attachments to other construction, and accessories. Indicate dimensions, weights, conditions at openings, and at storage areas, and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, including floor tolerances required and direction of travel. Indicate blocking to be provided by others.
- D. Setting Drawings: Show imbedded items and cutouts required in other work, including support beam punching template.
- E. Samples: Color samples demonstrating full range of finishes available by architect. Verification samples will be available in same thickness and material indicated for the work.

1.4 Quality Assurance:
- A. Installer Qualifications: An experienced installer who is certified in writing by the operable partition manufacturer, as qualified to install the manufacturer's partition systems for work similar in material, design, and extent to that indicated for this Project.
- B. Acoustical Performance: Test operable partitions in an independent acoustical laboratory in accordance with ASTM E90 test procedure to attain no less than the STC rating specified. Provide a complete and unedited written test report by the testing laboratory upon request.

C. Preparation of the opening shall conform to the criteria set forth per ASTM E557 *Standard Practice for Architectural Application and Installation of Operable Partitions*.

1.5 Delivery, Storage and Handling:
A. Clearly mark packages and panels with numbering systems used on Shop Drawings.
B. Protect panels during delivery, storage, and handling to comply with manufacturer's direction and as required to prevent damage.

1.6 Warranty:
A. Provide written warranty by manufacturer of operable partitions agreeing to repair or replace any components with manufacturing defects.
B. Partition Warranty Period: Two (2) years from date of shipment.

PART 2 — PRODUCTS

2.1 Manufacturer: Shall be Modernfold "Audio-Wall" Model 933E electrically operated continuously hinged operable partition as manufactured by Modernfold, Inc. or prior approved equal by one of the following:
A. Hufcor/AirWall.
B. Panelfold, Inc.
C. Woodfold-Marco Mfg. Co.

2.2 Operation:
A. OP-01: Acousti-Seal 933E, series of continuously hinged flat panels, electrically operated, top supported with operable floor seals.
B. Final Closure:
1. OP-01: Side Jamb
C. OP-01: Partition shall be operated by two push button control stations wired in series and located on opposite sides of the partition. Control stations shall be activated by key switch at stack end of partition. Motor unit shall be reversible, continuous duty, and class A insulated. Motor unit shall have NEMA MG 1 service factor, high starting torque, thermal overload protection, and open/drip proof enclosure. Motor assembly shall have wiring compliant with NFPA 70, 24 volt controls, compliant with UL 508A, and speed of 28 feet/minute. The drive unit motor shall be equipped with outboard limit switches to prevent over-extension. A positive chain drive attached to the lead panel shall pull the partition across the opening. Cable, belt, or other friction type drives will not be accepted.
D. Electric motor shall consist of:
1. 208-volt, 3-phase.

2.3 Panel Construction:
A. Nominal 3-inch (76 mm) thick panels in manufacturer's standard 48-inch (1220 mm) widths. All panel horizontal and vertical framing members fabricated from minimum 18-gage formed steel with overlapped and welded corners for rigidity. Top channel is reinforced to support suspension system components. Frame is designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of the panel skin.
B. Panel skin shall be:

1. Roll-formed steel wrapping around the panel edge. Panel skins shall be lockformed and welded directly to the frame for unitized construction. Acoustical ratings of panels with this construction minimum:
   a) 50 STC

C. Hinges for Panels, Closure Panels, Pass Doors, and Pocket Doors shall be:
   1. Full leaf butt hinges, attached directly to panel frame with welded hinge anchor plates within panel to further support hinge mounting to frame. Lifetime warranty on hinges. Hinges mounted into panel edge or vertical astragal are not acceptable.

D. Panel Trim: No vertical trim required or allowed on edges of panels; minimal groove appearance at panel joints.

E. Panel Weights:
   1. 50 STC - 8 lbs./square foot

F. Panel finish shall be:
   1. Reinforced heavy duty vinyl with woven backing weighing not less than 30 ounces (850 g) per lineal yard.

G. Panel Trim: Exposed panel trim of one consistent color:
   1. To be selected by Architect.

2.4 Sound Seals:

A. Vertical Interlocking Sound Seals between panels: Roll-formed astragals, with reversible tongue and groove configuration in each panel edge, for universal panel operation. Rigid plastic astragals or astragals in only one panel edge are not acceptable.

B. Horizontal Top Seals: Continuous contact extruded vinyl bulb shape with pairs of non-contacting vinyl fingers to prevent distortion without the need for mechanically operated parts.

C. Horizontal Bottom Floor Seals:
   1. Modernfold IA2 bottom seal. Automatic operable seals providing nominal 2-inch (51 mm) operating clearance with an operating range of +1/2-inch (13 mm) to –1-1/2 inch (38 mm) which automatically drop as panels are positioned, without the need for tools or cranks.

2.5 Suspension System:

A. OP-01: #30 Suspension System.
   1. Suspension Tracks: Track shall be structural aluminum. Static loading of track with brackets at 48-inch (1220 mm) centers shall show no failure of track or brackets at 5,000 pounds (2250 kg) point loading at mid-span. Track shall be supported by adjustable steel hanger brackets connected to structural support by pairs of 3/8-inch (9.5 mm) diameter threaded rods.
      a) Exposed Track Soffit: Track soffit to be integral to track shape and shall be powder-coated off white paint finish. Track must accommodate termination of plenum sound barriers on both sides of track for maximum sound control.
   2. Carriers: One trolley in alternating panels with 3-inch (76 mm) diameter glass reinforced nylon, all steel precision-ground ball-bearing wheels. Steel wheeled or reinforced polymer trolleys on aluminum track not permitted. Trolleys shall attach to panels with 1/2-inch (13 mm) diameter pendent bolt mounted to welded steel mounting plate.

2.6 Options:

A. Pocket Doors: Acousti-Seal Pocket Doors by Modernfold, Inc., with same construction, finish, and appearance as the adjacent panels. Equipped with electric interlock system.
   1. Pocket door configuration shall be manually operated. Type III double doors hinged to jamb on each side and closing in the center. One of the door panels shall be equipped with a smaller hinged panel that folds back when the operable partition is extended into the pocket.

PART 3 — EXECUTION

3.1 Examination:
- A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable partitions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation:
- A. General: Comply with ASTM E557, operable partition manufacturer's written installation instructions, Drawings and approved Shop Drawings.
- B. Install operable partitions and accessories after other finishing operations, including painting have been completed.
- C. Match operable partitions by installing panels from marked packages in numbered sequence indicated on Shop Drawings.
- D. Broken, cracked, chipped, deformed or unmatched panels are not acceptable.

3.3 Cleaning and Protection:
- A. Clean partition surfaces upon completing installation of operable partitions to remove dust, dirt, adhesives, and other foreign materials according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions in a manner acceptable to the manufacturer and Installer that insure operable partitions are without damage or deterioration at time of Substantial Completion.

3.4 Adjusting:
- A. Adjust operable partitions to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and other moving parts.

3.5 Demonstration:
- A. Demonstrate proper operation and maintenance procedures to Owner's representative.
- B. Provide Operation and Maintenance Manual to Owner's representative.

END OF SECTION 10 22 26

SECTION 12 23 13 — WOOD INTERIOR SHUTTERS

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 wood interior shutters indicated on the Drawings and specified herein.

1.3 Scope: Provide window treatments in accordance with Specifications herein and on the Drawings. Furnish and install wood interior shutters complete and operable in accordance with the conditions and requirements as herein noted or otherwise implied. The work shall include the furnishings of all labor, materials, tools, etc. as required and any other items or supplements not specifically mentioned herein, but necessary for complete installation.

1.4 Operation: Openings shall be fitted precisely for fully operable shutters, hinged within the opening. Louvers shall be spaced at 2" on center and shall close fully with 1/2" overlap.

1.5 Submittal Data: If awarded, successful bidders must submit catalog data and actual color samples for approval.

A. Submit shop drawings indicating the following:
   1. Field measured dimensions of openings scheduled to receive window treatments. (Note: No extra charge or compensation will be allowed for the differences between field measurements and dimensions on the drawings).
   2. Illustrations of special accessory components not included in manufacturer's data.
   3. Details of head and sill conditions, corner conditions and conditions between adjacent wood interior shutter units.

1.6 Quality Assurance:

A. The work of this Section shall be by an experienced window treatment specialist. Each window treatment contractor who bids must submit a statement detailing that his or her company has been in business under its present name for a minimum of 5 consecutive years in contract (commercial) window blind fabrication. Window treatment contractors who bid shall also list previous completed projects of a similar scope and size. Include names and phone numbers of end users having first-hand knowledge of window treatment contractor’s performance on a minimum of 5 projects in the past 3 years. If any sub of the window treatment contractor does not operate his own workroom, and an outside workroom or installation service is to be used, the name and address of the outside workroom or installation service shall be included in a separate letter which details their experience as required above for the window treatment specialist.

B. It is the responsibility of each window treatment contractor who bids to make a thorough inspection of the special conditions that occur related to the work called for under this contract.

C. Window treatment contractor shall be responsible for complying with attached specifications and window schedules pertaining to but not limited to exact number of shutters required. These totals must be included as a part of their proposal and will be used as a basis for contract award.
D. Before ordering material or fabricating any work, the window treatment contractor shall verify all measurements and conditions at the job site. It will be the responsibility of the successful contractor to field measure all window openings and be responsible for the proper fit of all window treatments. No extra charge for compensation will be allowed for differences between field measurements and dimensions on the drawings.
E. Upon beginning the installation, the window treatment contractor shall assume the responsibility that the installation methods are proper and adequate for the conditions expected.
F. Window treatment contractor shall repair or replace to the satisfaction of the Owner any items showing defects of materials or workmanship at no cost to the Owner for a period of one year after approval of installation.
G. Window treatment contractor is responsible for monitoring the progress of the job in order to have all materials ready to install at the proper time. Sufficient qualified personnel must be assigned to the installation to assure timely completion.
H. Any product substitutions must be submitted for approval 7 days prior to bid date. Prebid approval of window treatment subcontractors is required. Requests for approval must be received at least 7 days prior to bid date.

PART 2 — PRODUCTS

2.1 Wood Interior Shutters:
A. Material: Shutters shall be fabricated of the highest-grade kiln dried, defect-free material. All wood shall be sound, stable and suitable for safe use free of open or loose knots or pitch pockets. Dowels shall be 3" x 3/8" spiraled birch or other suitable hard wood.
B. Construction:
1. Shutter stiles and rails shall be of mortise and dowel joinery with 3" dowels in each joint and glued securely under pressure.
2. Any panel exceeding 56" in height shall have lock rail installed at center or specified location.
3. Louvers shall rotate on nylon tenons bored and placed such that louvers remain balanced in position eliminating the need for tension adjustment mechanisms.
4. Inside stiles shall be rabbeted, outside stiles shall be mortised for hinges.
5. Louvers shall have nylon spacers at each end providing friction-free movement within stile.
6. Yoke pins connecting tilt control arm to louvers shall be coated, effectively being glued in position with wire gauge of #18.
7. Yoke pins shall measure minimum of 3/4" in louvers; 5/8" in tilt control arm and should be set in such a position so as to not strike or scar adjacent preceding louver with normal operation.
C. Structural Dimension: The finish thickness of the stiles shall be minimum 1". The finish thickness of the rails shall be 7/8". Louvers shall measure 3/8" x 2 1/2" flat with bull nose profile front and back.

D. Millwork: All shutter components shall be surfaced four sides free of mill lines, skips, splinters and saw marks. After assemblage shutter shall be sanded smooth for finishing.
E. Finishing: Shutters shall be factory finished with a minimum of four (4) coats of finish including sealer, primer, undercoats, and final topcoats. No open cracks or flaws or dings shall exist in finished product. Paint color or stain color shall be matched precisely to that which is specified in contract and strike off sample of match shall be provided on request prior to finishing.

PART 3 — EXECUTION

3.1 Installation: Shutters shall be installed with brass finish hinges of 0.65 gauge suitable for weight of panels to allow full and safe operation with proper clearances at window stool and between panels.

END OF SECTION 12 23 13

SECTION 23 05 00 — MECHANICAL GENERAL PROVISIONS

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 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.

A. This Contractor shall review all of the Contract Documents including all Drawings and Specifications of all Trades to ensure the complete implementation of Work.

B. 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.

C. 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.

D. 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.

E. 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.

F. 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 General 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 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 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: 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 materials, labor, administration and services required for complete installation of all supports and anchors indicated on Drawings and specified within this section.
- A. Ductwork, piping, equipment hangers, supports and required anchors.
- B. Equipment bases, frames and supports.
- C. Flashing and sealing equipment and pipe penetrations.
- D. 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:
   a) Public Areas: Solid plate stainless steel with satin finish.
   b) Non-Public Areas: Split ring chrome plated with set screws.
   c) 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 60 — THROUGH PENETRATION FIRE STOPPING

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 materials, labor, administration and services required for complete installation of all through penetration fire stopping indicated on Drawings and specified within this section.

A. 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: 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 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, retained by the Owner.
- 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

2.1 Not Applicable

PART 3 — EXECUTION

3.1 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 controls 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.

3.2 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.

3.3 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.

3.4 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.

3.5 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 airflowat 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.

3.6 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.

3.7 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.

3.8 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.

3.9 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.

3.10 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.

3.11 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.

3.12 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
   (1) 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: 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.

D. 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.
F.

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 Air	Concealed Outside Building Insulation Envelope (i.e. Attic)	D1	3"
Kitchen Grease Hood Exhaust Air	All	D4	3"

Ductwork System	Application	Insulation Type	Insulation Thickness
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 31 10 — GALVANIZED SHEET METAL DUCTWORK

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 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 equal to DuroDyna Neoprene UL classification file # R4462.

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 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.

3.4 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.

3.5 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 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. Expand the existing fire alarm as shown.
6. Install empty conduit for telephone/computer outlets as shown.

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. Device Plates
   6. 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. 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.
D. Where existing panelboards are modified by the addition or removal of circuits, the directory card shall be re-typed to indicate any changes. Where new breakers are provided for existing panels, all bus connectors needed for an operational system shall be provided.
E. Adhesive cable tie mounts and plastic cable ties shall be used for wire management inside panelboards.
F. A sign shall be located at each panel warning of potential electric arc flash hazards per NEC 110.16 requirements.
G. Interrupting ratings shall be coordinated with the available short circuit current. Series rating is unacceptable.
H. 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.
I. 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.
J. Circuit breakers for existing panels shall be of new manufacture and shall match the brand and model number appropriate for that panel.

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. 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.
D. 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.
E. 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.
F. All other conduit shall be galvanized or sherodized electrical metal tubing (thin wall).
G. 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.
H. 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".
I. 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.
J. All metallic fittings shall be constructed of steel. Cast fittings will be rejected.

K. 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.
L. 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
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 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. 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(*).
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(*)

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. 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. Unless noted otherwise, lamp colors shall be 3500 degrees Kelvin.
E. All lighting fixtures shall have a minimum color rendering index as indicated on the fixture schedule.
F. 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 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.

2.10 Telephone/Data Systems

A. Provide outlet boxes and conduit stub-outs as indicated for telephone/data outlets.
B. Cables and devices will be provided under separate contract.
C. Provide plastic bushings on conduit ends.
D. Conduit shall be 3/4" EMT minimum.

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. Provide grounding for entire electric installation as indicated and specified herein. Following are included as requiring grounding:
    1. Conduits and other conductor enclosures.
    2. Lighting panel boards, control centers, etc.
    3. Non-current-carrying metal parts of fixed equipment such as motors and lighting fixtures.
    4. Grounding screw for every receptacle and switch.
D. 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.
E. 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. Locate conduits at least 6" from steam pipes, hot water pipes, or other hot surfaces.
11. Do not pull wires before conduit and outlet boxes are permanently secured in place.
12. 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.

13. Any conduit that stubs above ceiling without termination into a junction box shall have a plastic bushing permanently installed.
14. All empty conduits shall have a nylon pull cord.
15. Provide a minimum of two (2) spare ¾" conduit stub-ups from each recessed panelboard.
16. Provide metallic conduit sleeves for all low voltage cables that penetrate fire rated barriers.
17. 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.
18. 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).
   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 bottom 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. 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 shall be labeled “F”.
C. 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. The existing system shall be expanded as indicated.
B. Devices shall match those already in use within the facility.
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 (when required).
   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.

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. System shall meet approval of authority having jurisdiction (AHJ).
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. Proof of permit shall be provided to the Architect at the pre-construction meeting or to the project engineer when required. A copy of the permit shall be submitted by the General Contractor when he submits the list of sub-contractors for the project.
4. The installing Contractor shall be under contract with the Fire Alarm manufacturer as an Engineered Systems Distributor.
5. The system shall be installed in accordance with the Alabama Certified Fire Alarm Act.
6. **All work shall be performed by Certified Alarm Company as a sub-contract to the Electrical Contractor.**

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. Expand the existing control panel as necessary for the additional devices to be added.
2. Each device shall be electrically supervised in accordance with wiring style specified.
3. Visual Annunciation:
a. Separate indication on each device for alarm, trouble, or supervisory conditions.
b. Device names, not numbers, shall be programmed into the control panel in a logical manner.
c. Fault or trouble condition on any zone shall not affect any other zone.
C. Alarm Initiating Devices:
a. Ceiling mounted smoke detectors shall be provided and installed here. Ceiling mounted detectors shall be photoelectric type.
b. Ceiling mounted heat detectors shall be rate-of-rise type.

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.

D. 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.

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. Loop wires through each device on zone for proper supervision. Tee-taps are not permitted unless specifically allowed in writing by the manufacturer.
E. Provide dust protection for installed smoke detectors until finish work is completed and building is ready for occupancy.
F. Protect conductors from cuts, abrasion and other damage during construction.
G. Minimum conductor size shall be 14 AWG unless otherwise specified or recommended by the manufacturer.
H. Do not install manual fire alarm boxes close to light switches.
I. 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 all additions to the system that were installed under this contract. Warranty shall include all parts, labor, and travel.

END OF SECTION 28 31 00