PROJECT MANUAL

OWNER or TENANT
O'Reilly Automotive Stores, Inc., A Missouri Corporation
(formerly known as O'Reilly Automotive, Inc.)
Corporate Offices
233 South Patterson
Springfield, MO 65802
417-862-2674 Phone

New O'Reilly Auto Parts Store
1101 N. Illinois Street
Harrisburg, Arkansas

Date: April 26, 2021

ARCHITECT
pb2 architecture + engineering
2809 Ajax Avenue, Suite 100
Rogers, Arkansas 72758

Project Number: 2021.0102

DOCUMENT 00 01 05

CERTIFICATION PAGE
HARRISBURG, AR

TO THE BEST OF MY PROFESSIONAL KNOWLEDGE AND BELIEF, THESE CONTRACT DOCUMENTS HAVE BEEN PREPARED IN ACCORDANCE WITH LOCAL AND STATE CODE REQUIREMENTS.

ARCHITECT

Scott Joseph Broadbent
2809 Ajax Avenue, Suite 100
Rogers, AR 72758

Architect of Record _____ Date _____

MECHANICAL ENGINEER

Josh Dale McCall
2809 Ajax Avenue, Suite 100
Rogers, AR 72758

Mechanical Engineer of Record

Date

ELECTRICAL ENGINEER

Keith Allen Williams
2809 Ajax Avenue, Suite 100
Rogers, AR 72758

Electrical Engineer of Record

Date

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DOCUMENT 00 31 00

INFORMATION AVAILABLE TO BIDDERS

A. The following items are included for reference and are for information only

1. Environmental/Hazardous Materials Reports:
   a. Phase I Environmental Site Assessment Findings Report by **Commonwealth Environmental Associates, Inc.** dated **February 19, 2021.**
   a. Asbestos Survey Report by **Commonwealth Environmental Associates, Inc.** dated **February 19, 2021.**
2. The Phase I Environmental Site Assessment Findings Report and Asbestos Survey Report are the responsibility of Commonwealth Environmental Associates, Inc., and not the responsibility of the Architect of Record. The Reports are made available for Contractor's convenience and information but is not a warranty of existing conditions. The Architect disclaims any liability for use of or interpretation of data from these Reports.

B. Statement of Special Inspections:
   a. Refer to Section 01 45 16 – Quality Control Procedures for additional requirements.

END OF DOCUMENT

SECTION 00 90 00

PROJECT FORMS

PART 1 – GENERAL

1.01 FORMS

A. The following project forms (or equivalent if approved by Architect and Owner) shall be used on this project:

1.	AIA G702	Application and Certificate for Payment (Edition 1992)
2.	AIA G703	Continuation Sheet for G702 (Edition 1992)
3.	CSI 1.5C	Substitution Request (During the Bidding Phase) (Revised 02/21/20)
4.	CSI 13.2A	Request for Interpretation (Revised 02/21/20)
5.	CSI 13.6A	Change Order Request (Proposal) (Revised 07/00/09)
6.	CSI 13.6C	Proposal Worksheet Detail (Revised 02/21/20)
7.	CSI 13.6D	Proposal Worksheet Summary (Revised 02/21/20)
8.	ORL-1	Store Turn Over / General Walk Thru (Revised 02/14/08)
9.	ORL-F	Final Unconditional Waiver of Lien (Revised 06/26/13)
10.	ORL-F.1	Partial Waiver of Lien (Revised 06/26/13)
11.	ORL-G	Subcontractors and Major Material Suppliers List (Revised 01/06/11)
12.	ORL-H	Punch List (Revised 02/08/11)
13.	ORL-I	PEMB Building Damage Form (Revised 01/13/11)
14.	ORL-K	PEMB Building Shortage Form (Revised 01/13/11)
15.	ORL-L	Maintenance Data Sheet (Revised 02/28/08)
16.	ORL-Q	Completion Pictures Photo Key – Exterior (Revised 02/21/20)
17.	ORL-Q.1	Completion Pictures Photo Key – Interior (Revised 02/21/20)
18.	ORL-R	Weekly Field Report (Revised 02/28/08)
19.	ORL-S	Landscaping Turn Over (Revised 02/28/08)
20.	V1.1	Silvercote Insulation Delivery Procedures (Revised 022120)
21.	V2.1	Carrier New Construction Order (Revised 02/21/20)
22.	V2.2	Carrier Delivery Storage Handling (Revised 02/21/20)
23.	V2.3	Carrier Warranty Certificate (Revised 10/00/08)
24.	V3.1	Graybar Damaged-Loss Freight Procedures (Revised 02/21/20)
25.	V3.2	Garybar Electrical Equipment Release (Revised 05/31/19)
26.	V4.1	Global Door Ordering Guide (Revised 02/21/20)
27.	V5.1	Gridpoint EMS Release (Revised 02/21/20)

B. Contractor is authorized to reproduce forms as required for this project only. Reproduction for work not associated with this project is prohibited and is subject to copyright laws of the document author.

PART 2 – PRODUCTS – Not Applicable To This Section

PART 3 – EXECUTION

A. Submit forms as required in BIDDING REQUIREMENTS, CONTRACT FORMS, AND CONDITIONS OF THE CONTRACT and Section 01 20 00 – Project Procedures.

END OF SECTION

SECTION 01 11 00

SUMMARY OF WORK

PART 1 – GENERAL

1.01 SUMMARY

A. Project summary:
   1. Construction and completion of the O'Reilly Auto Parts Store for the Owner's intended use of wholesale and retail sale of auto parts at the location described in Invitation To Bid under a single lump sum contract and quantity of time as described in the Contract.
B. Work Owner, or Others, furnished and installed (Refer to drawings - Scope of Work Schedule).
C. Work Owner furnished, Contractor installed (Refer to drawings – Scope of Work Schedule). Contractor scope of work shall include coordination with Owner for ordering, receipt, handling, storage, and installation requirements of Owner furnished materials.
D. Permits and Fees: Apply for, obtain, and pay for permits, fees, and utility company back charges required to perform the work. Submit copies and invoices to Owner for reimbursement. No overhead and profit charges are allowed.
E. Industry Standards:
   1. Applicability of Standards: Except where more explicit or stringent requirements are written into the Contract Documents, applicable construction industry standards have the same force and effect as if bound into or copied directly into the Contract Documents. Such industry standards are made a part of the Contract Documents by reference. Individual specification sections indicate which codes and standards the Contractor must keep available at project site for reference.
   2. Publication Dates: Except as otherwise indicated, where compliance with an industry standard is required, comply with standard in effect as of date of Contract Documents.
   3. Conflicting Requirements: Where compliance with two or more standards is specified, and where these standards establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents specifically indicate otherwise. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Owner for a decision before proceeding.
   4. Copies of Standard: The Contract Documents require that each entity performing work be experienced in that part of the work being performed. Each entity is also required to be familiar with industry standards applicable to that part of the work. Copies of standards are needed for proper performance of the work; the Contractor is required to obtain such copies directly from the publication source.
   5. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where acronyms or abbreviations are used in the specifications or other Contract Documents they are defined to mean the recognized name of the trade association, standards generating organization, governing authority, or other entity applicable to the context of the text provisions.
F. Codes: Comply with applicable codes and regulations of authorities having jurisdiction. If pertinent codes and standards conflict with any instruction, process or material stated in the Contract Documents, the more stringent shall govern. Submit copies of inspection reports, notices and similar communications to Owner.
G. Definitions:
   1. Provide: Furnish and install, complete with all necessary accessories, ready for intended use. Pay for all related costs.

2. Approved: Acceptance of item submitted for approval. Not a limitation or release for compliance with the Contract Documents or regulatory requirements. Refer to limitations of 'Approved' in General and Supplementary Conditions.
3. Match Existing: Match existing as acceptable to the Owner.

H. Intent: Drawings and specifications are intended to provide the basis for proper completion of the work suitable for the intended use of the Owner. Anything not expressly set forth but which is reasonably implied or necessary for proper performance of the project shall be included.

I. Writing style: Specifications are written in the imperative mode. Except where specifically intended otherwise, the subject of all imperative statements is the Contractor. For example, 'Provide tile' means 'Contractor shall provide tile'.

PART 2 – PRODUCTS – Not Applicable To This Section

PART 3 – EXECUTION – Not Applicable To This Section

SECTION 01 20 00

PROJECT PROCEDURES

PART 1 – GENERAL

1.01 SUMMARY

A. Follow project procedures for proper submission of payment request, schedules, contract correspondence documents, coordination of work, and communication with Owner and Architect.
B. Submit information on Owner provided Project Forms where referenced by AIA, CSI, ORL, or numbers. Refer Section 00 90 00 for listing.

1.02 PROCEDURES PRIOR TO CONSTRUCTION

A. Within 72 hours of Contractor's receipt of Notice to Proceed or letter of intent.
   1. Submit Subcontractors and Major Material Suppliers to be used for the project, (ORL-G).
B. Within 10 days upon Contractor's receipt of Notice to Proceed or letter of intent.
   1. Submit proposed progress schedule, bar-chart type, indicating a time bar for each trade or operation or work to be performed at the site. Time bar shall demonstrate planned work, properly sequenced and intermeshed, for expeditious completion of the project.
   2. Forward copy of building permit within 48 hours of issuance by Government Agency.
C. Prior to commencing work on the project, Contractor must record Notice of Commencement or similar notices to the extent applicable in the state where the project is located. Provide copy of recorded notice to Owner.

1.03 PROCEDURES DURING CONSTRUCTION

A. Progress Payment Request Procedures: Application for payment and lien waivers to be received together on a monthly basis. Submit electronically to OREILLYPAYME@YAHOO.COM. Refer to General Conditions of the Contract for electronic submittal requirements.
   1. Submit Application and Certificate for Payment (AIA G702 and G703).
      a. Itemize separate line cost for each major item of work and each subcontracted item of work (Sections under Division 2 through 33 in Table of Contents as a basis for listing).
      b. Application to include a summary of approved Change Orders. Actual copies of change orders are not required.
   2. Submit lien waivers (ORL-F.1) for work completed in prior paid Application and Certificate of Payment.
B. Requirements for sequencing or scheduling:
   1. Coordination:
      a. Coordinate the work of all trades.
      b. Verify location of utilities and existing conditions.
      c. Schedule 10 days after notice to proceed with local utility companies for installation of utility service connections.
      d. Coordinate date of installation of temporary key storage device and combination code.
      e. Schedule and coordinate material manufacturer's installation inspections, where required in specification sections.

2. Work: Owner Furnished, Contractor Installed (Refer to drawings – Scope of Work Schedule)
    a. Section 07 21 00 – Building Insulation. Refer to procedures Form (V1.1).
    b. Section 08 11 19 – Steel Doors and Frames. Refer to procedures Form (V4.1).
    c. Section 08 71 00 – Door Hardware. Refer to procedures Form (V4.1).
    d. Section 13 34 19 - Pre-Engineered Metal Building System Erection. Owner to schedule with Contractor 28 days prior to anticipated shipping date of Owner supplied Pre-Engineered Metal Building. Refer to procedures Forms (ORL-I, ORL-K)
    e. Division 20, 21, 22, 23 and 25 – Mechanical. Contractor to schedule with Owner's Mechanical Equipment Supplier 14 days prior to completion of building areas being prepared for installation of mechanical systems for ordering, shipping, and receiving of equipment. Refer to procedures Forms (V2.1 , V2.2, V2.3).
    f. Division 26 – Electrical.
        1) Light fixture and switchgear package. Refer to procedures Forms (V3.1, V3.2).
        2) Energy Management System (EMS) package. Refer to procedures Form (V5.1).

C. Inspection:
1. Contractor to notify Owner's testing and inspection company prior to beginning major portions of the work as required by individual specification sections, but not less than 48 hours.
2. Coordinate with local, state or federal organizations having jurisdiction over the project for notification and inspection requirements. Forward copies of reports to Owner.
3. Meetings or correspondence between Contractor and Entities having jurisdiction over the project which result in requested modifications to the Work shall be summarized in writing within 72 hours of such meeting and forwarded to Owner for review and response.
4. Contractor shall provide Owner and Design Professional of Record copies of material manufacturer's installation inspection reports, where required in specification sections.

D. Testing:
1. Comply with Section 01 45 16 – Quality Control Procedures.
2. Unless otherwise indicated, Owner shall provide testing and inspection professional services as required by General Conditions and individual sections. Refer to sections for testing types and frequency requirements.
3. Owner and/or Design Professional of Record reserve the right to have tests made when deemed necessary.
    a. Tests not specified as part of a section shall be paid for by the Owner. Should test reveal a failure of the work to meet Contract Document requirements, subsequent tests, related to the failure, will be paid by the Owner, with cost deducted from monies owed to the Contractor by change order.
    b. Tests shall be made in accordance with recognized standards by a competent, independent testing laboratory.
    c. Materials found defective or not in conformance with the Contract Document requirements shall be promptly replaced or repaired at the expense of the Contractor.

E. Field engineering:
1. Secure the services of a registered civil engineer, land surveyor, or employ qualified personnel for setting, maintaining and establishing finished elevations and lines.
2. If the site conditions indicated in the Contract Documents differ materially from those the Contractor encounters in the performance of the work, the Contractor

shall within 48 hours and before such conditions are disturbed, notify the Owner in writing.

F. Construction contract administration correspondence to be submitted as follows:
   1. Weekly report (ORL-R) and supporting photos, summarizing site conditions and activities for the specified period. Report to be submitted by e-mail to OREILLYWEEKLYREPORTS@YAHOO.COM and received not later than 9:00 am the following Monday or first available business day of Owner operations.
      a. Photos shall be submitted as follows:
         1) Minimum acceptable resolution is approximately 1152 x 864. Maximum is 1400 x 1200.
         2) Set the photo quality and/or image resolution on the camera to the "fine" setting.
         3) Photos should be date stamped.
         4) Send the photos as an attachment of the e-mail, not as embedded images.
         5) Photos should be submitted as a .jpg/.jpeg file format
         6) Weekly reports should have a minimum of 10 photos attached.
   2. Contractor's Request for Interpretation (CSI 13.2A).
   3. Contractor's Change Order Request Proposal (CSI 13.6A).
   4. Contractor's Proposal Worksheet (CSI 13.6C and CSI 13.6D).

G. Contractor to maintain record drawings and specifications on site by annotation as work progresses.

1.04 GENERAL PROCEDURES

A. Dimensions: Verify dimensions indicated on drawings with field dimensions before fabrication or ordering of materials. DO NOT scale drawings.

B. Cutting and Patching:
   1. Provide cutting and patching work to properly complete the work. Do not cut and patch in a manner that would result in a failure of the work to perform as intended, decreased energy performance, increased maintenance, decreased operational life, or decreased safety.
   2. Perform work with workmen skilled in the trades involved. Use proper tools to minimize damage to adjacent work. Check for concealed utilities and structure before cutting.
   3. Match existing materials with new materials conforming to project requirements.
   4. Make patches, seams, and joints durable and inconspicuous. Comply with tolerances of new work.

C. General Installation Requirements
   1. Inspect substrates and report unsatisfactory conditions in writing.
   2. Do not proceed until unsatisfactory conditions have been corrected.
   3. Take field measurements prior to fabrication where practical. Form to required shapes and sizes with true edges, lines and angles. Provide inserts and templates as needed for work of other trades.
   4. Install materials in exact accordance with manufacturer's instructions and approved submittals.
   5. Install materials in proper relation with adjacent construction and with proper appearance.
   6. Restore construction and site damaged during installation. Replace construction, which cannot be restored, at no additional expense to the Owner.
   7. Refer to additional installation requirements and tolerances specified under individual specification sections.

D. Existing conditions: Notify Owner of existing conditions differing from those indicated on the drawings. Do not remove or alter structural components without prior written approval. Inspect conditions prior to work to identify scope and type of work required. Protect adjacent work.

1.05 PROCEDURES PRIOR TO CONTRACT CLOSEOUT

A. The following are prerequisites to substantial completion. Provide the following:
   1. Punch list (ORL-H).
   2. Within Fourteen (14) days prior to substantial completion, submit As-Built Survey and photographic documentation of completed construction complying with Section 02 21 00.

B. Provide the following prerequisites for final acceptance: Refer to General Conditions of Contract for additional requirements.
   1. Submit Final payment request (AIA G702 and G703).
   2. Submit Final Unconditional Waiver of Lien (ORL-F).
   3. Submit Completed punch list (ORL-H).
   4. Notice of Owner's review and approval of As-Built Survey.
   5. Submit Occupancy Permit.
   6. Submit construction completion photos in format as defined in Part (1.03.F.1.a) and Forms (ORL-Q, ORL-Q.1).

C. Provide the following closeout items:
   1. Submit electronic media of approved As-Built Survey and photographic documentation of completed construction.
   2. Submit one set of As-Built drawings in hard copy and electronic scans in PDF format, prepared by the Contractor showing in red ink, on-site changes to the original construction documents.
   3. Submit Warranties, where indicated.
   4. Comply with requirements of Section 20 02 00 - Contract Closeout & Commissioning.
   5. Submit Operation and Maintenance Manuals.
   6. Submit Maintenance Data Sheet (ORL-L)
   7. Submit Store Turn Over / General Walk Thru (ORL-1)
   8. Submission of Landscape Turn Over (ORL-S)
   9. Final cleaning and touch-up.
   10. Removal of temporary facilities.

PART 2 – PRODUCTS – Not Applicable To This Section

PART 3 – EXECUTION – Not Applicable To This Section

END OF SECTION

SECTION 01 33 00

SUBMITTALS AND SUBSTITUTIONS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide types of submittals including shop drawings, product data, samples, schedules, reports, and request for substitutions, as required by the Bidding and Contract Documents in strict accordance with provisions listed in individual sections and quantity and format indicated. Provide required resubmittals if original submittals are not approved. Provide distribution of approved submittals including modifications after submittals have been approved.
B. Provide warranties as specified; warranties shall not limit length of time for remedy of damages Owner may have by legal statute. Warranties shall be signed by contractor, supplier or installer responsible for performance of warranty.

PART 2 – PRODUCTS

2.01 PRE-BID SUBSTITUTIONS

A. The naming of specified items on the drawings or in the specifications mean that such named items are specifically desired by the Owner. If the words “or acceptable equal” or “or approved equal” follows such named items, substitution request may be submitted. REQUEST FOR SUBSTITUTION MUST BE RECEIVED BY OWNER 5 DAYS PRIOR TO BID SUBMITTAL, UNLESS OTHERWISE NOTED.
B. Substitution Request Forms (Refer Section 00 90 00): Request must be submitted to Owner by e-mail electronically in PDF format on copies of form (CSI 1.5C) and must name the exact item proposed with complete information filled out and back-up data attached as specified on that form. Use separate Substitution Request Form for each item. Request showing only brand name or manufacturer, or otherwise incomplete, will not be reviewed. Submit samples if requested.
C. The Owner is the sole judge as to the equality of proposed substitutions. Only written acceptances will be held valid by the Owner.
D. If any substitution will affect a correlated function, adjacent construction, or the work of other trades or contractors, the necessary changes and modifications to the affected work will be considered as part of the substitution, to be accomplished without additional cost to the Owner, if and when accepted.
E. Under no circumstances shall the Owner’s acceptance of any such substitution relieve the Contractor from timely, full and proper performance of the work.

2.02 AFTER AWARD OF CONTRACT SUBSTITUTION REQUEST

A. Substitution request will be considered only under one of the following conditions:
    1. Unavailability of specified product due to a strike, lockout, bankruptcy, discontinuance of manufacturing of a product, or natural disasters. Submit proof that orders were placed within 10 days after review by Owner of item listed in specifications. Failure to order materials in time for proper delivery is not an acceptable condition.
    2. When warranty of performance is required and, in the judgement of the Contractor, the specified product or process will not produce the desired result.
B. Submit request for such substitution in writing electronically to Owner within 10 days of date of ascertaining unavailability of material or equipment specified, or that the performance cannot be warranted.

C. If any substitution will affect correlated function, adjacent construction, or work of other trades or contractor, the necessary changes and modifications to the affected work will be considered as part of the substitution, to be accomplished without additional cost to Owner, if and when accepted.
D. Approved substitutions will be effected by a Change Order. Under no circumstances shall the Owner's acceptance of any such substitution relieve the Contractor from timely, full and proper performance of the work.

2.03 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

A. Prior to submittal to Owner, Contractor shall review shop drawings, product data, and samples for compliance with Contract Documents and shall affix Contractor's approved stamp to each submittal. Failure to follow these procedures will result in rejection of submission and no additional contract time will be allowed for delay for this cause. Refer to individual specifications sections for required submittal types.
B. Submit by e-mail, Contractor's stamped approved shop drawings electronically in PDF format for Owner's review. Required shop drawings shall be drawn to a scale sufficiently large to show pertinent features of item and its method of connection to work. Submit related shop drawings together; partial submittals will not be accepted. Reproduction of contract documents in any form for use as shop drawings will not be permitted. Provide manufacturer's name and model number of prefabricated items and indicate methods of attachment and clearances required relative to other trades affecting all elements of work. Identify deviations from Contract Documents, (if any). Check dimensions, check that trades have been coordinated and that no conflict will develop in installation.
C. Submit by e-mail, Contractor's stamped approved product data electronically in PDF format for Owner's review. Mark data clearly to indicate exact items submitted, and note deviations from Contract Documents, (if any).
D. Submit by delivery service, physical material samples for Owner's review.
E. The Owner will review submittals and stamp electronically with indication of action as appropriate. The Owner will retain record of electronic files, and return copy of electronic files to the Contractor. For submittal returned "Rejected/Resubmit" or "Revise/Resubmit", correct the submittal, and resubmit. For submittal returned "Reviewed", "Approved", or "Approved as Noted", provide such number of electronic files and/or prints as may be needed for field distribution. Submittal returned "Not Subject to Review", are for submittals not required by the Contract Documents and require no action by Owner. Owner shall retain physical material samples until project completion.

PART 3 – EXECUTION

3.01 IDENTIFICATION OF SUBMITTALS

A. Completely identify each submittal and re-submittal by showing at least the following information in e-mail subject line or by physical transmittal cover:
    1. Name of project and Owner's project number as it appears on Construction Documents.
    2. Name and address of submitter, plus name and telephone number of the individual who may be contacted for further information.
    3. Drawing number and specifications section number to which the submittal applies.
    4. Whether this is an original submittal or re-submittal.

3.02 TIMING OF SUBMITTALS

A. General: Make all submittals far enough in advance for schedule dates of installation to provide all required time for reviews, for securing necessary approvals, for possible revision and re-submittal, and for placing orders and securing delivery.
B. Make submission affecting section of color, texture, and/or pattern within thirty (30) days after signing the Contract.
C. Delays: Costs of delays due to late submittals may be back-charged as necessary and shall not be borne by the Owner.

END OF SECTION

SECTION 01 45 16

QUALITY CONTROL PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SCHEDULES AND FORMS

A. The following schedules and forms to be provided on drawings, included herein, or under separate cover by design professional of record for project specific conditions and local building code requirements.
   1. STATEMENT OF SPECIAL INSPECTIONS (Refer to Section 00 31 00 – Information Available to Bidders)
   2. SCHEDULE OF INSPECTION AND TESTING AGENCIES
   3. FINAL REPORT OF SPECIAL INSPECTIONS

1.03 SUMMARY

A. This Section includes administrative and procedural requirements required for compliance with the International Building Code, Chapter 17, Structural Tests and Special Inspections.
   1. Exceptions: Portions of special inspections shall not be required where the fabricator is approved in accordance with building code requirements and agencies having jurisdiction.

B. Structural and construction material testing and special inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve contractor of responsibility for compliance with other construction document requirements.
   1. Specific quality-assurance and quality-control requirements for individual construction activities are specified in their related Sections. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and control procedures that facilitate compliance with the construction document requirements.
   3. Requirements for contractor to provide quality-assurance and control services required by architect, owner, or authorities having jurisdiction are not limited by provisions of this section.

C. The Owner will engage one or more qualified special inspectors and/or testing agencies to conduct structural tests, construction material testing and special inspections specified in this section and related sections and as may be specified in other divisions of these specifications.

D. Related Sections include but are not limited to the following:
   1. 03 30 00 CAST-IN-PLACE CONCRETE
   2. 03 38 00 POST-TENSIONED SLABS-ON-GRADE
   3. 04 20 00 UNIT MASONRY
   4. 05 12 00 STRUCTURAL STEEL
   5. 05 21 00 STEEL JOIST
   6. 05 31 00 STEEL DECK

7. 05 40 00 COLD-FORMED METAL FRAMING
8. 07 24 00 EXTERIOR INSULATION AND FINISH SYSTEMS
9. 13 34 18 PRE-ENGINEERED METAL BUILDING SYSTEM ERECTION
10. 13 34 19 PRE-ENGINEERED METAL BUILDING SYSTEM
11. 31 00 00 EARTHWORK
12. 31 40 10 HELICAL SCREW FOUNDATIONS
13. 31 62 00 DRIVEN PILES
14. 31 63 00 BORED AND BELLED CONCRETE PIERS

1.04 DEFINITIONS

A. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved by the building official.
B. Approved Fabricator: An established and qualified person, firm or corporation approved by the building official pursuant to applicable building code requirements. Fabricator shall be registered and approved to perform work on the premises of the fabricator without special inspection as defined in the applicable building code. Approval shall be based upon review of fabricator's written procedural and quality control manuals and periodic auditing of fabrication practices by an approved special inspection agency. Fabricator shall submit certificate of compliance upon request.
C. Construction Documents: Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit. Construction Documents include all supplemental instructions, sketches, addenda, and revisions to the drawings and specifications issued by the registered design professional beyond those issued for a building permit.
D. Shop Drawings/Submittal Data: Written, graphic and pictorial documents prepared and/or assembled by the contractor based on the Construction Documents.
E. Structural Observation: Visual observation of the structural system by a representative of the registered design professional's office for general conformance to the approved construction documents. Structural observations are not considered part of the structural tests and special inspections and do not replace inspections and testing by the testing agency or special inspector.
F. Special Inspector: A qualified person who demonstrates competence, to the satisfaction of the code enforcement official and registered design professional in responsible charge, for inspection of the particular type of construction or operation requiring special inspection. The special inspector shall be a licensed professional engineer or engineering intern or a qualified representative from the testing agency.
G. Special Inspection, Continuous: The full-time observation of work requiring special inspection by an approved special inspector who is present in the area where the work is being performed.
H. Special Inspection, Periodic: The part-time or intermittent observation of work requiring special inspection by an approved special inspector who is present in the area where the work has been or is being performed and at the completion of the work.
I. Testing Agency: A qualified materials testing laboratory under the responsible charge of a licensed professional engineer, approved by the code enforcement official and the registered design professional in responsible charge, to measure, examine, test, calibrate, or otherwise determine the characteristics or performance of construction materials and verify conformance with construction documents.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. Minimum qualifications of inspection and testing agencies and their personnel shall comply with ASTM E329-03 Standard Specification for Agencies in the Testing and/or Inspection of Materials Used in Construction.
    a. Inspectors and individuals performing tests shall be certified for the work being performed as outlined in the appendix of the ASTM E329. Certification by organizations other than those listed must be submitted to the building official for consideration before proceeding with work.

B. In addition to these requirements, local jurisdiction may have additional requirements. It is the responsibility of the testing and inspection agencies to meet local requirements and comply with local procedures.

1.06 CONFLICTING REQUIREMENTS, REPORTS, AND TEST RESULTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to the owner for a decision before proceeding.
B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to the owner for a decision before proceeding.
C. The special inspector's reports and testing agencies results shall have precedence over reports and test results provided by the contractor.
D. Where a conflict exists between the construction documents and approved shop drawings/submittal data, the construction documents shall govern unless the shop drawings/submittal data are more restrictive. All conflicts shall be brought to the attention of the registered design professional in responsible charge and owner.

1.07 SUBMITTALS BY SPECIAL INSPECTOR AND/OR TESTING AGENCY

A. Special inspectors shall keep and distribute records of inspections. The special inspector shall furnish inspection reports to the building official (if required), contractor, and owner. Reports shall indicate that work inspected was done in conformance to approved construction documents. Discrepancies shall be brought to the immediate attention of the contractor and Owner for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the building official, contractor and Owner prior to the completion of that phase of the work. A final report documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted at a point in time agreed upon by the permit applicant and the building official prior to the start of work.
    1. Special inspection reports and test results shall include, but not be limited to, the following:
        a. Date of inspection.
        b. Description of inspections or tests performed including location (reference grid lines, floors, elevations, etc.).
        c. Statement noting that the work, material, and/or product conforms or does not conform to the construction document requirements.
            1) Name and signature of contractor's representative who was notified of work, material, and/or products that do not meet the construction document requirements.
    2. Name and signature of special inspector and/or testing agency representative performing the work.

B. Schedule of Non-Compliant Work: Each agent shall maintain a log of work that does not meet the requirements of the construction documents. Include reference to original inspection / test report and subsequent dates of re-inspection/retesting.
C. Reports and tests shall be submitted within 1 week of inspection or test. Schedule of Non-Compliant Work shall be updated daily and submitted at weekly intervals.
D. Final Report of Special Inspections. Submitted on forms per local jurisdiction requirements.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.01 CONTRACTOR'S RESPONSIBILITY

A. The contractor shall coordinate the inspection and testing services with the progress of the work. The contractor shall provide sufficient notice to allow proper scheduling of all personnel. The contractor shall provide safe access for performing inspections and on site testing.
B. The contractor shall submit construction schedules to the owner, and testing and inspecting agencies. Schedules will note milestones and durations of time for materials requiring structural tests and special inspections.
C. Each contractor responsible for the construction of a seismic-force-resisting system, designated seismic system, or component listed in the quality assurance plan shall submit a written contractor's statement of responsibility to the building official and the owner prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain the following:
    1. Acknowledgment of awareness of the special requirements contained in the quality assurance plan.
    2. Acknowledgment that control will be exercised to obtain conformance with the construction documents approved by the building official.
    3. Procedures for exercising control within the contractor's organization, the method and frequency of reporting and the distribution of the reports.
    4. Identification and qualifications of the person(s) exercising such control and their position(s) in the organization.
D. Each contractor responsible for the construction of a main windforce-resisting system or a wind-resisting component listed in the quality assurance plan shall submit a written statement of responsibility to the building official and the owner prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain the following:
    1. Acknowledgment of awareness of the special requirements contained in the quality assurance plan.
    2. Acknowledgment that control will be exercised to obtain conformance with the construction documents approved by the building official.
    3. Procedures for exercising control within the contractor's organization, the method and frequency of reporting and the distribution of the reports.
    4. Identification and qualifications of the person(s) exercising such control and their position(s) in the organization.
E. The contractor shall repair and/or replace work that does not meet the requirements of the construction documents.
    1. Contractor shall engage an engineer / architect to prepare repair and/or replacement procedures.
    2. Engineer/architect shall be registered in the state in which the project is located and shall be acceptable to the registered design professional in responsible charge, code enforcement official, and owner.

3. Procedures shall be submitted for review and acceptance by the registered design professional in responsible charge, code enforcement official, and owner before proceeding with corrective action.

F. The contractor shall be responsible for costs of:
   1. Re-testing and re-inspection of materials, work, and/or products that do not meet the requirements of the construction documents and shop drawings/submittal data.
   2. Review of proposed repair and/or replacement procedures by the registered design professional in responsible charge and the inspectors and testing agencies.
   3. Repair or replacement of work that does not meet the requirements of the construction documents.

3.02 STRUCTURAL OBSERVATIONS

A. Structural observations may be made periodically as determined by the registered design professional in responsible charge and/or owner.

3.03 TESTING AND INSPECTIONS

A. Testing and inspection shall be in accordance with the Schedule of Special Inspections.
B. Reference related specifications for the minimum level of inspections and testing. Provide additional inspections and testing as necessary to determine compliance with the construction drawings and Governing Authority.

END OF SECTION

SECTION 01 51 00

TEMPORARY FACILITIES

PART 1 – GENERAL

1.01 SUMMARY

A. Provide temporary utilities and miscellaneous facilities required during construction, complete, including utility costs, maintenance, and removal.

PART 2 – PRODUCTS

2.01 UTILITIES

A. Temporary Utilities: Provide and pay for costs of gas, water, and electricity required for performance of the work. Make necessary arrangements with utility companies for temporary service.
   1. Gas and Water: Provide necessary temporary piping, fittings, and metering.
   2. Electricity: Provide necessary temporary electrical wiring and metering. Provide area distribution boxes so located that individual trades may use their own construction type extension cords to obtain adequate power and lighting for construction operations.

2.02 TEMPORARY SANITARY FACILITIES

A. Provide on-site temporary toilet facilities for use of construction personnel as specifically required by local or state health department. Maintain in a sanitary condition.

2.03 FIELD OFFICE AND SHEDS

A. Contractor’s option to provide field office and storage facilities adequate in size and accommodation for Contractor’s field project representative office, supplies, and tools.

2.04 PROJECT IDENTIFICATION

A. Contractor’s option to provide project sign.

2.05 PARKING AND STAGING AREAS

A. Provide adequate space for construction activities.
   1. Do not unreasonably encumber site with materials or equipment. Confine stockpiling of materials in an orderly fashion. New building may be used to secure materials, tools, and equipment in a manner to allow Work to continue unimpeded.
   2. Confine operations at site to areas permitted under Contract. Portions of site beyond areas of which is indicated are not to be disturbed. Conform to site rules and regulations affecting work while engaged in project construction.

2.06 TEMPORARY HEAT AND VENTILATION

A. Provide temporary heat where needed for proper performance of the work, for curing or drying of work recently installed, and protection of work in place from adverse effects of low temperatures.

B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, and gases.

2.07 DEWATERING, SNOW, AND ICE REMOVAL

A. Maintain site, excavations, and construction free of water, snow, and ice, as necessary for protection and execution of the work.

2.08 TEMPORARY FENCING

A. Provide temporary fencing, barricades and guards to protect existing construction, trees and other vegetation indicated to remain, against unnecessary damage.
B. Provide site enclosure fence, barricades, warning signs, and lights as required for compliance with local, state, and national safety regulations.
C. Provide environmental protection systems required for compliance with local, state, and national regulations.

2.09 TEMPORARY FIRE PROTECTION

A. During construction period and until fire protection needs are fulfilled by permanent facilities, provide and maintain types and forms of temporary fire protection needed to protect facilities against fire losses. Store combustible materials in recognized fire-safe locations and containers.

2.10 SECURITY

A. Provide sufficient control to prevent illegal entry or damage during nights, holidays, or other periods when work is not being executed, and such other controls as required during working hours.
B. Provide temporary key storage on site as follows:
    1. Install during construction when building interior is securable. Mount key storage device on rear entry door pull hardware, unless otherwise directed by Owner.
    2. Temporary key storage device to be combination type with maximum five (5) key capacity. Device to store only keys associated with temporary construction locks. Upon installation submit storage lock combination code to Owner.
    3. Prior to final closes out, schedule remove of temporary key storage device with Owner.

2.11 CLEANING AND TRASH REMOVAL

A. Provide facilities necessary for storage and confining construction waste materials, debris and rubbish. Maintain site in a clean and orderly condition.

PART 3 – EXECUTION

3.01 REMOVAL

A. Maintain construction facilities and temporary controls as long as needed for safe and proper completion of work. Remove temporary facilities and controls as rapidly as progress of work will permit or as directed by Owner.

END OF SECTION

SECTION 01 52 40

CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Salvaging nonhazardous demolition and construction waste.
   2. Recycling nonhazardous demolition and construction waste.
   3. Disposing of nonhazardous demolition and construction waste.

1.03 SUBMITTALS

B. Comply with Section 01 33 00.
C. Waste Management Plan: Submit 3 copies of plan within 7 days of date established for the Notice to Proceed.

1.04 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the work.

1.05 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:
   1. Demolition Waste:
      a. Asphaltic concrete paving.
   2. Construction Waste:
      a. Site-clearing waste.
      b. Masonry and CMU.
      c. Lumber.
      d. Wood sheet materials.
      e. Wood trim.
      f. Metals.
      g. Roofing.
      h. Insulation.
      i. Carpet and pad.
      j. Gypsum board.
      k. Piping.

l. Electrical conduit.

3. Packaging: Regardless of salvage/recycle goal indicated in paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
   a. Paper
   b. Cardboard
   c. Boxes
   d. Plastic sheet and film
   e. Polystyrene packaging
   f. Wood crates
   g. Plastic pails

1.06 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit three copies of report. Include separate reports for demolition and construction waste. Include the following information:
   1. Material category.
   2. Generation point of waste.
   3. Total quantity of waste in tons.
   4. Quantity of waste salvaged, both estimated and actual in tons.
   5. Quantity of waste recycled, both estimated and actual in tons.
   6. Total quantity of waste recovered (salvaged plus recycled) in tons.
   7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit 3 copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Qualification Data: For Waste Management Coordinator.

1.07 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of Projects with similar requirements, as waste management coordinator.

B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Waste Management Conference: General Contractor conduct conference at Project site to comply with requirements in Section 01 20 00 – Project Procedures. Review methods and procedures related to waste management including, but not limited to, the following:
   1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
   2. Review requirements for documenting quantities of each type of waste and its disposition.
   3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
   4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
   5. Review waste management requirements for each trade.

1.08 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements of this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan. Contactor shall complete and submit attached Construction

Waste Management (CWM) Plan, Construction Waste Management (CWM) Worksheet and Construction Waste Management (CWM) Acknowledgement to the City.

B. Waste Identification: Indicate anticipated types and quantities of demolition waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
   1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
   2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
   3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
   4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
   5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
   6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
   1. Total quantity of waste.
   2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
   3. Total cost of disposal (with no waste management).
   4. Revenue from salvaged materials.
   5. Revenue from recycled materials.
   6. Savings in hauling and tipping fees by donating materials.
   7. Savings in hauling and tipping fees that are avoided.
   8. Handling and transportation costs. Include cost of collection containers for each type of waste.
   9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 PLAN IMPLEMENTATION

A. General: Implement waste management plan as approved by Architect. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
   1. Comply with Section 01 51 00 - Temporary Facilities for operation, termination, and removal requirements.

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall monitor the site in conjunction with the Project Superintendent. Job superintendent shall monitor on a daily basis. Coordinator shall still be responsible for all documentation.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
   1. Distribute waste management plan to everyone concerned within three days of submittal return.
   2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.

2. Comply with Section 02 01 00 – Site Preparation for controlling dust and dirt, environmental protection, and noise control.

3.02 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers.
   3. Store items in a secure area until installation.
   4. Protect items from damage during transport and storage.
   5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

3.03 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.
B. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
   1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
      a. Inspect containers and bins for contamination and remove contaminated materials if found.
   2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
   4. Store components off the ground and protect from the weather.
   5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.04 RECYCLING DEMOLITION WASTE

A. Asphaltic Concrete Paving: Grind asphalt to maximum 1-1/2-inch (38-mm) size.
   1. Crush asphaltic concrete paving and screen to comply with requirements in Section 31 00 00 - Earthwork for use as subbase or fill material with prior approved by Geotechnical Engineer.
B. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility.

3.05 RECYCLING CONSTRUCTION WASTE

A. Packaging:
   1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
   2. Polystyrene Packaging: Separate and bag materials.
   3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
   4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
B. Wood Materials:
   1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
   2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
   1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.06 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
B. Burning: Do not burn waste materials.
C. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.
D. Disposal: Transport waste materials and dispose of at designated spoil areas on Owner's property.
E. Disposal: Transport waste materials off Owner's property and legally dispose of them.

3.07 ATTACHMENTS

A. Construction Waste Management (CWM) Plan
B. Construction Waste Management (CWM) Worksheet
C. Construction Waste Management (CWM) Acknowledgement

END OF SECTION

Construction Waste Management (CWM) Plan

Note: This sample form may be used to assist in documenting compliance with the waste management plan.

Project Name: _____
Job#: _____

Project Manager: _____
Waste Hauling Company: _____
Contact Name: _____

All Subcontractors shall comply with the project ' s Construction Waste Management Plan. All Subcontractor foremen shall sign the CWM Plan Acknowledgment Sheet.

Subcontractors who fail to comply with the Waste Management Plan will be subject to backcharges or withholding of payment, as deemed appropriate. For instance, Subcontractors who contaminate debris boxes that have been designated for a single material type will be subject to backcharge or withheld payment, as deemed appropriate.

1. The project's overall rate of waste diversion will be_ %.
2. This project shall generate the least amount of waste possible by planning and ordering carefully, following all proper storage and handling procedures to reduce broken and damaged materials and reusing materials whenever possible. The majority of the waste that is generated on this jobsite will be diverted from the landfill and recycled for other use.
3. Spreadsheet 1, enclosed, identifies the waste materials that will be generated on this project, the diversion strategy for each waste type and the anticipated diversion rate.
4. Waste prevention and recycling activities will be discussed at the beginning of weekly subcontractor meetings. As each new subcon- tractor comes on-site, the WMP Coordinator will present him/her with a copy of the CWM Plan and provide a tour of the jobsite to identify materials to be salvaged and the procedures for handling jobsite debris. All Subcontractor foremen will acknowledge in writ- ing that they have read and will abide by the CWM Plan. Subcontractor Acknowledgment Sheet enclosed. The CWM Plan will be posted at the jobsite trailer.
5. Salvage: Excess materials that cannot be used in the project, nor returned to the vend or, will be offered to site worker s, the owner, or donated to charity if feasible.
6. [HAULING COMPANY] will provide a commingled drop box at the jobsite for most of the construction waste. These commingled
   drop boxes will be taken to (Sorting Facility Name and Location). The average diversion rate for commingled waste will be %.
   As site conditions permit, additional drop boxes will be used for particular phases of construction (e.g., concrete and wood waste) to ensure the highest waste diversion rate possible.
7. In the event that the waste diversion rate achievable via the strategy described in (6) above, is projected to be lower than what is required, then a strategy of source-separated waste diversion and/or waste stream reduction will be implemented. Source separated waste refers to jobsite waste that is not commingled but is instead allocated to a debris box designated for a single material type , such as clean wood or metal.

   Notes:

   I . Waste stream reduction refers to efforts taken by the builder to reduce the amount of waste generated by the project to below four (4) pounds per square foot of building area.

   2. When using waste stream reduction measures, the gross weight of the product is subtracted from a base weight of four (4) pounds per square foot of building area. This reduction is considered additional diversion and can be used in the waste reduc- tion percentage calculations.

8. [HAULING COMPANY] will track and calculate the quantity (in tons) of all waste leaving the project and calculate the waste diver- sion rate for the project. [HAULING COMPANY] will provide Project Manager with an updated monthly report on gross wdght hauled and the waste diversion rate being achieved on the project. [HAULING COMPANY' s] monthly report will track separately the gross weights and diversion rates for commingled debris and for each source-separated waste stream leaving the project. In the event that [HAULING COMPANY] does not service any or all of the debris boxes on the project, the [HAULING COMPANY] will work with the responsible parties to track the material type and weight (in tons) in such debris boxes in order to determine waste diversion rates for these materials.
9. In the event that Subcontractors furnish their own debris boxes as part of their scope of work, such Subcontractors shall not be excluded from complying with the CWM Plan and will provide [HAULING COMPANY] weight and waste diversion data for their debris boxes.
10. In the event that site use constraints (such as limited space) restrict the number of debris boxes that can be used for collection of des- ignated waste the project Superintendent will, as deemed appropriate, allocate specific areas onsite where individual material types are to be consolidated. These collection points are not to be contaminated with non-designated waste types.
11. Debris from jobsite office and meeting rooms will be collected by [DISPOSAL SERVICE COMPANY]. [DISPOSAL SERVICE COMPANY] will, at a minimum, recycle office paper, plastic, metal and cardboard.

Construction Waste Management (CWM) Worksheet

Note: This sample form may be used to assist in documenting compliance with the waste management plan.

Project Name: _____

Job Number: _____

Project Manager: _____

Waste Hauling Company: _____

Construction Waste Management (CWM) Plan

WASTE MATERIAL TYPE	DIVERSION METHOD:		PROJECTED DIVERSION RATE
	COMMINGLED AND SORTED OFF SITE	SOURCE SEPARATED ON SITE	
Asphalt			
Concrete			
Shotcrete			
Metals			
Wood			
Rigid insulation			
Fiberglass insulation			
Acoustic ceiling tile			
Gypsum drywall			
Carpet/carpet pad			
Plastic pipe			
Plastic buckets			
Plastic			
Hardiplank siding and boards			
Glass			
Cardboard			
Pallets			
Job office trash, paper, glass & plastic bottles, cans, plastic			
Alkaline and rechargeable batteries, toner cartridges, and electronic devices			
Other:			
Other:			
Other:			
Other:			

Construction Waste Management (CWM) Acknowledgment

Note: This sample form may be used to assist in documenting compliance

Project Name: _____

Job Number: _____

Project Manager: _____

Waste Hauling Company: _____

CWM Plan Acknowledgment

The Foreman for each new Subcontractor that comes on site is to receive a copy of the Construction Waste Management Plan and complete this Acknowledgment Form.

I have read the Waste Management Plan for the project; I understand the goals of this plan and agree to follow the procedures described in this plan.

DATE	SUBCONTRACTOR COMPANY NAME	FOREMAN NAME	SIGNATURE

SECTION 02 21 00

AS-BUILT SITE SURVEY

PART 1 - GENERAL

1.01 SUMMARY

A. Provide services of a licensed Land Surveyor to perform an as-built site survey of the project constructed site conditions at substantial completion and as a prerequisites for final acceptance and project close out. It's recommended, but not required, to utilized services of Land Surveyor who performed original survey where provided.

1.02 SUBMITTALS

A. Comply with Sections 01 33 00 and Section 01 20 00.
B. Within Fourteen (14) days prior to substantial completion, submit for review and approval as-built survey in electronic AutoCAD DWG format and PDF format. Perform survey under direct supervision of a professional Land Surveyor licensed in the State where the project is located. Drawings shall be sealed, signed, dated, and authenticated as required by applicable state registration laws.
C. Within Fourteen (14) days prior to substantial completion, submit photographic documentation of constructed site improvements.

1.03 QUALITY ASSURANCE

A. Survey shall be performed based upon standards of practice and in compliance with State registration law where the project is located.
B. Applicable American Land Title Association/American Congress on Surveying and Mapping (ALTA/ACSM) standards for services requested.

1.04 PHOTOGRAPHIC DOCUMENTATION

A. Provide photographs of completed site construction as follows:
    1. Minimum of 24 photos documenting constructed conditions.
    2. Minimum acceptable resolution is approximately 1152 x 864. Maximum is 1400 x 1200.
    3. Set the photo quality and/or image resolution on the camera to the "fine" setting.
    4. Photos should be date stamped.
    5. Send photos as an e-mail attachment, not as embedded images.
    6. Photos should be submitted as a .jpg/.jpeg file format.

1.05 DRAWING FORMAT

A. Sheets:
    1. Electronic Media: Provide in AutoCAD DWG format and PDF format.
    2. Drafting Standards: Adhere to the United States National CAD Standards (Current Edition) Uniform Drawing System (UDS). Graphics shall be placed in logical layering system with entities drawn by layer line type and color. X-Refs to be bound to single drawing file.
    3. Size: 24"x36" with left binding edge and Land Surveyor's title block information at right edge.
    4. Identification: Label sheet number as "AS-1" and title "AS-BUILT SITE SURVEY". Include Owner's three letter project code. Include property address and legal description. Include date survey performed and date drawing issued.
    5. Include legend of symbols and abbreviations used on the drawings.
    6. All information shall be included on the same drawing, unless prior written approval granted

by Owner.

B. Site Orientation: Show site orientation to match layout indicated on civil construction drawings. Locate north direction.
C. Dimensions and Elevations: Show dimensions and elevations in imperial units with format and scale to match civil construction drawings.

1.06 BOUNDARY SURVEY REQUIREMENTS

A. Show property boundary lines, giving length and bearing (including reference or basis) on each straight line, interior angles, radius, point of tangency, and length of curved lines.
B. Show locations and names of adjoining streets and highways.
C. Show locations of structures (buildings, pavement, curbs, sidewalks, ramps, parking stripping, refuse areas, storm water control systems) on the property and include dimensions to boundary lines and other structures. Describe all structures.
D. Dimension perimeters in feet and decimals to 0.05 feet.
E. Describe fences and walls and show their locations with respect to nearest boundary lines.
F. Show locations of trees and plantings 1 ½ inch diameter and larger at breast height within one foot tolerance. Identify tree species. Note lawn and landscape ground cover area types.

1.07 TOPOGRAPHICAL SURVEY REQUIREMENTS

A. Note a minimum of one permanent benchmark on site and elevation to nearest 0.01 foot. Where available, use benchmark and elevation established on civil construction documents.
B. Show contours at one (1) foot intervals.
C. All spot elevations to be to nearest 0.01 foot.
D. Note spot elevations at each intersection of twenty (20) foot grid covering the property.
E. Note spot elevations at street intersections and at twenty (20) feet on center of curb, gutter, sidewalk, and edge of paving, including far side of paving.
F. Show elevations of building floor, sidewalks at entrance openings, sidewalks at building perimeter, sidewalks along accessible routes at ten (10) feet intervals, accessible parking areas, and at locations matching civil construction documents.
G. Show elevations and locations of drainage structures (catch basins, manholes, etc), pipes (include invert, size, type, and length), ditches, swales, any other improvements or features used for conveyance of storm water including critical roadway pavement, curb, sidewalk, or berm elevations which were designed to control overland drainage. Show final spot ground elevations of all detention basins including horizontal location and elevations along top and bottom of bank including changes of direction and twenty (20) foot intervals. Show location and elevations of any control structures, weirs, orifices, etc. (include crest elevations, crest length and orifice diameter, etc.) including all dimensions, widths and measurements of all detention outlet structures.

1.08 UTILITY SURVEY REQUIREMENTS

A. Show locations of all existing and constructed utilities of electric, telephone, communications, water, gas, and sanitary sewer systems serving building and adjacent to site. Indicate sizes, elevations, inverts at sanitary sewer and storm water systems, service points of connection and building entrance points, meters, transformers, light poles, power poles, clean outs, manholes, fire hydrants, post indicator valves, and associated utility elements.

PART 2 – PRODUCTS – Not Applicable

PART 3 - EXECUTION

3.01 GENERAL

A. Surveyor shall obtain and review Project Construction Documents for defined scope of work

prior to performing As-Built Survey. Where required, contact Owner and/or Design Professional of Record for clarifications of design intent.

B. Coordinate work and schedule with contractors to perform survey at period sufficient to document completed site construction.
C. Where necessary, obtain adjacent property owner approval for permission to access off site areas.
D. Surveyor shall conduct survey in accordance with requirements specified herein. Note discrepancies of field conditions from those indicated in Construction Documents.
E. Surveyor shall take reasonable precautions to prevent damage to the property and shall reasonably restore the site to conditions existing prior to the Surveyor’s entry and performance of services.

END OF SECTION

SECTION 02 41 00

DEMOLITION

PART 1 – GENERAL

1.01 SUMMARY

A. Provide demolition work of existing conditions, complete, as indicated, specified, and required for new work, including removal and legal disposal of demolished materials and capping of existing utilities.
B. Building and Site Demolition: (Where indicated)
   1. Demolition of building structures.
   2. Demolition of site improvements including paving, curbing, site walls, and utility structures.
   3. Demolition of below-grade foundations and site improvements to depth to avoid conflict with new construction or site work.
   4. Removal of hollow items or items which could collapse.
   5. Protection of site work and adjacent structures.
   6. Disconnection, capping, and removal of utilities.
   7. Pollution control during building demolition, including noise control.
   8. Removal and legal disposal of materials.
   9. Relocation of pipes, ducts, conduits, other mechanical work; refer Divisions 20, 21, 22, 23, 25 and 26.
C. Selective Demolition: (Where indicated)
   1. Selective demolition of interior partitions, systems, and building components designated to be removed.
   2. Selective demolition of exterior façade, structures, and components designated to be removed.
   3. Protection of portions of building adjacent to or affected by selective demolition.
   4. Removal of abandoned utilities and wiring systems.
   5. Notification to Owner of schedule of shut-off of utilities which serve occupied spaces.
   6. Pollution control during selective demolition, including noise control.
   7. Removal and legal disposal of materials.

1.02 SUBMITTALS

A. Where required by governing authority, submit documentation of proper disposal of demolition materials and terminating utilities.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations for demolition of structure, safety of adjacent structures, dust control, service utilities, discovered hazards, and environmental requirements. Use experienced workers.

1.04 PROJECT CONDITIONS

A. Immediate areas of work will not be occupied during selective demolition. Adjacent areas may be occupied by the public, including children.

PART 2 – PRODUCTS – Not Applicable To This Section

PART 3 – EXECUTION

3.01 DEMOLITION

A. Do not damage building elements and improvements indicated to remain. Items of salvage value, not included on schedule of salvage items to be returned to Owner, shall be removed from structure. Storage or sale of items at project site is prohibited.
B. Do not close or obstruct streets, walks, drives or other occupied or used spaces or facilities without the written permission of the Owner and the authorities having jurisdiction. Do not interrupt utilities serving occupied or used facilities without the written permission of the Owner and authorities having jurisdiction. If necessary, provide temporary utilities.
C. Cease operations if public safety or remaining structures are endangered. Perform temporary corrective measures until operations can be continued properly.
D. Provide adequate protection against accidental trespassing. Secure project after work hours.

END OF SECTION

SECTION 02 60 00

HAZARDOUS MATERIALS ABATEMENT

PART 1 – GENERAL

1.01 SUMMARY

A. Provide abatement work of existing asbestos and hazardous materials conditions, complete as indicated, specified, and required for new work, including removal, transportation and legal disposal of materials.
B. Refer to Section 00 31 00 for Owner provided hazardous materials report indicating type and content of asbestos or hazardous materials in existing conditions.

1.02 SUBMITTALS

A. Submit documentation of proper disposal of asbestos and hazardous demolition materials.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations for demolition of structure, safety of adjacent structures, dust control, service utilities, discovered hazards, and environmental requirements.
B. Contractor shall use experienced workers certified and licensed by governing agency having jurisdiction. Retain and submit documentation upon request for verification.

1.04 PROJECT CONDITIONS

A. Immediate areas of work will not be occupied during selective demolition. Adjacent areas may be occupied by the public, including children.

PART 2 – PRODUCTS – Not Applicable To This Section

PART 3 – EXECUTION

3.01 DEMOLITION

A. Follow the recommendations of report, industry standards, and government requirements for performance of the work.
B. Do not damage building elements and improvements indicated to remain. Items of salvage value.
C. Cease operations if public safety or remaining structures are endangered. Perform temporary corrective measures until operations can be continued properly.
D. Provide adequate protection against accidental trespassing. Secure project after work hours.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE-CONCRETE

PART 1 – GENERAL

1.01 SUMMARY

A. Provide cast-in-place concrete for general building construction where indicated on drawings and specifications:
   1. Footings, foundations, piers and retaining walls (where indicated).
   2. Building slabs on ground supported concrete foundation systems (where indicated).
   3. Requirements (materials, mixes, finishes) apply to concrete work specified in other sections; refer to individual sections for reference.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit manufacturer's data and installation instructions for the following items when used:
   1. Concrete admixtures.
   2. Curing, sealers, hardeners and densifiers.
   3. Miscellaneous materials.

C. Shop Drawings: Submit concrete reinforcement fabrication, bending and placement. Comply with ACI 315 showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement.

D. Concrete Mix Design: Submit concrete mix design for each strength or composition of concrete to be used.

E. Installer Qualifications: Upon request, submit personnel and supervisor ACI certifications.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect.
   1. ACI 211, Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
   2. ACI 301, Specifications for Structural Concrete for Buildings.
   3. ACI 305.1, Standard Specifications for Hot Weather Concreting.
   4. ACI 306.1, Standard Specifications for Cold Weather Concreting.
   5. ACI 318, Building Code Requirements for Structural Concrete and Commentary.
   6. ASTM A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   7. ASTM A1046, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain, and Deformed, for Concrete.

8. ASTM C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
9. ASTM C33, Standard Specification for Concrete Aggregates.
10. ASTM C42, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
11. ASTM C94, Standard Specification for Ready-Mixed Concrete.
12. ASTM C114, Standard Test Methods for Chemical Analysis of Hydraulic Cement.
13. ASTM C171, Standard Specification for Sheet Materials for Curing Concrete.
14. ASTM C150, Standard Specification for Portland Cement.
15. ASTM C138, Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
16. ASTM C143, Standard Test Method for Slump of Hydraulic-Cement Concrete.
17. ASTM C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
18. ASTM C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
19. ASTM C260, Standard Specification for Air-Entraining Admixtures for Concrete.
20. ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
21. ASTM C494, Standard Specification for Chemical Admixtures for Concrete.
22. ASTM C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
23. ASTM C1293, Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction.
24. ASTM C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
25. ASTM C1602, Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete.
26. ASTM D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
27. ASTM E1155, Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.
28. ASTM E1745, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
29. Concrete Reinforcing Steel Institute, Manual of Standard Practice.
30. Environmental Protection Agency (EPA) volatile organic compound (VOC) evaporation requirements.

C. Concrete Installer Qualifications:
   1. A qualified installer who employs Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
   2. Assign experienced mechanics from previous applications including lead mechanic. These personnel shall be on site at all times while work is being performed.

D. Pre-Installation Conference:
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete Subcontractor.

e. Joint filling contractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semi-rigid joint fillers, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness, floor and slab flatness and levelness measurement, concrete curing procedures, concrete repair procedures, and concrete protection plan.
3. Minutes of the meeting shall be recorded, typed and printed by the contractor and distributed by him to all parties concerned within 5 days of the meeting. One copy of the minutes shall also be transmitted to the following for information purposes: Owner's representative, Architect, and Structural Engineer.
4. The minutes shall include a statement by the concrete contractor indicating that the proposed mix design(s), and placing, finishing and curing procedures can produce the concrete quality required by these specifications

E. Carbon Monoxide / Carbon Dioxide Exposure: General Contractor shall be responsible for monitoring interior concrete floor exposure to excessive exhaust gases containing carbon dioxide (CO2) or carbon monoxide (CO). To minimize potential damage to interior concrete floor during slab placement and curing periods, maximum CO2 levels shall be 4,500 parts per million and maximum CO levels shall be 15 parts per million at concrete surface within 5 feet of any source of exhaust gases. Unvented combustion heaters shall not be in operation during concrete placement and equipment inside the building during concrete placement shall be limited to the equipment necessary to place and finish concrete. Only two concrete trucks shall be in the building at any given time and under no circumstance shall there be any earth moving equipment, dump trucks, grading equipment, or any other motorized equipment in operation until after the interior concrete floor is placed and protected by specified curing method. Carbon Monoxide and Carbon Dioxide shall be checked using an appropriate meter and results documented.

1.04 FIELD SAMPLING AND TESTING

A. Comply with Section 01 45 16 – Quality Control Procedures.

B. Testing Laboratory and Reporting: Owner shall employ a qualified independent testing laboratory to perform material evaluations of sampling and testing specified. Submit test results within 7 days of obtaining data. Laboratory Strength Test reports shall contain the following information:
1. Batch plant identification.
2. Project identification.
3. Date of testing.
4. Sample identification and location within construction.
5. Design mix used including materials, water / cement ratio, admixtures, and recorded slump.
6. Compressive strength results, developed at 7 days and 28 days.

C. Samples:
1. Field samples shall be made and cured in accordance with ASTM C31, for each concrete strength, at the rate of minimum 3 test cylinders and one slump test for each 40 cubic yards or fraction thereof, from each day’s pour and record locations for report.
2. Test slump in accordance with ASTM C143.
3. Test density in accordance with ASTM C138.
4. Test temperature in accordance with ASTM C1064.

5. Test air content in accordance with ASTM C173 Volumetric Method, or ASTM C231 Pressure Method. Test air content each time test cylinders are made.
6. Test compression strength in accordance with ASTM C39.
7. Test cylinders (6in. X 12 in.) shall be as follows: One (1) at 7 days, two (2) at 28 days, and reserve the remaining for testing after a longer period as required by the Owner if the 28 day test does not meet the required strength. If test cylinders (4 in. X 8 in.) are cast then One (1) at 7 days, three (3) at 28 days, with no reserve for testing after a longer period. Either coring may be performed or an additional three (3) cylinders may be requested by the Owner for the resolution of 28 day test cylinders that do not meet the required strength.
8. When early form removal is requested, field cure cylinders tested at 7 or less days to determine sufficient strength.
9. Additionally, test slump every 25 cu. yd., recording locations and data for report.
10. The taking of samples from small pours of 10 cubic yards or less may be omitted at the discretion of the Architect.

D. Testing:
   1. Where strength of any group of 3 cylinders falls below minimum compressive strength specified, the Owner shall have the right to require that test specimens be cut from the structure. Specimens shall be selected by Owner from location in structure represented by test specimen or specimens which failed.
   2. Specimens shall be secured, prepared, and tested in accordance with ASTM C42, within a period of 60 days after placing concrete.
   3. Concrete shall be considered to meet the strength requirements of this specification if the following are satisfied:
      a. Every arithmetic average of any three consecutive strength tests equals or exceeds fc'.
      b. No strength test falls below fc' by more than 500 psi if fc' is 5000 psi or less, or by more than 0.10fc' if fc' exceeds 5000 psi.
   4. Should laboratory analysis indicate that the proper concrete mix has not been used by the Contractor, all such concrete poured using the improper mix shall be subject to rejection.
   5. The cost of coring specimens from the structure, patching the resulting holes, and making the laboratory analysis shall be borne by the Contractor.
   6. The holes from which the cored samples are taken shall be packed solid with no slump concrete proportioned with the same design strength as the specified concrete.
   7. If any of the specimens cut from the structure fail to meet the requirements outlined in ACI 318. The Owner shall have the right to require any and all defective concrete to be replaced and all cost resulting therefrom shall be borne by the Contractor.
   8. Additional Sampling: In addition to the slump tests specified above, the Contractor shall keep a cone (mold) and rod apparatus on the job site for random testing of batches. When concrete does not meet the specified slump requirements, and when directed by the Architect, immediately perform a slump test in accordance with ASTM C143. Concrete not meeting the slump requirements shall be removed from the job site.

PART 2 – PRODUCTS

2.01 FORM MATERIALS

A. Form Materials:
   1. For Exposed Finish Concrete: Plywood, metal or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces.

2. For Unexposed Finish Concrete: Use plywood, lumber, metal, or other acceptable material. If lumber is used, it must be dressed on at least 2 edges and 2 sides for a tight fit.

B. Form Release: Commercial formulated release coating that will not bond with, stain, nor adversely affect concrete surfaces, will not impair subsequent treatments or finishes requiring bond or adhesion, nor impede wetting of concrete surfaces by water or curing compound. Comply with Environmental Protection Agency (EPA) volatile organic compound (VOC) evaporation requirements.

2.02 REINFORCEMENT MATERIALS

A. Steel Reinforcement:
1. Refer to drawings for reinforcement sizes and spacing.
2. Reinforcing Bars: ASTM A615(S1), Grade 60, deformed billet steel bars of grades as indicated on the drawings, free from loose rust, scale and other coatings that may reduce bond.
3. Mesh or Fabric Reinforcement: ASTM A1064, welded wire reinforcement.
4. Tie Wires: Soft annealed iron wire not smaller than 18 gauge.
5. Fiber Reinforcement: (NOT PERMITTED).

B. Accessories: Include all spacers, chairs, ties, and other devices necessary for properly spacing and fastening reinforcement in place. Use plastic protected reinforcing bar supports conforming to CRSI Class 1 specification for exposed finish concrete.

2.03 CONCRETE MATERIALS

A. Concrete Materials:
1. Portland Cement: ASTM C150, Type I or Type I/II, color gray unless otherwise indicated.
2. Supplementary Cementitious Materials: (Note: Fly ash and silica fume are not permitted for exposed exterior surfaces where finish appearance is an important factor. White silica fume may be used.)
a. Fly Ash Admixture: Use of quality fly ash by weight will be permitted as a cement reducing admixture by 20% maximum. Provide fly ash meeting requirements of ASTM C618, Class C or Class F with the following special requirements. Loss on ignition in Table I shall not exceed 3%. Compliance to Table IA shall apply. Amount retained on the 325 sieve in Table 2 shall not exceed 20%. Chemical analysis of the fly ash shall be reported in accordance with ASTM C114. Submit report indicating for a 6 month period immediately prior to submittal date, weekly test and tests results performed on concrete with fly ash admixture. Fly ash shall not be permitted in concrete to receive dry shake hardeners.
a. Silica Fume: ASTM C1240.
b. Slag Cement: ASTM C989.
c. Metakaolin: ASTM C618, Class N.
3. Normal Weight Concrete Aggregates: ASTM C33, Class 4S, and the following:
a. Fine Aggregate: Clean, sharp, natural or manufacturer sand, free from loam, clay, lumps, or other deleterious substances.
b. Coarse Aggregate: Clean, uncoated, processed, locally available, non-reactive aggregate, containing no clay, mud, loam, or foreign matter; maximum size 1-1/2".
c. Combined aggregate gradation for slabs and other designated concrete shall be 8% - 18% for large top size aggregates (1½ in.) or 8% - 22% for smaller top size aggregates (1 in. or ¾ in.) retained on each sieve below the top size and above the No. 100.

4. Mixing Water: ASTM C1602. Clean, free from oil, acid, salt, injurious amounts of vegetable matter, alkalies, and other impurities; potable.

B. Admixtures:
   2. Air Entrained Admixture:
      a. ASTM C260.
      b. Manufacturers:
         i. Euclid: Aea Series.
         ii. Master Builders: MasterAir Series.
         iii. W.R. Grace: Dorex AEA.
         iv. Sika Chemical: Sika Aer.
   3. Water-Reducing Admixture:
      a. ASTM C494, Type A.
      b. Manufacturers:
         i. Euclid: Eucon or Plastol Series.
         ii. Master Builders: MasterPozzolith , MasterPolyheed Series or MasterPolyeed Series.
         iii. W.R. Grace: WRDA, Daracem, Mira, Zyla, or Adva Series.
         iv. Sika Chemical: Plastiment, Plastocrete, ViscoCrete, Sikaplast, or Sikament Series.
   4. Retarding or Water-Reducing and Retarding Admixture:
      a. ASTM C494, Type B or D.
      b. Manufacturers:
         i. Euclid: Eucon Retarder 75.
         ii. Master Builders: MasterSet R Series or MasterSet DELVO Series.
         iii. W.R. Grace: Recover or Daratard 17.
         iv. Sika Chemical: Plastiment or Plastocrete Series.
   5. Accelerating or Water-Reducing and Accelerating Admixture:
      a. ASTM C494, Type C or E. (Non-Corrosive, Non-Chloride only permitted)
      b. Manufacturers:
         i. Euclid: Accelguard Series.
         ii. Master Builders: MasterSet FP 20 or MasterSet AC 534.
         iii. W.R. Grace: Daraset, Daracel, Lubricon, Polarset, or DCI Series.
         iv. Sika Chemical: Plastocrete 161 FL, Plastocrete 161 HE, Sikaset NC, Sika Rapid 1, or Sikaset HE.
   6. High-Range Water-Reducing or High-Range Water-Reducing and Retarding Admixture (Super Plasticizer):
      a. ASTM C494, Type F or G.
      b. Manufacturers:
         i. Euclid: Eucon Series.
         ii. Master Builders: Master Rheobuild 1000 or MasterGlenium Series.
         iii. W.R. Grace: ADVA Series.
         iv. Sika Chemical: Sikament or ViscoCrete Series.
   7. Workability-Enhancing Admixture:
      a. ASTM C494, Type S. Shall retain concrete workability without affecting time of setting or early-age strength development.
      b. Manufacturers:
         i. Euclid:
         ii. Master Builders: MasterSure Z 60.
         iii. W.R. Grace:
         iv. Sika Chemical:
   8. Alkali-Silica Reactivity Inhibitor:
      a. ASTM C494, Type S. Formulated lithium nitrate admixture containing a nominal content of 30% for the prevention of alkali-silica reactivity (ASR) in concrete.
      b. Manufacturers:

i. Euclid: Eucon Integral ARC.
ii. Master Builders: MasterLife ASR 30.
iii. W.R. Grace: RASir.
iv. Sika Chemical:

9. Shrinkage-Reducing Admixture:
   a. ASTM C494, Type S.
   b. Manufacturers:
      i. Eculid:
      ii. Master Builders: MasterLife SRA Series or MasterLife CRA 007.
      iii. W.R. Grace:
      iv. Sika Chemical:
10. Corrosion-Inhibiting Admixtures: Shall be a nominal 30 percent solution of calcium nitrite or an amine ester-based organic corrosion-inhibiting admixture.
      i. Euclid:
      ii. Master Builders: MasterLife CI 30 or MasterLife CI 222.
      iii. W.R. Grace:
      iv. Sika Chemical:
11. Permeability-Reducing Admixture:
   a. ASTM C494, Type S.
   b. Manufacturers:
      i. Euclid:
      ii. Master Builders: MasterLife 300 Series.
      iii. W.R. Grace:
      iv. Sika Chemical:
12. Viscosity-Modifying Admixture:
   a. ASTM C494, Type F or G.
   b. Manufacturers:
      i. Euclid:
      ii. Master Builders: MasterMatrix VMA Series.
      iii. W.R. Grace:
      iv. Sika Chemical:
13. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures containing more than 0.30% chloride ions by mass of cement. Upon request provide admixture manufacturer's written certification that chloride ion content complies with specified requirements.
14. Other Admixtures: Do not use other admixtures unless accepted in writing by Architect.

2.04 PROPORTIONING OF MIXES, BATCHING AND MIXING

A. Concrete Mix Design:
   1. Prepare design mixes for each type of concrete, in accordance with ACI 301 and ACI 318, except as otherwise specified.
   2. Proportion design mixes by weight for class of concrete required, complying with ACI 211, except as otherwise specified.
   3. Proposed mix designs shall be accompanied by complete standard deviation analysis or trial mixture test data. Submit written reports to the Architect for design mix at least 15 calendar days prior to the start of work. If trial batches are used, gross weight and yield per cu. yd. of trial mixtures. Proposed mix design shall list the following information.
      a. Batch plant identification and location.
      b. Concrete materials and water-cementitious materials ratios.
      c. Strength. Compressive strength at 7 days and 28 days.
      d. Measured slump.
      e. Air content range.
      f. Admixtures used.

B. Compressive Strength: Minimum concrete strength shall be 4,000 psi at 28 days in accordance with ASTM C94, unless otherwise noted on drawings.

C. Water-Cementitious Materials Ratio:
   1. Concrete subject to freezing and thawing shall have a maximum water-cementitious material ratio of 0.48 by weight (4,000 psi at 28 days).
   2. All concrete subjected to deicers and/or required to be watertight shall have a maximum water-cementitious material ratio of 0.45 (4500 psi at 28 days or more).
   3. All reinforced concrete subjected to brackish water, salt spray or deicers shall have a maximum water-cementitious ratio of 0.40 (5000 psi at 28 days or more).
   4. All trowel finished interior slabs, subjected to vehicular traffic, shall have a maximum water-cementitious ration of 0.53.
   5. No water shall be added to ready-mix concrete at the job site.

D. Air-Entrainment: Use air-entrained admixture in strict compliance with manufacturer's directions.
   1. All concrete exposed to freezing and thawing shall have an air content of 4.5% to 7.5%.
   2. All interior slabs and slabs to receive dry shake hardeners shall have an air content of 3% maximum.

E. Admixture Usage: Use admixtures in strict compliance with manufacturer's directions.
   1. All admixtures shall be plant batched and mixed, ready for placement upon arrival to job site. No field batching and mixing permitted without written authorization from the Architect.
   2. Concrete for interior floor slabs must contain specified mid-range or high range water-reducing admixture (superplasticizer).
   3. All Concrete less than 8 inches thick, and slabs placed at air temperatures below 50° F shall contain specified non-corrosive non-chloride accelerator.
   4. Concrete required to be air entrained shall contain an approved air-entraining admixture.
   5. Pumped concrete, architectural concrete, concrete required to be watertight, and concrete with water-cementitious materials ratio below 0.50 shall contain specified high-range water- reducing admixture (superplasticizer).

F. Slump Limits:
   1. Concrete containing no water-reducing admixture shall have slump of 4", plus or minus 1".
   2. Concrete containing mid-range water-reducing admixture shall have a maximum slump of 6", plus or minus 1".
   3. Concrete containing high-range water-reducing admixture shall have a maximum slump of 8", plus or minus 1".
   4. Concrete receiving a "dry shake" harder shall have a maximum slump of 3" to 4".

G. Batching and Mixing: Concrete shall be ready-mixed in accordance with ACI 318. No hand mixing allowed.

2.05 CURING MATERALS

A. General:
   1. Provide products compatible with finish flooring materials or special finish systems. Refer to drawing finish schedule for types and locations.
   2. Comply with Environmental Protection Agency (EPA) volatile organic compound (VOC) evaporation requirements.
   3. Reactive silicate based products are prohibited for use as curing compounds.

B. Water: Potable.

C. Absorptive Cover: AASHTO M182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

D. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

E. Evaporation Retarder:
   1. Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
   2. Coverage Rate: Per manufacturer's recommendations.
   3. Manufacturers: Master Builders "MasterKure ER 50", Euclid "EUCOBAR", W.R. Meadows "EVAPRE", or approved equal.

F. Curing Materials: (Used on freshly placed interior concrete surfaces to receive tile, resilient flooring, or additional surface treatments and finishing which ALLOW proper dissipation of curing material.)
   1. Dissipating resin curing compound, ASTM C309, Type I, with fugitive dye. Film must chemically break down within 30 day period when exposed to UV conditions.
   2. Coverage Rate: Per manufacturer's recommendations, but not less than 300 sq. ft. per gallon.
   3. Manufacturers: Euclid "Kurex DR 100", L&M "Cure R", ChemMasters "Spray-Cure Clear", Sierra TK Products "TK-2519 DC WB", or approved equal.

G. Curing and Sealing Materials: (Used on exterior exposed concrete surfaces of slabs, curbs, sidewalks, and interior concrete surfaces NOT subject to additional surface treatments and finishing.)
   1. High solids curing and sealing compound, ASTM C1315, transparent, acrylic, solvent-based, 30% minimum solids content, moisture loss of not more than 0.40 kg/sq. meter. when applied at coverage rate of 300 sq. ft. per gallon.
   2. Coverage Rate: Per manufacturer's recommendations, but not less than 300 sq. ft. per gallon minimum.
   3. Manufacturers: Euclid "Super Aqua-Cure VOX", BASF "Kure-N-Seal 30", L&M "Dress & Seal WB30", or approved equal.

2.06 LIQUID FLOOR TREATMENTS

A. Additional Surface Treatments and Finishing Materials:
   1. Liquid Densifier Treatment Materials: (Used on interior concrete as an exposed finish.)
      a. Penetrating concrete densifier, odorless, colorless, non-yellowing sodium silicate solution designed to harden, dustproof and protect concrete floors.
      b. Coverage Rate: Per manufacturer's recommendations, but not more than 225 sf. ft. per gallon minimum.
      c. Manufacturers: Curecrete Distribution "Ashford Formula", Euclid "Eucosil", L&M "Sealhard", Prosoco "Consolideck Blended Densifier", or approved equal.

2.07 MISCELLANEOUS MATERIALS

A. Accessories:
   1. Connectors: Provide all metal connectors required for placement in cast-in-place concrete, for the attachment of structural and non-structural members.

2. Reglets: Fabricated reglets of not less than 0.022 inch thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
3. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

B. Expansion and Isolation Joint Filler Strips:
1. ASTM D1751, non-extruding premoulded material, ½" thick, unless otherwise noted, composed of fiberboard impregnated with asphalt, except use ASTM D1752, Type II, resin-bound cork for walks and other exposed areas.
2. Manufacturers: Sonneborn "Sonoflex F" closed cell polyurethane foam expansion joint filler or approved equal.

C. Semi-rigid Joint Filler:
1. Comply with Section 07 92 00.
2. Two-component, semirigid, 100 percent solids, epoxy resin with Shore A durometer hardness of 80 in accordance with ASTM D2240.

D. Vapor Barrier:
1. Sheet type conforming with ASTM E1745, Class A, tensile strength 45 lbf/in, puncture resistance 2200 grams, polyethylene film, .010" thick minimum with manufacturer's recommended adhesive or pressure-sensitive tape.
2. Manufacturers: Fortifiber Building Systems Group, Grace, Poly-America, Visqueen, W.R. Meadows, or approved equal.

E. Non-Shrink Grout: CRD-C 621, factory pre-mixed grout.
1. Manufacturers (Metallic): Master Builders "Embeco 885", Euclid "High Flow Grout", or L&M "Ferrogrout".
2. Manufacturers (Non-Metallic): Master Builders "Construction Grout", Euclid "Eucon-NS", L&M "Crystex", or approved equal.

F. Bonding Agent:
1. ASTM C1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
2. Manufacturers: W.R. Grace "Daraweld C", Larsen "Weldcrete", Euclid "Eucoweld", L&M "Everbond", or approved equal.

G. Epoxy Bonding Adhesive:
1. ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, or class sutable for application temperature and of grade to suit requirements.
2. Manufacturers: BASF "MasterEmaco ADH" or approved equal.

H. Patching Mortar: Free-flowing, polymer-modified cementitous coating; Master Builders "MBT Underlayment – Self leveling", Euclid "TAMMSPATCH II", or Sika Chemical "Sikatop 120.

PART 3 – EXECUTION

3.01 TOLERANCES:

A. ACI Standards shall govern concrete work except where specified differently.

B. Floor flatness and levelness tolerances: Subfloors Under Materials Such As Vinyl, Tile, Paint and Carpet: ASTM E1155, floor flatness (Ff) of 40, floor levelness (Fl) of 40.

C. Variation from plumb:
   1. 0 to 10 feet: ¼" maximum.
   2. 20 feet or more: 3/8" maximum.

D. Variation in thickness:
   1. Footings: 5%
   2. Slabs: +3/8" and -1/4"

E. Variation in grade:
   1. 0 to 10 feet: ¼" standard, 1/8" for floor slabs.
   2. 10 to 20 feet: 3/8" standard, ¼" for floor slabs.
   3. 40 feet or more: ¾" standard, 3/8" for floor slabs.

F. Variation in plan:
   1. 0 to 20 feet: ½".
   2. 40 feet or more: ¾" standard, plus ½" for footings.

G. Variation in eccentricity: 2% for footings.

H. Variation in openings:
   1. Size: plus 1/8".
   2. Location: ¼".

I. Variation in stairs & landings:
   1. Consecutive steps:
      a. Treads: 1/8".
      b. Risers: 1/16".
   2. Flight of Stairs:
      a. Treads: ¼".
      b. Risers: 1/8".

3.02 FORM WORK INSTALLATION

A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.

B. Construct forms per ACI 347 guide, to sizes and shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, molding, rustications, reglets, chambers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Solidly butt joints and provide back up at joints to prevent leakage of cement paste.

C. Fabricate forms for easy removal without hammering or prying against the concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.

D. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings on forms at inconspicuous location.

E. Chamfer exposed corners and edges ¾" unless otherwise indicated. Where applicable use wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

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

G. Preparation of Form Surfaces: Coat the contact surfaces of forms with a form-coating compound where applicable before reinforcement is placed.

H. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such ties. Accurately place and securely support items built in to form.

I. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms after concrete placement, if required, to eliminate mortar leaks.

3.03 VAPOR BARRIER-RETARDER INSTALLATION

A. General: Place, protect, and repair vapor barrier-retarder systems in accordance with ASTM E1643 and manufacturer's instructions.

B. Sheet Vapor Barrier: Apply directly over compacted subgrade and under subbase. Lay with 6" wide side laps and end laps and seal watertight with manufacturers adhesive or tapes. Lay film just before subbase is placed and protect against punctures. Repair punctures with adhesive-applied extra sheet before proceeding.

3.04 REINFORCEMENT INSTALLATION

A. Comply with the Concrete Reinforcing Steel Institute (CRSI) "Recommended Practice for Placing Reinforcing Bars", and as indicated on drawings and herein specified.

B. Clean reinforcement of loose rust, mill scale, dirt, and other materials or coatings, which reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by chairs, spacers, and hangers as required. Set wire ties so ends are pointed into concrete.

D. In all cases, provide minimum concrete protection over bar reinforcement of at least 3" unless otherwise indicated on drawings.

E. Do not place bars more than 2" beyond the last leg of continuous support. Do not use supports to hold runways for conveying equipment.

F. Install mesh welded wire fabric reinforcement in as long lengths as practicable, lapping pieces at least one mesh plus 2" but in no case less than 8". Lace splices with wire. Offset end laps to prevent continuous laps in either direction. All welded wire fabric reinforcement must be securely supported at three feet maximum in each direction.

3.05 JOINTS, INSERTS AND EMBEDDED ITEM INSTALLATION

A. Joints: Provide slab joints, sawed joints and formed construction joints. Locate and install joints, which are not shown on drawings, so as not to impair the strength and appearance of the structure. Submit joint layout to Architect if requested.

B. Inserts: Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Properly locate all embedded items in cooperation with other trades, and secure in position before concrete is placed. Use setting drawings, diagrams, instructions, and directions provided by suppliers of the items to be attached thereto.

C. Embedded Items: Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
   2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashings is shown at lintels, shelf angles, and other conditions.

3.06 CONCRETE PLACEMENT

A. Comply with ACI 301, and as herein specified.

B. Pre-Placement Inspection: Before placing concrete, clean and inspect formwork, reinforcing steel, and items to be embedded or cast-in. Notify other crafts in ample time to permit the installation of their work, and cooperate with them in setting such work, as required. Make sure soil treatment for termite control has been applied, where required, before vapor barrier, subbase, and concrete are installed. Coordinate the installation of joint materials and vapor barriers with placement of forms and reinforcing steel.

C. Notify the Testing Company 24 hours before placing any concrete. Coordinate governmental inspections, if required, with agency having jurisdiction. Allow sufficient time for inspection of reinforcing and for corrective action prior to scheduled concrete placement.

D. Conveying: Convey concrete from the mixer to the place of final deposit by methods that will prevent the separation or loss of materials. Provide equipment for chuting, pumping, and pneumatically conveying concrete of proper size and design as to insure a practically continuous flow of concrete at the point of delivery and without segregation of the materials. Keep open troughs and chutes clean and free from coatings of hardened concrete. Do not allow concrete to drop freely more than 10 feet. Do not use vibrators to transport concrete inside of forms. All equipment and methods used for conveying are subject to the approval of the Architect.

E. Depositing: Deposit concrete continuously or in layers of such thickness that no concrete will be placed on hardened concrete so as to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete near or in its final location to avoid segregation due to rehandling or flowing, and displacement of the reinforcement.

F. Cold Weather Placing: Comply with the requirements of ACI 306.1.

G. Hot Weather Placing: Comply with the requirements of ACI 305.1.

H. Consolidation: Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners. When using vibrators, insert and withdraw vibrators vertically at uniformly spaced

locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the placed layer of concrete and at least 6" into the proceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration to the time necessary to consolidate the concrete and complete embedment or reinforcement and other embedded items without causing segregation of the mix.

3.07 FINISH OF FORMED SURFACES

A. Rough Form Finish: For formed concrete surfaces not exposed to view in the finished work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched, fins and other projections exceeding ¼" in height rubbed down or chipped off.

B. Smooth Form Finish: For formed concrete surfaces exposed to view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp-proofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smooth.

C. Smooth Rubbed Finish: Provide a smooth rubbed finish for exposed concrete surfaces and surfaces which have received smooth form finish treatment not later than one day after form removal. Moisten concrete surfaces and rub smooth with carborudum brick or other abrasive until uniform color and texture is produced. Do not apply cement grout other than that created by rubbing process.

3.08 SLAB FINISHES

A. Place, consolidate, strike off and level concrete slab to proper elevation. After the concrete has stiffened sufficiently to permit the operation, and water sheen has disappeared, float surface at least twice to uniform sandy texture.

B. Trowel Finish: After floating, trowel surface at least twice to smooth dense finish.

C. Slabs to Receive Floor Covering: Finish as in paragraph "Trowel Finish" above, except trowel to remove trowel marks and to smooth, even finish; omit second troweling.

D. Slabs to Receive Polished Concrete Finishing:
   1. Comply with additional requirements of Section 03 35 43.
   2. Provide hard steel trowel finish with a minimum of 3 passes with power trowel to achieve Class 5 finish as described in ACI 302.1R to comply with minimum tolerances of Ff and Fl specified herein.
      a. Inspect troweling machine and remove accumulated mortar prior to each pass.
      b. Finish surface shall be free of trowel marks, burn marks and mottling.
      c. Finishes surfaces to the following tolerances in accordance with ASTM E1155.

E. Non-Slip Broom Finish: (At exterior walks, steps, and elsewhere as indicated).

3.08 REMOVAL OF FORMS

A. Do not remove forms until the concrete has attained 67% or 28 day strength or minimum of 4 days. Use a method of form removal that will not cause overstressing of the concrete.

3.09 CONCRETE CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Start initial curing as soon as free water has disappeared from concrete surface. Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Immediately after concrete finishing operations cure concrete according to ACI 308.1, by one or a combination of the following methods: Weather permitting; keep continuously moist for not less than 7 days. 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.

D. Curing Methods: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing compound, by curing and sealing compound, and by combinations thereof, as herein specified. **Curing method and project conditions shall be compatible with subsequent additional surface treatments and finishing products and procedures. Review drawings for finish types and locations to coordinate requirements with other trades.**
   1. Provide moisture curing by keeping concrete surface continuously wet by covering with water, by water-fog spray, or by 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 12” lap over adjacent absorptive covers. Do not allow Absorbent Cover materials to dry out during specified curing period.
   2. Provide moisture-cover curing by covering concrete surface with specified moisture-retaining cover, placed in widest practicable width with sides and ends lapped at least 12” and sealed with waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape. The cover shall be placed flat on the concrete surface, avoiding wrinkles, to minimize mottling immediately after wetting the slab to rejection. It shall be placed and weighted so that it remains in contact with the concrete during the specified duration of curing. Windrows of sand or earth, or pieces of lumber shall be placed along all edges and joints in the film to retain moisture and prevent wind from getting under the film and displacing it.
   3. Surfaces of exterior exposed concrete surfaces of slabs, curbs, sidewalks, and interior concrete surfaces NOT subject to additional surface treatments and finishing.: Provide curing and sealing compound meeting ASTM C1315 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.
      b. Do not use membrane curing and sealing compounds on surfaces which are to receive liquid densifier treatments, be covered with coating material applied directly to concrete, waterproofing, painting, and other coatings and finish materials, unless otherwise acceptable to Architect.
   4. Surfaces of freshly placed interior concrete slabs to receive tile, resilient flooring, or other subsequent additional surface treatments and finishing which ALLOW

proper dissipation of curing material: Provide dissipating resin curing compound meeting ASTM C309 as follows:

a. Apply specified dissipating resin curing 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.
b. Dissipating all curing compound residue shall be fully removed prior to application of any subsequent floor coverings or treatments.

5. Surfaces of freshly placed interior concrete slabs to receive tile, resilient flooring, or other subsequent additional surface treatments and finishing which DO NOT ALLOW proper dissipation of curing material: Provide moisture curing method specified.
6. Curing Formed Surfaces:
   a. Cure formed concrete 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.
7. Curing Unformed Surfaces:
   a. Cure unformed surfaces, such as slabs and other flat surfaces by application of appropriate curing compound. Moisture curing, or moisture retaining cover.

3.10 ADDITIONAL SURFACE TREATMENTS AND FINISHING

A. General: Refer to drawings for interior finish types and locations.

B. Polished Concrete Finishing: Comply with the requirements of Section 03 35 43.

C. Penetrating Liquid Densifier Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
   1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
   2. Apply compound on exposed floors indicated. Application shall be made by factory certified applicator, and in strict accordance with the directions of the manufacturer. Spray, squeegee or roll on liquid densifier to clean, dry concrete surface at a rate no greater than 225 sq. ft. per gallon. The liquid should be scrubbed into the surface with a mechanical scrubber. Keep the surface wet with the densifier during the application process. When the product becomes slippery under foot, but not more than 40 minutes after initial application, the surface shall then be thoroughly flushed with water, broomed, and squeegeed or vacuumed to remove all excess liquid.

3.11 PROTECTION

A. No wheeling, working, or walking on finished surfaces will be allowed for 16 hours after concrete is placed.

B. Provide plywood or other acceptable protective cover at all traffic areas throughout the job.

C. Protect all exposed concrete floors, steps, and walks from paint and other materials or equipment that may mar or damage these surfaces.

3.12 MISCELLANEOUS ITEMS

A. Filling Holes: Fill in holes and openings left in concrete for the passage of work by other trades after their work is in place. Mix, place, and cure concrete to blend with in-place construction. Provide all other miscellaneous concrete filling required to complete work.

B. Non-Shrink Grout Application: Grout out equipment bases and other locations indicated with non-shrink grout. Provide non-metallic type where grout is exposed.

C. Drainage Items: Unless otherwise indicated, provide 4000 psi concrete for culverts and other items required for drainage installation.

3.13 CONCRETE SURFACE REPAIRS

A. General: Repair and patch defective areas with cement mortar of the same type and class as the original concrete, immediately after removal of forms. Cut out honeycomb, rock pockets, voids over ½" diameter, 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, before placing cement mortar in the same manner as adjacent concrete. Proprietary patching compounds may be used when acceptable to the Architect.

B. Smooth, Exposed-To-View Surfaces: Blend cements so that, when dry, patching mortar will match color of surrounding concrete. 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.

C. Concealed Formed Surfaces: Repair defects that adversely affect the durability of the concrete. If defects cannot be repaired, remove and replace the concrete.

D. Other repair methods may be used, subject to Architect's acceptance.

3.14 CLEAN-UP

A. Do not allow debris to accumulate. Clean up all concrete and cement materials, equipment and debris upon completion of any portion of the concrete work, and upon completion of the entire cast-in-place concrete work.

END OF SECTION

SECTION 03 35 43

POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.01 SUMMARY

A. Provide polished concrete finishing system where indicated on drawings, complete. This section includes the following:
   1. Concrete floor substrate grinding to specified finish.
   2. Applying sealer, hardener and densifier and performing grinding and polishing to specified finish.
   3. Application of protective sealer and stain inhibiter and polishing to specified finish.
B. Special Note: Products, materials, tolerances and installation requirements specified under this section shall govern over requirements specified in other related sections. Coordinate with polished concrete finish locations indicated on drawings.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.
B. Test Reports: Upon request provide sheen gloss reading test results conducted as specified and recorded on floor plan diagram confirming compliance with specified performance criteria.
C. Warranty: Provide 10 year product manufacturer's warranty agreeing to replace and repair defective materials that may occur within the warranty period at no cost to the Owner.
D. Installer's Certification: Provide letter documenting Installer's accreditation and certification compliance as specified under quality assurance.

1.03 QUALITY ASSURANCE

A. The following specifications are provided as a guide to the minimum "Polishing/Grinding Steps" and liquid densifier/sealer applications required. It is the contractor/installers ultimate responsibility to provide a diamond polished/ground floor meeting the specified criteria. In all cases the specified Surface Preparation and Cleaning steps, the minimum number of specified Diamond Polishing/Grinding Steps, the specified applications of liquid densifier and concrete stain inhibitor/sealer shall be performed.
B. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years.
C. Installer's Certification:
   1. Contact manufacturers specified for listing of approved Certified Installers.
   2. Use experienced installers who have successfully performed a minimum of 5 projects of at least 6000 square feet each. Upon request provide listing of projects and contact references.
   3. Upon request provide letter of certification from manufacturer stating that Installer is certified applicator of polished concrete finishing system specified and is familiar with proper procedures and installation requirements required by the manufacturer.
D. Deliver, handle, and store materials in accordance with manufacturer's instructions. Maintain records of product container numbers.
E. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Owner..
   1. Comply with related standards indicated in Section 03 30 00 Cast-In-Place Concrete.

2. ASTM E 1155, Standard Test Method for Determining Floor Flatness and Levelness Using the F number system.
3. ASTM E 430, Standard Test Methods for Measurement of Gloss of High-Gloss Surfaces by Abridged Goniophotometry.
4. ASTM G23-81, Standard Test Method for Ultraviolet Light and Water Spray Resistance.

F. Finish and Appearance Quality Standards per Concrete Polishing Association of America (CPAA):
1. Class level of cut / aggregate exposure based on the following criteria:
   a. Class A - Cream: Polishing only the portland paste at the surface of the substrate without exposing small, medium or large aggregate.
   b. Class B – Salt/Pepper: Exposing the fine aggregate such as sand and small aggregate within the substrate. The depth of grind will depend greatly on placement and finishing procedures. Generally this level of grind can be achieved within 1/16 inch of the surface.
   c. Class C – Medium Aggregate: Exposing more of the overall girth of the aggregate within the substrate. The depth of grind will depend greatly on the placement and finishing procedures. Generally this level of grind can be achieved within 1/8 inch of the surface.
   d. Class D – Large Aggregate: Exposing the overall girth of the aggregate within the substrate. The depth of grind will depend greatly on the placement and finishing procedures. Generally this level of grind can be achieved within ¼ inch of the surface.
2. Level of sheen per ASTM E 430 when the concrete surfaced is mechanically processed. Gloss readings are not to be obtained through the use of any microfilming products, sealers, coating, enhancers or the result of resin transfer from resin bond abrasives. Readings shall be taken not less than 10’ on center in field areas and within 1’ of floor area perimeters. In no case shall a reading be below 2% of specified minimum sheen.
   a. Level 1 Sheen (Flat) appearance with no to very slight diffused reflection.
   b. Level 2 Sheen (Satin) as determined by gloss reading of 45-60 before application of specified concrete stain inhibitor and sealer. Not less than 5 step process concluding with 800 grit resin bonded tooling.
   c. Level 3 Sheen (Semi-Gloss) as determined by gloss reading of 60-70 before application of specified concrete stain inhibitor and sealer. Not less than 6 step process concluding with 1500 grit resin bonded tooling.
   d. Level 4 Sheen (High Gloss0 as determined by gloss reading of 70 or higher before application of specified concrete stain inhibitor and sealer. Not less than 7 step process concluding with 3000 grit resin bonded tooling.

PART 2 – PRODUCTS

2.01 PROJECT SYSTEM PERFORMANCE AND APPERANCE CRITERIA

A. Concrete Mix Color: Natural without dyes or pigment additives.
B. Quality Class Level of Cut: Class C – Medium Aggregate.
C. Quality Level of Sheen: Level 2, Satin, Polished with 800 grit minimum, Gloss reading 45-60 per ASTM E 430.
D. Ultra Violet Light and Water Spray: ASTM G23-81 – No adverse effect to ultra violet and water spray.

2.02 MATERIALS AND MANUFACTURERS

A. GENERAL

1. Compatibility: Provide products which are recommended by manufacturers to be fully compatible with project substrate conditions and special concrete floor finish materials, means and methods.
2. Provide special concrete floor finish products from a single manufacturer unless otherwise approved.
3. All products used shall comply with Environmental Protection Agency (EPA) volatile organic compound (VOC) evaporation requirements.

B. CAST-IN-PLACE CONCRETE MATERIALS
1. Materials: Comply with Section 03 30 00. Materials and products shall be compatible with special concrete floor finish system.

C. SEALER, HARDENER AND DENSIFIER PRODUCTS
1. Manufacturers: Contact manufacturers for listing of Certified Installers of specified products.
   a. Advanced Flooring Products, 888-942-3144.
   b. Euclid Chemical Company, 800-321-7628.
   c. L&M Construction Chemicals, 800-362-3331.
   d. L. M. Scofield Company, 800-800-9900.
   e. Prosoco Inc., 800-255-4255.
2. Concrete Sealer, Hardener and Densifier: Advanced Flooring Products “RetroPlate 99”, Euclid “Euco Diamond Hard”, L&M “FGS Hardener Plus”, L. M. Scofield Company “Formula One Lithium Densifier MP, Prosoco “Consolideck LS” or approved equal.
3. Concrete Stain Inhibitor and Sealer: Advanced Flooring Products “RetroGuard Stain Inhibitor and Sealer”, Euclid “Euco Diamond Hard”, L&M “PermaGuard SPS”, L. M. Scofield Company “Formula One Guard-W”, Prosoco “Consolideck Concrete Protector”, or approved equal.

D. AUXILIERY MATERIALS
1. Water: Potable.
2. Joint Sealants: Semi-rigid, 2-component, self-leveling, 100% solids, rapid curing, polyurea control and expansion joint filler with Shore A 80 or higher hardness. Comply with Section 07 92 00. Materials and products shall be compatible with special concrete floor finish system. Use color that matches adjacent surface finish.
3. Grinding and Polishing: Provide other related materials as recommend by manufacturer, not specifically described, but required for complete and proper system installation.
4. Cleaning and Preparation Agents: Products recommended by manufacturer for project conditions.
5. Protection Materials: Products recommended by manufacturer for project conditions.

PART 3 – EXECUTION

3.01 PROJECT CONDITIONS

A. Environmental Requirements:
1. Comply with manufacturer’s written instruction for substrate temperature and moisture content, ambient temperature and humidity, ventilation and other conditions affecting installation and performance of special concrete floor finish.
2. Coordinate scheduling with Owner to provide completion of installation of special concrete floor finish prior to 10 days minimum of installation of racking and equipment for an uninhibited continuous application of finish system.

B. Examination:
1. Inspect substrate and report unsatisfactory conditions in writing. Verify that surfaces and site conditions are ready to receive work. Correct conditions

detrimental to timely and proper installation of work. Beginning work means acceptance of substrate conditions.
2. Concrete must be cured for sufficient period recommended by the special concrete floor finish manufacturer before application can begin.
3. Comply with special concrete floor finish manufacturer's recommendations and instructions. Clean, prime and prepare substrate surfaces for proper installation.

C. Tolerances:
1. Comply with Section 03 30 00.
2. Where new or existing substrates are not in compliance with specified tolerances provide repair, grinding, patching or other remedies recommended by polished concrete floor finish manufacturer for project conditions and approved by the Owner and/or Architect.

D. Protection:
1. Provide manufacturer's approved substrate protection materials, means and methods to maintain and ensure system performance and appearance criteria specified.
2. Avoid surface deposits of oil, chemicals, agents or other material that will adversely affect special concrete floor finish performance or appearance. No satisfactory chemical or cleaning procedure may be available to remove petroleum stains from the concrete surface. Prevention is therefore essential.
3. All hydraulic powered equipment must be diapered to avoid staining of the concrete.
4. No trade will park vehicles on the inside slab. If necessary to complete work, drop cloths will be placed under vehicles at all times.
5. No pipe cutting machine shall be used on the inside floor slab.
6. Do not place steel on interior slab to avoid rust staining.
7. All equipment must be equipped with non-marking tires.
8. Do not drag or drop equipment or material across the slab which will scratch, chip or damage surfaces.

3.02 INSTALLATION

A. General:
1. Install polished concrete floor finishing system per manufacturer's recommendations and instructions. Use equipment, means and methods for proper installation.
2. Where walls, columns or substrate penetrations are installed adjacent to or through polished concrete floor finish areas, extend grinding and polishing process to within 1" maximum distance from perimeter of surface interrupting condition by means necessary for uniform appearance with field surface area finish.

B. Concrete Substrate Installation:
1. New Construction:
   a. Comply with Section 03 30 00 and the governing requirements of this section.
   b. Provide hard steel trowel finish with a minimum of 3 separate passes with power trowel to achieve Class 5 finish as described in ACI 302R to comply with minimum tolerances specified in this section.
   c. Provide concrete curing and sealing materials compatible with special concrete floor finish system recommended by manufacturer.
2. Existing Construction:
   a. Remove existing applied floor finish(s) including, but not limited to, carpet, VCT, tile, grout, mastic, adhesives, paint, epoxy or other non-concrete floor material to concrete substrate conditions by appropriate means and methods necessary for proper installation of new special concrete floor finish per manufacturer's recommendations.
   b. Where existing substrates are not in compliance with specified tolerances provide repair, grinding, patching or other remedies recommended by special

concrete floor finish manufacturer for project conditions and approved by the Owner and/or Architect

C. Concrete Substrate Grinding and Polishing:
   1. Use equipment, means and methods recommended by manufacturer.
   2. Grind, polish and clean concrete floor surfaces using methods depending on substrate conditions to achieve project system performance and appearance criteria.
   3. Scrub and rinse floor and remove residual color, dust and debris.
   4. All grinding and polishing passes shall be made in the same direction until the entire given area has been covered.

D. New Construction Concrete Control Joints:
   1. Freshly Placed Uncured Concrete: After concrete grinding and polishing, clean concrete substrate of dirt, chalk, markings and saw cut debris with cleaning agent or process recommended by manufacturer.

E. Sealer, Hardener and Densifier Application:
   1. Prior to application of product, substrate to be clean, dry and absorbent. Confirm surface absorbency with a light water spray. If surface does not wet uniformly, use appropriate surface preparation cleaner or mechanical process to remove remaining surface contaminants per manufacturer's recommendations.
   2. Calculate Target Coverage Rate: Variations in concrete quality, porosity, job conditions, temperature and relative humidity will affect coverage rates and drying times. Test a representative section of the substrate surface to calculate the target coverage rate, but not less than 200 sq. ft. per gallon.
   3. Apply material at specified coverage rate by means recommend by manufacturer. Apply sufficient product to wet the surface until rejection without producing puddles. Use a clean, soft bristle push broom, microfiber pad or other means recommended by manufacturer to spread the product and ensure uniform wetting, saturation and penetration of surfaces.
   4. If surfaces dry immediately or become sticky, increase rate of application and reapply product. Avoid excess material puddling.
   5. Before product dries and cures, immediately clean surfaces not intended to receive application of material.
   6. Allow treated surfaces to dry or cure for duration recommended by manufacturer for project conditions.
   7. Remove any dried powder residue using stiff broom, power sweeper, automatic scrubbing machine, and/or cleaning agent recommended by manufacturer. Avoid pads or brushes which may damage the floor finish.

F. Sealer and Stain Inhibiter Application:
   1. Prior to application of product, surfaces to be clean, dry and absorbent. Use appropriate surface preparation cleaner or mechanical process to remove contaminants per manufacturer's recommendations.
   2. Calculate Target Coverage Rate: Variations in concrete quality, porosity, job conditions, temperature and relative humidity will affect coverage rates and drying times. Test a representative section of the substrate surface to calculate the target coverage rate per manufacturer's recommendations, but not less than 500 sq. ft. per gallon.
   3. Apply material at the specified coverage rate by means recommend by manufacturer to produce an even coat. Restrict spreading area of product to maintain wet edge and avoid drying and visible overlapping.
   4. Allow treated surfaces to dry or cure for duration recommended by manufacturer for project conditions.
   5. Per manufacturer's recommendations where required, once dry, burnish surface using a high-speed burnisher, or polishing pad for use on gloss finishes, to heat and fuse the material bond to increase durability and longevity. Surface temperatures immediately behind the burnisher must achieve 90.5 degrees Fahrenheit.

6. Repeat sealer and stain inhibiter material application and burnishing process between coats as necessary for specified gloss finish. Apply up to three coats maximum.
7. Do not allow floor to be subjected to any forms of moisture, including mopping and wet foot traffic for 12 hours minimum.

G. Testing:
1. Test with a properly calibrated abridged goniophotometry device in accordance with ASTM E 430.
2. Record results on floor plan diagram. Readings shall be taken not less than 10’ on center in field areas and within 1’ of floor area perimeters.
3. Results shall comply with specified system performance and appearance criteria.
4. Rework areas not in compliance until acceptable results are achieved or otherwise approved by Owner.

H. Joint Sealant Installation:
1. Clean concrete floor joints and substrate by means necessary to allow proper bonding and sufficient sealant material deposit.
2. Install sealant material in control and expansion joints in compliance with Section 07 92 00.
3. Install joint sealants to a depth flush with adjacent surfaces.
4. Remove excess material and clean.

3.03 PROTECTION, REPAIR AND CLEANING

A. Provide disposal of slurry, dust and debris in compliance with applicable codes.
B. Remove debris and spatter from adjoining surfaces as necessary.
C. Repair damages to surface caused by cleaning operation and construction activities per manufacturer’s recommendations.
D. Restrict areas to traffic, cover and provide protection as specified and per manufacturer’s recommendations to prevent damage by other trades during project completion.
E. Protect from elements, sweep, clean and maintain until project completion and Owner’s acceptance of the work.
F. Provide Owner’s representative documentation for proper cleaning and maintenance.

3.04 NON CONFORMING WORK

A. If O'Reilly does not accept defective or non-conforming Work, the contractor shall install, at Contractor’s expense (09 65 00) Resilient Flooring and (09 65 13) Resilient Base and Accessories. A Change Order will be issued to reflect an appropriate reduction in the Contract Sum to reimburse Owner the expense of two years of VCT maintenance costs, if VCT installation is required.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL

PART 1 - GENERAL

1.01 SUMMARY

A. Provide structural steel for building construction including sub-framing units which are part of the general framing system. Include related anchors, fasteners, and connectors.
B. Modify existing structural steel systems and components to accommodate remodeling and new work where indicated.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.
Submit for approval shop drawings, product data, test reports.
1. Submit shop drawings including complete details and schedules for fabrication and shop assembly of the members, details, schedules, procedures and diagram showing the sequence of erection. 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. Provide setting drawings, templates, and directions for the installation of anchor bolts and other anchorages to be installed by others.
2. Perform design under direct supervision of a professional structural engineer licensed in the state where the project is located. Drawings shall be sealed, signed and dated.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Standards: Comply with the following:
1. AISC “Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings:
2. AISC “Code of Standard Practice for Steel Buildings and Bridges”, Paragraph 4.2.1 is modified by deletion of the following sentence: “This approval constitutes the Owner’s acceptance of all responsibility for the design adequacy of any connections designed by the fabricator as a part of his preparation of these shop drawings”.
3. AISC “Specifications for Structural Joints using ASTM A325 or A490 Bolts” approval by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation”.
4. AWS D1.1 “Structural Welding Code”.
C. Testing and Inspection:
1. Comply with Section 01 45 16 – Quality Control Procedures.
2. The Owner shall employ an independent testing laboratory to inspect welded and bolted connections. The following items will be included in testing laboratory inspections:
a. Visual inspection of welded and bolted connections for quality.
b. Check by ultrasonic or radiographic means approximately 10% each column field weld splices and beam to column welds.

c. Test approximately 10% of high strength bolts for correct nut tightness.
3. Correct as directed, at Contractor's expense, connections that are found unsatisfactory by testing agency.

D. Field and Shop Welding: All structural welding shall be performed in accordance with AWS standards and by welders holding valid certificates and having current experience in the type and position of welds shown on drawings or in notes. Certificates shall be issued by an accredited testing agency. All full penetration welds shall be tested by a independent testing laboratory.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel Materials:
1. Structural Steel Shapes, Plates, and Bars: ASTM A 36.
2. Cold-Formed Steel Tubing: ASTM A 500, Grade B.
3. Hot-Formed Steel Tubing: ASTM A 501.
4. Steel Pipe: ASTM A 53, Type E or S, Grade B; or ASTM A 501.
5. Anchor Bolts: ASTM F 1554, headed type.
6. Unfinished Threaded Fasteners: ASTM A 307, Grade A.
7. High-Strength Threaded Fasteners: ASTM A 325 or ASTM A 490, as applicable.

B. Auxiliary Materials:
1. Direct Tension Indicators: ASTM A 959.
2. Electrodes for Welding: AWS Code.
3. Structural Steel Primer Paint: Lead free, alkyd primer equal to Tnemec "10-99 Series", Southern Coatings "Enviro-Guard 1-2900", or approved equal, meeting performance requirements of TT-P-86, Type I, and passing ASTM B 117 after 500 hours with no blistering, cracking, softening, delamination, or rust creepage at scribe and rusting at edges.
4. Grout:
a. Metallic Shrinkage-Resistant Grout: Premixed ferrous aggregate grouting compound equal to Master Builders "Embeco 153", Sonneborn "Ferrolith G", Euclid "Firmix", or W.R. Grace "Vibra-Foil".
b. Nonmetallic Shrinkage-Resistant Grout: Premixed nonmetallic grouting compound, CE CRD-C621 equal to Master Builders "Masterflow 713", Euclid "Euco N.S.", L & M "Crystex", or U.S. Grout "Five Star Grout".

PART 3 - EXECUTION

3.01 FABRICATION

A. Fabricate and assemble structural assemblies in accordance with AISC and AWS codes and specifications, and as indicated on final shop drawings.
B. Connections Design: All structural framing connections shall be designed by the steel fabricator to support at least one half the total uniform load capacity shown in the "Tables of Uniform Constants", Part 2 of the AISC Manual of Steel Construction 8th edition, for the given beam, space and grade of steel specified.
C. Fabricate work to shape and size with sharp lines and angles and smooth surfaces. Securely weld or bolt with bearing type connections, unless otherwise indicated. Dress welds smooth on exposed surfaces. Provide rabbets, lugs, and brackets so that work can be assembled in a neat substantial manner. Smooth exposed ends and edges of metal and form joints exposed to weather to exclude water.
D. Punch or drill structural steel and/or furnish all clips required to accommodate work of other trades, where supported on or secured to structural steel.

3.02 ERECTION

A. Verify that field conditions are acceptable. See that anchor bolts in concrete are properly set to template.
B. Set structural steel members to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
C. Allow for erection loads. Provide temporary bracing to maintain framing in alignment until completion of erection and installation of permanent bridging and bracing.
D. Field weld or bolt component connections as indicated on final shop drawings. Weld in compliance with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welded work.
E. Alterations to Structural Framing: Do not field cut or alter structural members without approval of Architect/Engineer.
    1. Do not enlarge unfair holes in members by burning or by the use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
    2. Do not use gas cutting torches in the field for correcting fabrication errors in the structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to the Architect/Engineer. Finish gas-cut sections equal to a sheared appearance when permitted.
F. Grout bearing plates on concrete to exact level required with grout and support on steel wedges until grout has set hard. Clean concrete and masonry bearing surfaces and roughen to improve bond. Clean the bottom of base plate contact surfaces.

3.03 PAINTING:

A. Shop Painting:
    1. Shop paint only structural steel work exposed to view. Paint embedded steel which is partially exposed on the exposed portions and the initial 2" of embedded areas only. Do not paint surfaces which are to be welded.
    2. Surface Preparation: Before painting, thoroughly clean all surfaces of all grease, rust, welding droppings and loose mill scale by methods conforming to SSPC-SP-1 and SSPC-SP-3. After erection, wire-brush and touch-up welded or abraded areas. Touch-up with primer.
    3. 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 2.0 mils. Use painting methods which will result in full coverage of joints, corners, edges and all exposed surfaces.
B. Touch-up Painting:
    1. Cleaning and touch-up painting of field welds, bolted connections and abraded areas of the shop paint on structural steel is included in Section 09 90 00.
C. Touch-up field welds and abraded areas with shop primer.

END OF SECTION

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 – GENERAL

1.01 SUMMARY

A. Provide cold-formed metal framing:
   1. Exterior and interior load-bearing steel-stud framing.
   2. Exterior and interior nonload-bearing steel-stud framing.

1.02 SUBMITTALS

A. None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for at least three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Standards: Comply with the provisions of the following specifications and standards, except otherwise noted or specified, or as accepted or directed by the Architect.
   1. AISI, Specification for Design of Cold-Formed Steel Structural Members.
   2. AWS D1.3, Structural Welding Code.
   3. ASTM A1003-13a Standard Specification for Sheet Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.
   4. ASTM C645-11a, Specifications for Non-Load (Axial) Bearing Steel Studs, Runners (Tracks), and Rigid Furring Channels for Screw Application of Gypsum Board.
   5. ASTM C754-11, Specifications for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.
   6. ASTM C1007-11a Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

1.04 LOADING AND DEFLECTION CRITERIA

A. In addition to the loads indicated on the drawings, components to withstand design criteria as follows:
   1. Interior partition framing: 5 psf minimum lateral load.
   2. Exterior masonry veneer framing: L/600 total deflection.
   3. All other framing locations, unless otherwise indicated: L/240 total deflection.
B. Design system to provide movement of components without damage.

1.05 TOLERANCES

A. Fabrication Tolerances: 1/8-inch in 10'.
B. Erection Tolerances: 1/16-inch.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers: Marino, Dietrich, Dale/Incor, Superior, USG, Gold Bond, Unimast, or approved equal.
B. Sheet Steel: ASTM A1003-13a, grade as required for structural performance of project conditions, G60 galvanized coating. Where in direct contact with fire treated wood products, provide G90 galvanized coating.
C. Cold-Formed Metal Framing Materials: Refer to drawings for specific member requirements:
    1. Exterior Framing: C-shaped load-bearing steel studs with 1.625-inch flange and flange return lip.
    2. Interior Framing (Load-Bearing): C-shaped steel studs with 1.625-inch flange and flange return lip.
    3. Interior Framing (Non-Load Bearing)" C-shaped steel studs with 1.250 inch flange and flange return lip.
    4. Shaftwall Framing: C-H, C-T, or I-shaped nonload bearing steel studs.
    5. Runner Channel: U-shaped with 1.25-inch minimum flange.
    6. Joist Framing: C-shaped load-bearing steel joists with 1.625-inch flange and flange return lip.
    7. Furring Channel: W-shaped steel furring channels.
    8. Furring Channel: Z-shaped, steel furring channels for rigid board insulation, 1 ¼" wide screw flange, toed in leg to grip insulation positively
    9. Resilient Channel: Single-leg, ½" deep x 1 ¼" wide screw flange
    10. Deflection Channel: Single slip track design with 2.0-inch minimum flange length.
    11. Units 14 gage (68 mils.) (.0677-inch min.) and heavier: Yield point 50,000 psi.
    12. Units 16 gage (54 mils.) (.0538-inch min.) and heavier: Yield point 50,000 psi.
    13. Units 18 gage (43 mils.) (.0428-inch min.): Yield point 33,000 psi.
    14. Units 20 gage (33 mils.) (.0329-inch min.): Yield point 33,000 psi.
    15. Units 24 gage (18 mils.) (.0179-inch min.): Yield point 33,000 psi.
D. Framing Accessories: With each type of metal framing required, provide manufacturers standard accessories as recommended by manufacturer for applications indicated, as needed to provide a complete metal framing system, including:
    1. Supplementary framing.
    2. Lateral bracing, bridging, and solid blocking.
        a. Strap: 1-1/2" x 20 gage.
        b. Channels: 1-1/2" x 20 gage.
    3. Web stiffeners.
    4. Gusset plates.
    5. Deflection track and vertical side clips.
    6. Stud kickers and girts.
    7. Joist hangers and end closures.
    8. Reinforcement plates.
    9. Anchors, clips, and fasteners.

PART 3 – EXECUTION

3.01 GENERAL

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.
B. Comply with requirements of ASTM C1007-11a for installation of steel studs and accessories and Metal Lath/Steel Framing Association Lightweight Steel Framing Systems Manual.
C. Make provisions for erection stresses. Provide temporary alignment and bracing. Framing components may be prefabricated into panels prior to erection. Perform lifting of prefabricated panels in a manner to prevent damage or distortion in any members in the assembly. Wire tying of framing components is NOT permitted.

3.02 INSTALLATION

A. Runner Tracks: Install continuous tracks sized to match studs. Align tracks accurately to the layout at base and top of studs. Secure tracks as recommended by the stud manufacturer for the type of construction involved, except do not exceed 24-inches on center spacing for nail or power driven fasteners, nor 16-inches on center for other types of attachment. Provide fasteners at corners and ends of tracks.
B. Wall Studs: Install at 24-inches on center, unless otherwise indicated.
   1. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
   2. Secure studs to top and bottom runner tracks by either welding or screw fastening at both inside and outside flanges. Erect horizontal and vertical load bearing studs one piece full length. Splicing of studs is NOT permitted. Punch-outs shall be 10-inches minimum from ends of studs.
   3. Allow for deflection, directly below horizontal building framing for non-load bearing framing as indicated on drawings.
   4. Install horizontal stiffeners in stud system, spaced vertically at not more than 4 feet on center. Fasten at each stud intersection.
   5. Construct corners using minimum 3 studs. Double stud wall openings, door and window jambs with opening larger than 2 feet square, except where indicated in manufacturers instructions. Install runner tracks and jamb studs with stud shoes or by welding and space jack studs same as full height studs of the wall. Secure stud system all around to wall opening frame in the manner indicated.
   6. Install supplementary framing, blocking, and bracing in the metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishing, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with the stud manufacturer's recommendations and industry standards in each case, considering the weight of loading resulting from the items supported.
   7. Where stud system abuts structural columns or walls, anchor ends of stiffeners to supporting structure.
   8. Install diagonal racking bracing at each corner where walls are free standing and not attached to structure.
   9. Frame both sides of expansion and control joints, with separate studs; DO NOT bridge the joint with components of the stud system.
C. Joist: Install at 24-inches on center, unless otherwise indicated.
   1. Place joist as shown on drawings; not more than 2-inches from abutting walls. Connect joist to supports using fasteners or welding
   2. Set joist parallel and level, with lateral bracing and bridging.
   3. Locate joist end bearing directly over load bearing studs or provide load distributing member to top of stud track. Punch-outs shall be 10-inches minimum from ends of joist.
   4. Provide web stiffeners at reaction point and/or as shown on drawings.
   5. Provide double joist at floor openings exceeding 2 feet and at interruption of one or more spanning members.
   6. End blocking shall be provided where joist ends are not otherwise restrained from rotation.
D. Restore damaged components. Protect work from damage.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide the following where indicated on drawings:
   1. Rough hardware.
   2. Pipe bollards.
   3. Loose bearing, leveling plates and templates.
   4. Anchor bolts, expansion anchors and miscellaneous fasteners.
   5. Steel supports for work of other trades.
   6. Loose steel lintels.
   7. Pipe and tube handrails and guardrail systems.
   8. Roof access ladder.
   9. Sidewalk drain cover plates, edge angles, and studs.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.
B. Upon request submit shop drawings of pipe and tube handrails and guardrail for approval.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect.
   1. AISC A 36-90, "Specifications of Structural Steel".
   2. ASTM A 53-90a, "Specification of Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless".
   3. ASTM A 500-90, "Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes".
   4. ASTM A 501-89, 'Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing".

PART 2 – PRODUCTS

2.01 MATERIALS

A. Ferrous Materials:
   1. Steel Plates, Shapes and Bars: ASTM A 36.
   2. Steel Pipe, Black Finish: ASTM A 53.
   3. Steel Tubing: ASTM A 500 or A 501.
   4. Rolled Steel Floor Plates: ASTM A 786.
   5. Reinforcing Bars: ASTM A 615, Grade 60.
   6. Concrete Inserts: Threaded or wedge type.
   7. Welding Rods and Bare Electrodes: AWS specifications.
B. Fasteners:
   1. Bolts and Nuts: Hexagon head type, ASTM A 307, Grade A.
   2. Lag Bolts: Square head, FS FF-B-561.

3. Machine Screws: Cadmium plated steel, FS FF-S-92.
4. Wood Screws: Flat head carbon steel, FS FF-S-111.
5. Plain Washers: Round carbon steel, FS FF-W-92.
6. Drilled-In Expansion Anchors: FS FF-S-325.
7. Toggle Bolts: Tumble-wing type, FS FF-B-588.
8. Lock Washers: Spring type carbon steel, FS FF-W-84.
9. Zinc-Coating: Fasteners in exterior assemblies or exterior walls.

C. Auxiliary Materials:
1. Nonshrink Metallic Grout: CE CRD-C621.
2. Nonshrink Non-Metallic Grout (where exposed): CE CRD-C621.
3. Interior Anchoring Cement: Hydraulic expansion cement.
4. Exterior/Interior Anchoring Cement: Erosion-resistant hydraulic expansion cement.
5. Finish: Primed and painted, refer to Section 09900 for additional requirements.

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION

A. Take field measurements prior to preparation of shop drawings and fabrication. DO NOT delay job; allow for cutting and fitting if field measurement is not practical.
B. Form work true to line with sharp angles and edges. Weld continuously, grind flush and make smooth on exposed surfaces, unless otherwise indicated.
C. Field weld components as indicated. Perform field welding in accordance with AWS D1.1.
D. Install work plumb and level with hairline joints and ground flush welds.
E. Lintels: Provide sizes indicated with 8-inch bearing at each end.
F. Touch-up damaged coatings with shop primer and galvanize repair paint.
G. Paint items scheduled in accordance with Section 09 90 00.

3.02 MISCELLANEOUS METAL FABRICATIONS

A. Pipe Railings: Standard weight steel pipe, with the fittings and brackets as variously detailed, of sizes indicated, neatly welded and all welds dressed smooth. Round with 2-inch minimum radius all changes of direction. Plug open ends. Set pipe in concrete in non-corrosive pipe sleeves with non-shrink grout or anchor to supports with adequate metal expansion bolts.
1. Steel Handrails and Guardrails: Type and layout as shown on drawings.
a. Submit shop drawings for Owner approval prior to beginning construction.
b. Handrails shall be constructed of 1-1/2” diameter standard pipe material at 36” high measured from the highest adjacent walking surface elevation above ground and as projected above from top of noising at stairs.
c. Guardrails shall be constructed of 1-1/2” diameter standard pipe material at 42” high measured from the highest adjacent walking surface elevation above ground.
d. Post shall be constructed of 1-1/2” diameter standard pipe material.
e. Infill pickets shall be constructed of ½” diameter solid bar material at 4” on center at locations where handrails or guardrails exceed 15” above the lowest adjacent ground surface.
f. Painting shall comply with Section 09 90 00.

B. Ladder: Steel bars, rods and shapes of sizes and designs indicated, and securely anchored to floor and wall.
C. Steel Supports: provide structural steel lintels, channels, braces, angles, etc., as indicated and assemble as detailed. Secure all connections to provide rigid supports of all items required including supports not specifically specified in other sections.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 – GENERAL

1.01 SUMMARY

A. Provide rough carpentry where indicated on plans:
   1. Framing with dimension lumber.
   2. Wood grounds, nailers, and blocking.
   3. Wood sheathing.

1.02 SUBMITTALS

A. None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Lumber Standards and Grade Stamps: US Product Standard PS 20, American Softwood Lumber Standard and inspection agency grade stamps. Factory mark each piece of lumber or plywood with type, grade, mill, and grading agency identification or submit mill certificate that material has been inspected and graded in accordance with requirements if it cannot be marked on material surface.
C. Construction Panel Standards: PS 1, US Product Standard for Construction and Industrial Plywood; APA PRP-108.
D. Preservative Treatment: AWPA UC3B for lumber and AWPA UC3B for plywood; waterborne pressure treatment. Label each piece of pressure treated lumber and plywood with the quality control mark.
E. Fire-Retardant Treatment: AWPA UCFB for lumber and AWPA UCFB for plywood; non-corrosive type. Identify material with appropriate classification marking of Underwriters Laboratories, Inc., US Testing, Timber Products Inspection, or other testing and inspecting agency acceptable to authorities having jurisdiction.

PART 2 – PRODUCTS

2.01 MATERIALS

A. General:
   1. Fire-Retardant Treatment: Provide at building interior and exterior where required by code.
   2. Preservative Treatment: Provide for wood in contact with soil, concrete, masonry, roofing, flashing, damp-proofing, and waterproofing, or where installed less than 18-inches above grade.
   3. Moisture Content: 19% for lumber items not specified to receive wood preservative treatment and stamped "S-DRY", "K-D", or "MC19".
B. Dimension Lumber:
   1. Species: Spruce-Pine-Fir graded under National Grading Rules, PS 20-70, or approved equal.
   2. Light Framing: Stud, NO. 3 or standard grade.

3. Structural Framing: No. 2 grade meeting or exceeding the stress rating allowable for repetitive members classified as follows:
   a. 1-1/2" thick and 3-1/2" wide

1). Fb Bending:	1650 psi
2). Ft Tension:	825 psi
3). Fv Shear:	90 psi
4). Fc Perpendicular:	405 psi
5). Fc Parallel:	975 psi
6). E Modulus of Elasticity:	1,600,000 psi

   b. 1-1/2" to 4" thick and 5-1/2" to 12" wide

1). Fb Bending:	1400 psi
2). Ft Tension:	625 psi
3). Fv Shear:	90 psi
4). Fc Perpendicular:	405 psi
5). Fc Parallel:	1000 psi
6). E Modulus of Elasticity:	1,600,000 psi

C. Construction Panels:
   1. Plywood Sheathing: APA sheathing, Exposure 1, exterior grade, fire-retardant treated. Waferboard, composite board, and oriented stand board (but not structural particle-board) are accepted as equals providing specified span ratings are met for installed condition. In all cases, thickness shown is minimum regardless of span rating. Material used for same purpose shall be of same thickness.
D. Fasteners and Adhesives:
   1. Fasteners: Nails, metal connectors, bolts, nuts, screws, washers, staples, and other fasteners (except as specified or noted otherwise); hot-dip galvanized steel.
   2. Power Nails: Not permitted without prior approval of Owner.
   3. Adhesives: Meet requirements of American Plywood Association Specifications AFG-01, (latest revision). Use Phenol Resorcinol type for use on pressure treated wood products.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Wood Framing: Comply with recommendations of NFPA manual for House Framing, NFPA Recommended Nailing Schedule, and NFPA National Design Specifications for Wood Construction.
B. Plywood: Comply with recommendations of APA Design and Construction Guide-Residential and Commercial.
C. Provide nailers, blocking, and grounds where required. Set work plumb, level, and accurately cut.
D. Install materials and systems in accordance with manufacturer's instructions. Install materials and systems in proper relation with adjacent construction. Coordinate with other work.
E. Comply with manufacturers requirements for cutting, handling, fastening, and working treated materials.
F. Securely attach carpentry work to substrate by anchoring and fastening as indicated and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes. 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 of wood, pre-drill as required.
G. Restore damaged components. Protect work from damage.

END OF SECTION

SECTION 07 21 00

BUILDING INSULATION

PART 1 – GENERAL

1.01 SUMMARY

A. Provide building insulation and vapor retarders where indicated. (Note: For Owner furnished/Contractor installed products, refer to drawings and Sections 01 11 00 and 01 20 00).
   1. Under slabs-on-grade and foundation walls, board type.
   2. Exterior cavity walls, board type.
   3. Below low slope roofing systems, board type.
   4. Exterior insulation and finish system (EIFS), board type.
   5. Exterior walls, blanket type.
   6. Underside of roofs, over heated spaces and over soffits, blanket type.
   7. Pre-engineered metal building insulation, blanket type.
   8. Interior walls, blanket type.
   9. Cavity, foam-in-place type.
   10. Sheet or chemical vapor retarders.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Submit product data upon request.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect.
   1. ASHRA Standard 90.1, Energy Conservation Code.
   2. ASTM C 518-10, Standard Test Method for Steady State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
   3. ASTM C 578-12b, Specification for Preformed, Cellular Polystyrene Thermal Insulation.
   4. ASTM C 665-12, Specification for Mineral-Fiber Thermal Insulation For Light Frame Construction and Manufactured Housing.
   5. ASTM C 991-16, Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings.
   6. ASTM C 1104, Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
   7. ASTM C 1029-15, Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation.
   8. ASTM C 1289-18a, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
   9. ASTM C 1136-17a, Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
   10. ASTM C 1763–16, Standard Test Method for Water Absorption by Immersion of Thermal Insulation Materials.

11. ASTM D 1621-16, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
12. ASTM D 2126-15, Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
13. ASTM D 2842-12, Standard Test Method for Water Absorption of Rigid Cellular Plastics.
14. ASTM D 4397-10, Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
15. ASTM E 84-13a, Standard Test Method for Surface Burning Characteristics of Building Materials.
16. ASTM E 96-16, Standard Test Methods for Water Vapor Transmission of Materials.
17. ASTM E 779–19, Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.
18. UL 1479, Fire Tests of Through-Penetration Firestops.
19. NAIMA, North American Insulation Manufacturers Association - Standards of Products.

PART 2 – PRODUCTS

2.01 MATERIALS

A. General: Refer to drawings for minimum “R” value and/or thickness requirements and locations.

B. Flame Spread and Smoke Development Ratings:
   1. Tested in accordance with ASTM E84-13a standards.
   2. Exposed and Concealed Insulation: Flame spread rating of 0 to 25, smoke development rating of 0 to 450.

C. Environmental Requirements and Certifications:
   1. VOC Emission Testing Compliance: Greenguard or Greenguard Gold test method, Pass.
   2. Formaldehyde Content: Free of formaldehyde containing materials.

D. Accessories:
   1. Adhesives, mechanical anchors, hangers and clips for application per manufacturer’s recommendations.
   2. Crack sealers, tapes, primers, and accessories for application per manufacturer’s recommendations.

2.02 BOARD INSULATION

A. Manufacturers: Dow, GAF, Johns Manville, Owens-Corning, StarRfoam Manufacturing, or approved equal for application.

B. Locations and Types:
   1. Under Slab and Foundation Perimeters:
      a. Type: Extruded polystyrene closed cell rigid (ASTM C 578), Type IV, “R” of 5.0 minimum per nominal inch (ASTM C 518), compressive strength 25 psi minimum (ASTM D 1621), water absorption 3.0 percent maximum by volume (ASTM D 2842), square edges.
      b. Profiles: Vertical grooves or fluted for drainage where indicated.
      c. Adhesive: Type recommended by manufacturer for project conditions.
   2. Exterior Walls – Exterior Insulation Finish Systems (EIFS):
      a. Type: Expanded polystyrene closed cell rigid (ASTM C 578), Type I, “R” of 4.6

minimum per nominal inch (ASTM C518), compressive strength 10 psi minimum (ASTM D 1621), water absorption 4.0 percent maximum by volume (ASTM D 2842), dimensional stability 2.0 percent maximum (ASTM D 2126), square edges.
   b. Profiles: Vertical grooves or fluted for drainage where indicated.
   c. Adhesive: Type recommended by manufacturer for project conditions.
3. Exterior Walls – Cavity and Continuous Insulation Assemblies:
   a. Type: Extruded polyisocyanurate closed cell rigid (ASTM C 578), Type I, Class 2, “R” of 6.5 minimum per nominal inch (ASTM C 518), compressive strength 25 psi minimum (ASTM D 1621), water absorption less than 0.1 percent maximum by volume (ASTM C 1763), square edges.
   b. Vapor Retarder: Integral foil face vapor retarder, where indicated.

2.03 BLANKET AND BATT INSULATION

A. Manufacturers: Certainteed, Johns Manville, Owens-Corning, or approved equal for application.

B. Locations and Types:
1. Exterior Stud Walls, Soffits and Roof Insulation: Glass fiber (ASTM C 665), Type I, Class A, “R” minimum value as indicated on drawings (ASTM C 518), with foil faced Type III, Class B, Category 1 (ASTM C 665), water vapor membrane permeance 0.05 maximum (ASTM E 96), water vapor sorption 5 percent or less by weight (ASTM C 1104), fungi resistance pass rating (ASTM C 1338).
2. Interior Walls: Glass fiber (ASTM C 665), Type I, Class A, unfaced, water vapor sorption 5 percent of less by weight (ASTM C 1140), fungi resistance pass rating (ASTM C 1338).
3. Width: Provide in same width as stud framing spacing, unless otherwise indicated.

2.04 PRE-ENGINEERED METAL BUILDING BLANKET AND BATT INSULATION

A. Manufacturers: Silvercote (No substitutes).

B. Materials:
1. Roof: Formaldehyde fee fiberglass, ASTM C991-16, Type I, Class A. Where two layers of insulation are used to attain required “R” factor, layers shall be oriented perpendicular to each other. Vapor retarder separate component.
2. Exterior Walls: Formaldehyde fee fiberglass, ASTM C991-16, Type I, Class A. Vapor retarder separate component.
3. Size: Equal to purlin or girt spacing in manufacturer’s standard lengths. Provide largest width and lengths possible to reduce number of seams and joints.
4. Vapor Retarder Liner Fabric Material:
   a. ASTM C1135-17a, woven reinforced high-density polyethylene yarns coated on both sides with a continuous polyethylene colored coating.
   b. Perm Rating: ASTM D4397-10, 6 mils minimum, 0.02 perms vapor transmission rating.
   c. Ultra Violet Radiation Inhibitor: Minimum rating 8.
   d. Fabric Color: White, unless otherwise indicated.
   e. Size and Seaming: Manufacturer’s standard sizes for project conditions with extrusion weld seams.
   f. Sealant: Solvent-based polyethylene fabric adhesive in type recommend by manufacturer.
   g. Tape: Double sided sealant tape, 3/4" wide, 1/32” thick in type recommended by manufacturer.
5. Steel Straps:
   a. 100 KSI minimum yield tempered, high tensile strength steel, galvanized.

b. Size: Minimum 0.02 inch thick by 1 inch wide by continuous length.
c. Finish: Concealed surfaces primed and painted with 0.2 mils minimum baked polyester paint. Exposed surfaces primed and painted with 0.7 mils minimum baked polyester paint.
d. Color: Match vapor fabric material finish, unless otherwise indicated.

6. Fasteners:
   a. For Light Gage Steel: #12 x ¾ inch plated Tek 2 type screws with sealing washers, painted.
   b. For Heavy Gage Steel: #12 x 1 ½ inch plated Tek 4 type screws with sealing washers, painted.
   c. Finish: Match steel strap finish, unless otherwise indicated.
7. Wall Insulation Hangers:
   a. Preformed rigid hangers, 32 inches long galvanized steel strips with barbed arrows every 8 inches along length.

2.05 LOW SLOPE ROOFING SYSTEMS BOARD INSULATION

A. General:
   1. Refer to specification section of low slope roofing system specified for additional requirements for materials and installation.
   2. Manufacturers subject to compliance with general requirements of low slope roofing system specified.

B. Manufacturers: Dow, GAF, Johns Manville, Owens-Corning, StarRfoam Manufacturing, or approved equal for application.

C. Locations and Types:
   1. Primary Continuous and Tapered Boards:
      a. Reinforced polyisocyanurate closed cell rigid (ASTM C 578) with coated facers (ASTM C 1289), Type II, Class 1, Grade 2, LTTR “R” of 5.7 minimum per nominal inch (ASTM C 518), compressive strength 20 psi minimum (ASTM D 1621), water absorption 0.5 percent by volume maximum (ASTM C 1763), square edges. Note: R-Value requirement as shown on drawings is exclusive of taper insulation.
      b. Profiles: Tapered for drainage, where indicated.
   2. Cover Boards:
      a. Reinforced high density closed cell polyisocyanurate rigid (ASTM C 578) with coated facers (ASTM C 1289), Type II, Class 4, Grade 2, LTTR “R” of 2.5 minimum per nominal 1/2" (ASTM C 518), compressive strength 120 psi minimum (ASTM D 1621), square edge profile in 1/2” thickness minimum, water absorption less than 3 percent (ASTM C 1763), mold resistance pass rating (ASTM D 3273).
   3. Vapor Retarder: Material type acceptable with manufacturer of low slope roofing system specified compatible with substrate conditions.

2.06 FOAM-IN-PLACE INSULATION

A. Manufacturers: Dow, Icynene, Johns Manville, PolyMaster, Loctite, RetroFoam, or approved equal for application.

B. Locations and Types:
   1. Gap fillers, Window and Door Perimeters: Minimal expanding, single component polyurethane foam sealant (ASTM C 1029), closed cell content 80 percent minimum (ASTM D2856), “U” value 0.25 minimum (ASTM C 518), compressive strength 9.3 psi minimum (ASTM D 1621), dimensional stability 14.31 percent maximum by volume (ASTM D 2126), moisture resistant

2. Cavity Walls: Expanding closed cell spray polyurethane foam, two component, medium density (ASTM C 1029), Class 1, “R” of 7.0 minimum nominal per inch (ASTM C 518), compressive strength 35 psi minimum (ASTM D 1621), water absorption 0.88 percent by volume (ASTM D 2842), water vapor permeance 0.61 maximum (ASTM E 96), air infiltration 0.001 L/s/m sq. (ASTM E 283), dimensional stability 12 percent by volume (ASTM D 2126), no fungus growth (ASTM C 1338), sound transmission coefficient STC 36 (ASTM E 2179).

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION

A. Install materials and systems in accordance with manufacturer’s instructions applicable to products and project conditions. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.

B. Extend insulation in thickness indicated to envelope entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation.

C. Thermal Assembly Penetrations: Coordinate locations of water piping in exterior walls to ensure placement on warm side of insulation and insulation encapsulates piping.

D. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise indicated or required to make up total thickness.

E. Seal joints between closed-cell (non-breathing) insulation units by applying adhesive, mastic or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic or sealant as recommended by insulation manufacturer.

F. Protect installed insulation and vapor retarder. Repair construction damaged by contractor activities prior to concealment and installation of subsequent materials.

3.02 BOARD INSTALLATION

A. Below Grade Applications:
   1. Install boards vertically or horizontally as indicated on drawings.
   2. Cut and friction fit insulation boards tightly and neatly with ends butted together.
   3. For vertical applications provide mechanical fasteners and/or adhesive where recommended by manufacture to secure in place.
   4. For horizontal applications provide mechanical fasteners or measures recommended by manufacture to secure in place and protect during work of other trades.

B. Above Grade Applications:
   1. Cut and friction fit insulation over or between framing members as indicated.
   2. Alternatively install insulation with suitable fasteners, adhesives, or over impaling pins. Place pins 3 inches to 5 inches from edge of insulation.

3.03 BATT AND BLANKET INSTALLATION

A. General: Install glass-fiber blankets in cavities formed by framing members according to the following requirements:
   1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.

2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

B. Cold-Form Metal Framing Construction: For wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

C. Wood Framing Construction: Install mineral-fiber blankets in accordance with ASTM C 1320 and as follows:
   1. With faced blankets having stapling flanges, secure insulation by friction fit inset or face stapling flanges to sides of framing members.
   2. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to produce airtight installation after concealing finish material is in place.

3.04 PRE-ENGINEERED METAL BUILDING BATT AND BLANKET INSTALLATION

A. Roof Insulation (Liner Systems):
   1. Install steel strap support system and vapor retarder fabric material to bottom of purlins towards conditioned space. Lap vapor retarder seams and apply joint tape per manufacturer's recommendations.
   2. Install first layer of batt insulation in framing cavity parallel with roof purlins and supported by vapor retarder material.
   3. Install second layer of batt insulation in framing cavity perpendicular and over top of roof purlins.
   4. Install pre-engineered metal building sheet metal roofing system attachment clips to purlins with thermal block spacers (R-5 minimum) per manufacturer's recommendations to minimum compressing insulation.

B. Wall Insulation (Full Cavity Systems):
   1. Install exterior materials covering pre-engineered metal building girt system.
   2. Install wall insulation hanger types and spacing in girt cavity per manufacturer's recommendations.
   3. Install single layer batt insulation in girt cavity to thickness required.
   4. Install steel strap support system and vapor retarder fabric material to inside face of girts towards conditioned space. Lap vapor retarder seams and apply joint tape per manufacturer's recommendations.

C. Wall Insulation (Compressed Systems):
   1. Prior to installation of exterior materials covering pre-engineered metal building girt system.
   2. Install insulated compression tape continuous or thermal blocks on exterior face of girts per manufacturer's recommendations.
   3. Install batt insulation with factory laminated vapor retarder fabric material to exterior face of girt system. Stretch batt material and provide attachments to hold in place as necessary for proper installation.
   4. Install exterior materials by compressing insulation over girts per manufacturer's recommendations.

3.05 FOAM-IN-PLACE INSTALLATION

A. General:
   1. Clean, prepare, and prime substrates per manufacturer's recommendations.
   2. Install foam-in-place insulation in quantities and rates recommend by manufacturer for project conditions to provide thermal performance specified.

3. Remove excess material, clean, and prepare insulation surfaces as required for installation of other work.

B. Gap Fillers, Window and Door Perimeter Applications:
   1. Install foam-in-place insulation in quantities and rates recommend by manufacturer to neatly fill cracks, joints, and voids from thermal intrusion.
   2. Avoid filling joints intended for weeping water from assemblies.
   3. Avoid expansive insulation applications that prohibits proper function of adjacent assemblies.

C. Roof, Ceiling, and Wall Applications:
   1. Provide supporting accessories, mesh, or membranes recommend by manufacturer where ventilation required in attics, chases, and cavities.
   2. Install foam-in-place insulation per manufacturer's recommendations for project conditions.

3.06 VAPOR RETARDER INSTALLATION

A. General:
   1. Install vapor retarder, where indicated, over entire area of substrate within thermal envelop assemblies as indicated on drawings and as required based upon project climate conditions.
   2. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping
   3. Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
   4. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor retarder manufacturer.
   5. Seal joints caused by pipes, conduits, electrical boxes and similar items penetrating vapor retarders with vapor retarder tape to create an airtight seal between penetrating objects and vapor retarder
   6. Seal all seams and around perimeter and penetrations with tape or sealant to form a continuous vapor retarder free of holes, leave no gapes in insulation/vapor envelope.
   7. Repair punctures and tears immediately before concealment of work.

END OF SECTION

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 – GENERAL

1.01 SUMMARY

A. Provide flashing and sheet metal (Work not included in Section 13 34 19) where indicated:
   1. Sheet metal flashing, coping, fascia, exposed trim, edges, counterflashing, cleats, caps, sills, drips, etc.
   2. Gutters and downspouts.
   3. Elastic flashing.
   4. Sheet metal accessories.

1.02 SUBMITTALS

A. None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect.
   1. SMACNA, (Sheet Metal and Air Conditioning Contractors National Association, Inc.) Architectural Sheet Metal Manual (Fifth edition).
   2. AA, (Aluminum Association), Aluminum Construction Manual- Aluminum Sheet Metal Work in Building Construction.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Sheet Metal:
   1. Pre-primed (field paint) Steel Sheets: 24 gage hot dipped galvanized steel (G90) commercial quality, primed one side with coating 1.0 mil total dry film thickness, and with wash coat on reverse side. Refer Section 09 90 00 for field paint, colors as indicated on drawings or as selected by Architect.
   2. Prefinished Steel Sheets: 24 gage hot dipped galvanized steel (G90) commercial quality, primed and finished one side with Kynar base fluoropolymer coating 1.0 mil total dry film thickness, and with wash coat on reverse side. Colors as selected by Architect. Coat pre-painted side with liquid applied factory installed strippable film for protection of finished surface. Vincent "ColorClad", Peterson "PacClad", or Copper Sales "Una-Clad".
   3. Sheet Aluminum: ASTM B 209, alloy 3003, mill finish, temper #14, 20 gage (.032-inch).
   4. Zinc-Coated Steel: ASTM A 526, G90 hot-dip galvanized, 20 gage (.032-inch).
   5. Lead: ASTM B 749, Type L51121, copper-bearing sheet lead, minimum 4 lb/sq. ft.
B. Flexible Sheet Membrane Flashing: Non-reinforced flexible black elastic rubber sheet, 20 mils thick, formulated from virgin polyvinyl chloride with plasticizers and other modifiers to remain flexible and waterproof in concealed applications.

C. Auxiliary Materials:
   1. Fasteners: Same metal as flashing/sheet metal or other non-corrosive metal as Solder recommended by sheet metal manufacturer. Match finish of exposed heads with materials being fastened.
   2. Solder: ASTM B 32, 50-50 tin/lead solder, with rosin flux.
   3. Roofing Cement: ASTM D 2822, asphaltic.
   4. Bituminous isolation coating. SSPC- Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compound for 15-mil dry film thickness per coat.
   5. Mastic and elastomeric sealant: Polyisobutylene; non-hardening, non-skinning, non-drying, non-migrating sealant.
   6. Epoxy seam sealer: 2-Part non-corrosive metal seam cementing compound, recommended by manufacturer for non-moving joints including riveted joints.
   7. Polyethylene underlayment: 6 mil carbonated polyethylene film.
   8. Reglets and metal accessories: Sheet metal clips, cleats, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, non-corrosive, size and gage required for performance.
   9. Adhesives: Type recommended by flashing sheet metal manufacturer for water/weather resistant seaming and adhesive application of flashing sheet.
   10. Paper Slip Sheets: 5-lb. rosin-sized building paper.

2.02 FABRICATION

A. Fabricate flashing, counter-flashing and other sheet metal work not exposed to view of aluminum. Fabricate flashing, gutters, downspouts, conductor heads, scuppers, copings, caps, edges, trim, and other exposed sheet metal work of pre-painted, or pre-primed and field painted, steel sheets. Use lead at drains, vents, where indicated, and where required to conform to contour of roofing components and accessories.
B. Fabricate for waterproof and weather resistant performance; with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work. Form work to fit substrates.
C. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels as indicated, with exposed edges folded back to form hems.
D. Fabricate pre-painted steel with strippable film in place. If soldering is necessary, mechanically remove coating. Touch up with color matched paint.
E. Seams: Fabricate non-moving seams in sheet metal with flat-lock seams. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.
F. Expansion Provisions: Where lapped or bayonet-type expansion provisions cannot be used, or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with mastic sealant (concealed within joints).
G. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant.
H. Separate dissimilar metals from each other to prevent electrolytic action by painting each metal surface in area of contact with a heavy application of bitumastic coating, or by other permanent separation as recommended by manufacturers of dissimilar metals.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Follow recommendations of SMACNA and AA Manuals for specific application.

B. Install materials and systems in accordance with manufacturer's instructions. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.
C. Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams, which will be permanently watertight and weatherproof.
D. Underlayment: Where aluminum is to installed directly on cementitous or wood substrates, install a course of paper slip sheet and a course of polyethylene underlayment.
E. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.
F. Secure edges of flashing to other work with angles and bars, and seal with sealant as indicated.
G. Retainers: Where indicated, provide saw cuts for metal counter-flashing system using metal flashing receiver as detailed and indicated.
H. Seal edges of metal flashings to substrates with roofing cement; install bed or bead of cement in manner, which will maintain a watertight seal.
I. Remove strippable film from pre-painted steelwork. Restore damaged components and finishes. Clean and protect work from damage.

END OF SECTION

SECTION 07 72 00

ROOF ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Provide roof accessories, complete:
   1. Roof curbs (Pre-engineered metal building): Provided under Section 13 34 18. (Owner furnished, Contractor installed)
   2. Roof hatches.
   3. Roof access straight ladders.
   4. Roof access ship ladders.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Shop Drawings: Submit shop drawings prior to fabrication and manufacturer’s installation recommendations.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Comply with ANSI and OSHA standards for project conditions.

PART 2 - PRODUCTS

2.01 ROOF HATCHES

A. Manufacturers: Bilco Type S Roof Scuttle specified. Equivalent products as manufactured by Babcock-Davis, Precision Ladders, or approved equal.

B. Assemblies shall be factory fabricated and unit field installed:
   1. Size: 36” x 30”.
   2. Cover: 11 gauge insulated aluminum.
   3. Framing: 11 gauge aluminum.
   4. Hinges: Heavy-duty stainless steel.
   5. Latch: Slam latch with interior and exterior turn handles.
   6. Curb Type: 12” in height with integral cap flashing, 1” fiberboard insulation, fully welded at corners, and 3 ½” mounting flange.
   7. Gasket: Extruded EPDM rubber gasket permanently adhered to cover.
   8. Lift assistance: Compression spring operators enclosed in telescopic tubes. Automatic hold-open arm with grip handle release.
   9. Finish: Mill finish
   10. Hardware: Engineered composite compression spring tubes. Steel compression springs with electrocoated acrylic finish. Type 316 Stainless steel hinges. All other hardware zinc plated/chromate sealed.

C. Accessories:
   1. Bilco Model LU-4 aluminum Ladder-up safety post, mill finish.

2.02 ROOF ACCESS STRAIGHT LADDERS

A. Manufacturers: Calico Ladders, Cotterman, Global Industries, Precision Ladders, or approved equal.

B. Assemblies shall comply with OSHA 1910.27 standards and be factory fabricated and unit field installed.
   1. Exposure: Interior or exterior applications, refer drawings for project conditions.
   2. Metal Material: Comply with Section 05 50 00. Welded schedule 40 aluminum construction in mill finish.
   3. Rungs: ¾" corrugated round rungs, 16" wide min. clear, 12" on center.
   4. Stringers: 2" wide min. with smooth edges.
   5. Stand Off Brackets: 7" clear from center of rung to wall. Space per manufacturer's recommendations for attachment to substrate framing members.
   6. Landings and Extensions: Manufacturer's standard construction for project conditions.
   7. Finish:
      a. Interior Applications: Mill finish aluminum.
      b. Exterior Applications: Paint all exposed parts to comply with Section 09 90 00, refer to drawings for colors.
   8. Mounting Hardware: Per manufacturer's recommendations for project conditions. Provide corrosive resistant material for exterior applications.

2.03 ROOF ACCESS SHIP LADDERS

A. Manufacturers: Calico Ladders, Precision Ladders, or approved equal.

B. Assemblies shall comply with OSHA standards and be factory fabricated and unit field installed.
   1. Exposure: Interior or exterior applications, refer drawings for project conditions.
   2. Metal Material: Comply with Section 05 50 00. Welded and/or bolted schedule 40 aluminum construction in mill finish.
   3. Angle: 60 degree to 75 degree. Refer to drawings for project conditions
   4. Treads: 6" wide min, tread plate or channel with slip resistant surface, 24"" wide min. clear, 10 ½" min. to 14" max. vertical spacing on center.
   5. Stringers: 5" wide min. channels or shapes.
   6. Handrail: 1 ¼" min. to 1 ½" max. dia. pipe or 1 ¼" min. to 1 ½" max. square tube. Material edges shall be smooth.
   7. Mounting Brackets: Space per manufacturer's recommendations for attachment to substrate framing members.
   8. Landings and Extensions: Manufacturer's standard construction for project conditions.
   9. Finish:
      a. Interior Applications: Mill finish aluminum.
      b. Exterior Applications: Paint all exposed parts to comply with Section 09 90 00, refer to drawings for colors.
   10. Mounting Hardware: Per manufacturer's recommendations for project conditions. Provide corrosive resistant material for exterior applications.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with accessory manufacturers' instructions and recommendations. Coordinate installation with roofing system to ensure weather tight performance. Anchor securely to structure to withstand inward and outward loads.

B. Install construction per ANSI and OSHA standards. Coordinate installation and substrate framing requirements with other trades.

C. Isolate dissimilar metals to prevent galvanic corrosion.

D. Test and operate units; clean, lubricate and adjust moving parts. Leave unfinished metal fabrications ready for field painting where specified or indicated on drawings.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide joint sealers at interior and exterior vertical and horizontal joints. Work includes joints around frames of doors, windows, louvers, or other openings in exterior walls, flooring joints, joints at penetrations of walls, decks, roofs, and floors by piping and other services and equipment, joints between items of equipment and other construction, joints at plumbing fixtures, joints at dissimilar material transitions, expansion and contraction joints of masonry and concrete, and other joints indicated to be sealed.

1.02 SUBMITTALS

A. None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Compatibility: Provide joint sealers, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by testing and field experience.
B. Colors: As selected by Owner from Manufacturers' standard colors or match color of material applied, unless otherwise indicated.

2.02 ELASTOMERIC JOINT SEALANTS

A. Provide manufacturers standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C 920 requirements, including those for type, grade class, and uses.
B. One-Component Nonsag Urethane Sealant: Type M, Grade NS, Class 25, Sonneborn "Sonolastic NP 1", Tremco "Dymonic", Bostik "Chem-Calk 900", Pecora "Dynatrol 1", Mameco "Vulkem 116", or approved equal.
C. Two-or-More Component Nonsag Urethane Sealant: Type M, Grade NS, Class 25. Tremco "Dymeric", Sonneborn "Sonolastic NP 2", Bostik "Chem-Calk 500", Pecora "Dynatrol II", or approved equal.
D. Two-Component Pourable Urethane Sealant: Type M, Grade P, Class 25. Tremco "THC 900", Sonneborn "Sonolastic SL-2", Bostik "Chem-Calk 550", Pecora "NR-200 Urexpan", or approved equal.
E. One-Component Pourable Urethane Sealant: Type S, Grade P, Class 25. Sonneborn "SL-1", Bostik "Chem-Calk 550", Pecora "NR-201 Urexpan", Maneco "Vulken 45", or approved equal.

F. One-Component Mildew-Resistant Silicone Sealant: Type S, Grade NS, Class 25. GE "SCS 1702", Dow Corning "786", Tremco "Proglaze White", Pecora "863 #345", or approved equal.

2.03 ACRYLIC EMULSION SEALANT

A. One component, nonsag, acrylic, paintable, mildew-resistant, complying with ASTM C 843. Tremco "Acrylic Latex Caulk", Sonneborn "Sonolac", Pecora "AC-20", Woodmont "Chem-Calk 600", or approved equal.

2.04 MISCELLANEOUS MATERIALS

A. Joint Cleaner: Type of joint cleaning compound recommended by sealant manufacturer for the joint surfaces to be cleaned.
B. Joint Primer/Sealer: Type recommended by the sealant manufacturer for the joint surfaces to be primed or sealed.
C. Bond Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer, to be applied to sealant-contact surfaces where bond to the substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape wherever applicable.
D. Sealant Backer Rod: Compressible rod stock polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable non-absorptive material as recommended for compatibility with sealant by the sealant manufacturer. Provide size and shape of rod which will control the joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide a highly compressible backer to minimize the possibility of sealant extrusion when joint is compressed.
E. Joint Fillers for Concrete Paving: Refer to Section 03 30 00 (CIP) for requirements.

PART 3 – EXECUTION

3.01 JOINT TYPES AND USAGE

A. Acrylic Emulsion Sealant: All interior joints except joints with metal, aluminum, and wet work.
B. Elastomeric Sealants: Use single or multi-component urethane at all exterior joints and all interior joints with aluminum or metal. Use mildew resistant silicone sealant at sinks, plumbing fixtures, and other wet work. Use minimum 35 Shore A hardness single or multi-component pourable polyurethane sealant for horizontal joints subject to pedestrian and vehicular traffic.

3.02 JOINT SURFACE PREPARATION

A. Clean joint surfaces immediately before installation of sealant. Remove dirt, insecure coatings, moisture, and other substances, which would interfere with bond of sealant.
B. Perform preparation in accordance with ASTM C804 for solvent release or ASTM C790 for latex base sealants.
C. For elastomeric sealants, DO NOT proceed with installation of sealant over joint surface which have been painted, lacquered, waterproofed, or treated with water repellent or other treatment or coating. Remove coating or treatment from joint surfaces before installing sealant.
D. Etch cementitious joint surfaces to remove excess alkalinity. Etch with 5% solution of muriatic acid; neutralize with dilute ammonia solution, rinse thoroughly with water and allow to dry before sealant installation.

E. Rough joint surfaces on vitreous coated and similar non-porous materials, wherever sealant manufacturer's data indicates lower bond strength than for porous surfaces. Rub with fine abrasive cloth or wool to produce a dull sheen.

3.03 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.
B. Examine substrate, report unsatisfactory conditions in writing. Beginning work means acceptance of substrates.
C. Clean and prime joints, and install bond breakers, backer rods and sealant as recommended by manufacturers.
D. DO NOT apply sealant at temperatures below 40° F.
E. Apply sealant with hand-caulking gun with nozzle of proper size to fit joints. Use sufficient pressure to insure full contact to both sides of joint to full depth of joint. Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of the joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.
F. Install sealants to depths as shown or, if not shown, as recommended by the sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead.
    1. For sidewalks, pavements, and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposure, fill joints to a depth equal to 75% of joint width, but neither more than 5/8-inch deep nor less than 3/8-inch deep.
    2. For normal moving joints sealed with elastomeric sealants, but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than ½-inch deep nor less than ¼-inch deep.
    3. For joints sealed with non-elastomeric sealants, fill joints to a depth in the range of 75% to 125% of joint width.
G. DO NOT allow sealants or compounds to overflow or spill onto adjoining surfaces. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either.
H. Tool joints immediately after application of sealant if required to achieve full bedding to substrate or to achieve smooth sealant surface.
I. Cure and protect sealants as directed by manufactuers. Replace or restore damaged sealants. Clean adjacent surfaces to remove spillage.

END OF SECTION

SECTION 08 11 19

STEEL DOORS AND FRAMES

PART 1 – GENERAL

1.01 SUMMARY

A. Provide steel doors and frames.
   1. Provide handling and installation of Owner furnished steel door and frame systems (Refer to drawings – Scope of Work Schedule).
   2. Exterior and interior steel doors.
   3. Hollow metal steel frames.

1.02 SUBMITTALS

A. None required unless submitting for approved equals.
B. (Florida Projects) Exterior door and frame assemblies not furnished by Owner, submit current Florida Product Approval documentation and where required Notice of Acceptance (NOA) documentation issued by Miami-Dade County. Contractor shall verify Manufacturer's tested assembly conditions and installation substrates are compatible with conditions indicated in the construction documents.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect.
   1. ANSI/SDI-100, Recommended Specifications for Standard Steel Doors and Frames.
   2. SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames".
   3. Fire-Rated Assemblies: ANSI/NFPA 80, and acceptable testing agency listing.
   4. Thermal-Rated Assemblies at Exterior: ASTM C518-10 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   5. High Wind and Impact Resistance Assemblies:
      a. ANSI A250.13: Testing and Rating of Severe Windstorm Resistant Components for Swinging Door Assemblies.
      b. ASTM E1886-05: Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Storm Shutters Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
      c. ASTM E1996-12a: Standard Specifications for Performance of Exterior Windows, Glazed Curtain Walls, Doors and Storm Shutters Impacted by Wind Borne Debris in Hurricanes.
      d. ASTM E330-02 (2010): Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
      e. Florida Building Code (FBC), TAS 201-94: Large Missile Impact Test.
      f. Florida Building Code (FBC), TAS 202-94: Uniform Static Air Pressure Test.
      g. Florida Building Code (FBC), TAS 203-94: Cyclic Pressure Loading Test.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Black Mountain Door, Ceco, Curries, Mesker, Steelcraft, Republic,Tell Manufacturing, Daybar, or approved equal.
B. Provide metal doors and frames from a single manufacturer.

2.02 GENERAL

A. Fabrication: Fabricate steel doors and frames rigid, neat in appearance and free from defects, warp, or buckle. Provide clean cut, straight, and true molded members, well formed and aligned miters, dressed and ground smooth, and where applicable, concealed fasteners. Reinforce at corners as required to prevent sagging. Accurately form metal to required sizes and profiles including astragals. Fit, assemble, and weld units at factory or shop.
B. Fire Rated Units: Provide fire-rated units complying with ANSI/NFPA 80 “Standard for Fire Doors and Window”, and units tested, listed, and labeled in accordance with NFPA 252 “Standard Methods of Fire Test of Door Assemblies” by a nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction. Labels must be affixed to the frame. DO NOT paint labels.
C. High Wind and Impact Resistant Units: Refer to drawings for governing code and design requirements. Components and assemblies shall meet or exceed minimum impact resistance and design pressures indicated, but not less than -50/+50 psf, when tested in accordance with ASTM E330-02 and FBC, TAS 202-94 and TAS 203-94. Unit shall be tested, listed, and labeled by an independent testing agency acceptable to authorities having jurisdiction. Labels shall be affixed to components. DO NOT paint labels.
D. Anchors, Fasteners, Accessories: Manufacturers standard, hot-dipped galvanized at exterior. Provide not less than 3 anchors per jamb.

2.03 STEEL DOORS

A. Exterior Doors: ANSI/SDI-100, Grade II, heavy-duty, minimum 18 gage (.0358 inch) cold-rolled sheet steel, 1-3/4 inches thick with face sheets zinc coating G60, mill phosphatized. Provide thermally improved doors with maximum U-value of 0.24 BTU/hr./sq. ft/degree F (ASTM C518-10), “R” factor 14.97, STC rating 26 (ASTM E 90 and ASTM E 413).
B. Interior Doors: ASNI/SDI-100, Grade II, heavy-duty, minimum 18 gage (.0358 inch) cold-rolled steel, 1-3/4 inches thick. Provide acoustically improved doors with minimum STC of 33 (ASTM E90-09 and ASTM E413-10) where indicated.
C. Cores: Continuously reinforced with a full core of resin-impregnated kraft honeycomb with 1-inch nested, hexagonal-shaped cells. Bond core to inside of both face sheets or polystyrene insulated panel core.
D. Channel Fillers: Flush steel channel fillers for top channel of exterior doors.
E. Vision Panels: Provide glazing stops/moldings for glazed panels. Glass and glazing is specified in Section 08 80 00.
F. Astragals: Provide T and U astragal for pairs of exterior and fire-rated doors and as indicated on door schedule.

2.04 STEEL FRAMES

A. Exterior and Interior Frames: Welded type, 16 gage (.0598 inch) sheet steel oil or cold rolled. At exterior openings provide frames with G60 zinc coating, mill phosphatized. Joints to be mitered or coped corners.

B. Accessories: Door silencers and plaster guards, minimum 3 on strike jamb.
C. Glazing Frames: Provide manufacturers standard steel channel or tubular stops, predrilled for screws and factory finished as specified for doors and frames. Glass and glazing is specified in Section 08 80 00.

2.05 HARDWARE

A. Preparation: Prepare hollow metal units to receive mortised and concealed finished hardware, including cutouts, reinforcing, drilling, and tapping in accordance with door hardware schedule and templates provided by the hardware supplier. Reinforce hollow metal units to receive surface-applied hardware. Drilling and tapping for surface-applied hardware will be done on the job site.
B. Location of Hardware: Locate finish hardware as indicated in door hardware supplier templates and/or in compliance with Door and Hardware Institute publication “Recommended Location for Builder’s Hardware”.

2.06 FINISH

A. Finish: Factory primed and field finished. Provide manufacturers standard rust inhibitive primer compatible with finish paint specified in Section 09 90 00. Provide asphalt emulsion sound deadening coating on concealed frame interiors. DO NOT prime or paint testing agency labels.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install doors and frames in compliance with SDI-100. Set frames accurately in position, plumb and aligned, and securely anchor to adjacent construction.
B. Install hardware, adjust as required to provide smooth and proper operation with secure latching or locking.
C. Erect fire doors and frames in compliance with ANSI/NFPA 80 and requirements of authorities having jurisdiction.
D. Clearances: Provide clearances of not more than 1/8-inch at jambs and heads, and not more than ¾-inch from floor or 3/16-inch from thresholds. Exterior doors provide 3/8-inch undercut for accessibility threshold standards.
E. Touch-up damaged coatings and leave ready to receive finish painting.

END OF SECTION

SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide flush wood doors where indicated:
   1. Interior solid core flush doors.

1.02 SUBMITTALS

A. None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Owner.
   1. Quality Standards: NWWDA I.S. 1A, and AWI Architectural Quality Standards.
   2. Quality Standards: NWWDA I.S. 1A, and WIC Manual of Millwork.
   3. Fire Rated Wood Doors: Meeting NFPA 252 requirements.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers: Ampco, Mohawk, Summit, Graham, or approved equal
B. Interior Solid Core Doors:
   1. Grade: Custom grade.
   2. Construction: PC-7 (7-ply, particleboard core) or SLC-7 (7-ply, glued-block core), 1-3/4 inches thick.
   3. Wood Finish: Rotary-sliced natural birch faces.
   4. Rating: Provide rating as scheduled on drawings. DO NOT finish over required label.
C. Auxiliary Materials (Where scheduled on drawing):
   1. Glazing Frames: Provide manufacturers standard steel channel or tubular stops, 18 gage cold rolled steel, factory primed, and approved for use in door of fire-rating indicated, pre-drilled for screws and factory finished as specified for doors and frames. Glass and glazing is specified is Section 08 80 00.

2.02 HARDWARE

A. Preparation: Prepare wood door units to receive mortised and concealed finished hardware, including cutouts, reinforcing, drilling and tapping in accordance with door hardware schedule and templates provided by the hardware supplier. Reinforce wood door units to receive surface-applied hardware. Drilling and tapping for surface-applied hardware will be done on the job site.

B. Location of Hardware: Locate finish hardware as indicated in door hardware supplier templates and/or in compliance with Door and Hardware Institute publication “Recommended Location for Builders Hardware”.

2.03 FINISH

A. Comply with requirements of Section 09 90 00. Do not prime or finish testing agency labels. Refer to interior finish schedule for colors.
B. Factory pre-finished.
C. Color: Equal to Graham #300 medium brown. Any variance requires submittal of sample for prior approved by Owner.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install door and frames in compliance with SDI-100 and NWMA I.S 1A. Prefit doors to frames. Premachine doors for hardware listed on door hardware schedules. Factory bevel doors.
B. Set door and frame accurately in position, plumb and aligned, and securely anchor to adjacent construction.
C. Install hardware, adjust as required to provide smooth and proper operation with secure latching or locking.
D. Install doors with not more than 1/8-inch clearance at top and sides, 1-inch at bottom unless otherwise indicated.
E. Erect fire doors and frames in compliance with NFPA 80 and requirements of authorities having jurisdiction.
F. Touch-up damaged coatings and leave ready to receive final finish.
G. Adjust, clean, and protect.

END OF SECTION

SECTION 08 36 13

SECTIONAL OVERHEAD DOORS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide sectional overhead doors:
   1. Exterior units.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.
B. Submit Manufacturer's product data, installation instructions, and warranty.
C. (Florida Projects) Submit current Florida Product Approval documentation and where required Notice of Acceptance (NOA) documentation issued by Miami-Dade County. Contractor shall verify Manufacturer's tested assembly conditions and installation substrates are compatible with conditions indicated in the construction documents.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions
B. Warranty: Manufacturer's standard 3 year minimum warranty for all components and assemblies.
C. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect.
   1. ANSI/DASMA 102-2004, American National Standards Specifications for Sectional Overhead Type Doors.
   2. ANSI/DASMA 105, Test Method for Thermal Transmittance and Air Infiltration of Garage Doors.
   3. ANSI/DASMA 108, Standard Method For Testing Sectional Garage Doors – Determination of Structural Performance Under Uniform Static Air Pressure Difference.
   4. ANSI/DASMA 115, Standard Method for Testing Garage Doors – Determination of Structural Performance Under Missile Impact and Cyclic Wind Pressure.

PART 2 – PRODUCTS

2.01 GENERAL

A. Manufacturers: Overhead Door Corp. specified. Equivalent products by Raynor Garage Door Co., Wayne/Dalton Corp., Atlas Roll-Lite Overhead Doors, Windsor Door, or approved equal.
B. General: Provide products which are recommended by Manufacturer to be fully compatible with project structural criteria and substrate conditions. Refer to drawings for opening sizes and additional requirements.
C. Wind Load Design: ANSI/DASMA 102 standards in conformance with local code requirements. Where required, high wind resistance components and assemblies shall meet or exceed minimum impact resistance and design pressures indicated when tested in accordance with ANSI/DASMA 108. Unit shall be tested, listed, and labeled

by an independent testing agency acceptable to authorities having jurisdiction. Labels shall be affixed to components. DO NOT paint labels.

2.02 MATERIALS

A. Manufacturers: Overhead Door Corp. “591” Series.
B. Sectional Overhead Door Construction:
   1. Panel Thickness: 1-5/8 inch.
   2. Exterior Surface: Ribbed, textured.
   3. Exterior Steel: 0.016 inch, hot-dipped galvanized.
   4. End Styles: 16 gage.
   5. Insulation: CFC-free and HCFC-free polyurethane, fully encapsulated.
   6. Thermal Values: R-value of 14.86; U-value of 0.067.
   7. Air Infiltration: 0.08 cfm at 15 mph; 0.13 cfm at 25 mph.
   8. High-Usage Package: Required.
C. Wind Load Design: Provide materials to meet the design and performance requirements specified. Refer to drawings for structural design criteria.

2.03 MATERIALS (WIND-BORN DEBRIS REGIONS)

A. Manufacturers: Overhead Door Corp. “426” Series.
B. Sectional Overhead Door Construction:
   1. Panel Thickness: 1-3/4 inch min..
   2. Exterior Surface: Ribbed, textured.
   3. Exterior Steel: 0.016 inch, hot-dipped galvanized.
   4. End Styles: 16 gage.
   5. Insulation: CFC-free and HCFC-free polyurethane, fully encapsulated.
   6. Thermal Values: R-value of 14.86; U-value of 0.067.
   7. Air Infiltration: 0.08 cfm at 15 mph; 0.13 cfm at 25 mph.
   8. High-Usage Package: Required.
C. Wind Load Design: Pressure not less than -50/+50 psf in accordance with ANSI/DASMA 108.
D. Wind-Borne Debris Region Areas:
   1. Within 1 mile of the coastal mean high water line where the ultimate wind speed “Vult” is 130 mph or greater.
   2. In areas where the ultimate design wind speed “Vult” is 140 mph or greater.
E. Impact Resistance: Meet requirements of large missile test in accordance with ANSI/DSMA 115 or approved impact-resisting standards.
F. High-Velocity Hurricane Zones (HVHZ) (Where required): Comply with Miami-Dade County requirements for Notice of Acceptance (NOA).

2.04 OPERATION AND HARDWARE

A. Operation: Manual pull rope.
B. Hardware: Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races. Provide manufacturer’s hardware complete as required to comply with approved testing data for project conditions.
C. Lock: Interior mounted slide lock engaging single jamb track with single action.
D. Weatherstripping: EPDM rubber tube seals fitted inside joints between sections. EPDM rubber bulb-type strip at bottom. Header and jamb weatherstripping.
E. Standard Spring: 10,000 cycles (High cycles).
F. Track: Provide lift clearance type track as recommended by manufacturer to suit loading required and clearances available.
G. Attachment: Provide secondary framing and fasteners as required by manufacturer for proper operation.

2.05 FINISH

A. Finish and Color: Two-coat baked-on polyester with white exterior and white interior. Field paint as indicated on drawings; refer to Section 09 90 00 for requirements.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install materials and systems in accordance with manufacturers' instructions. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.
B. Install assemblies complete with all hardware, anchors, inserts, supports, and accessories. Restore damaged finishes and test for proper operation. Clean and protect work from damage.

END OF SECTION

SECTION 08 41 13

ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide aluminum entrances and storefront:
   1. Exterior entrance doors.
   2. Frames for entrances.
   3. Storefront-type framing system.

1.02 SUBMITTALS

A. None required unless submitting for approved equals.
B. (Florida Projects) Submit current Florida Product Approval documentation. Contractor shall verify Manufacturer's tested assembly conditions and installation opening types (substrates) are compatible with conditions indicated in the construction documents.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Provide five year warranty under provisions of General Conditions including coverage for insulated glass units.

1.04 PERFORMANCE REQUIREMENTS

A. Provision for Thermal Movements: System performance to provide for expansion and contraction within system components caused by temperature cycling resulting from a surface temperature ranging from 0° F to 180° F without causing buckling, stressing on glass, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other detrimental effects. Operating doors and windows shall function normally over this temperature range.
B. Test Procedures and Performance (Refer to drawings for structural design criteria):
   1. Air Infiltration:
      a. Test units in accordance with ASTM E 283 at static air pressure difference of 6.24 psf.
      b. Air infiltration shall not exceed 0.06 cmf/ft maximum per square foot of fixed wall area.
   2. Water Resistance:
      a. Test unit in accordance with ASTM E 331.
      b. There shall be no water leakage at a static test pressure of 12.0 psf.
   3. Uniform Load Deflection:
      a. Test in accordance with ASTM E 330.
      b. Design and size members to withstand not less than 30 psf minimum positive and negative design wind pressure normal to the plane of the wall, unless greater loads are required by local code requirements.
      c. Deflection under design load shall not exceed L/175 of the clear span.
   4. Structural Uniform Load:
      a. Test in accordance with ASTM 330 at not less than 1.5 times the design wind pressure specified, minimum 60 psf.

b. At conclusion of the test, there shall be no glass breakage, permanent damage to fasteners, storefront parts, or any other damage would cause the storefront to be defective.

5. Condensation Resistance Factor:
   a. Test unit in accordance with ASTM 1503.1.
   b. Condensation Resistance Factor (CRF) shall not be less than 59.
6. Thermal Transmittance:
   a. Test unit in accordance with ASTM 1503.1.
   b. Conductive thermal transmittance (U-Value) shall not be less than 0.63 BTU/hr/degree F/SF.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers: EFCO, Kawneer, or Oldcastle Building Envelope, (No substitutes).
B. Framing:
   1. Materials: Aluminum, extruded, 6063 T5 or T6 alloy and tempered, meeting requirements of ASTM B 221, alloy GS 10A-T5.
   2. Construction: Manufacturer's standard assemblies of either screw spline or shear block connections meeting test procedures and performance requirements specified. Where required by project conditions, provide additional vertical steel reinforcement.
   3. Fasteners: Aluminum or non-magnetic stainless steel. Concealed fastenings shall be cadmium or zinc-plated steel.
C. Aluminum Entrances and Storefront (Refer to drawings):
   1. Framing:
      a. Quality Standard: Equal to Kawneer series "451T" or EFCO series "403(T)".
      b. Size: 2" x 4 ½" in wall thickness and design required for project conditions.
      c. Construction: Thermal broken per manufacturer's standards.
      d. Glazing Stops:
         1). Exterior Units: Double glazed, 1" insulated double glazed consisting of 1/4 inch exterior pane, 1/2 inch air space, 1/4 interior pane, unit installed from exterior side.
         2). Interior Units: Single glazed, 1/4 inch non-insulated.
D. Aluminum Swing Doors (Refer to drawings):
   1. Framing:
      a. Quality Standard: Kawneer series "350" or EFCO series "D300".
      b. Size: (Refer to drawings).
      c. Stiles & Top Rails: 3 1/2" x 1 3/4" x 0.125" thick, plus or minus 0.005, glazing stop section 0.050" wall thickness.
      d. Bottom Rail: 10" minimum x 1 3/4" x 0.125" thick, plus or minus 0.005, glazing stop section 0.050" wall thickness.
      e. Glazing Stops:
         1). Exterior Units: Double glazed, 1" insulated double glazed consisting of 1/4 inch exterior pane, 1/2 inch air space, 1/4 interior pane, unit installed from exterior side.
         2). Interior Units: Single glazed, 1/4 inch non-insulated.
   2. Door Hardware: (Refer to drawing door hardware schedule). Comply with Section 08 71 00.
E. Finish (Refer to Drawings):
   1. Organic: Finish all exposed areas of aluminum frames, doors, and components with High performance 70% PVDF Fluoropolymer Ultrapon color in accordance with Aluminum Association Designation AA-M12-C42-R1X and AAMA 2605-98. Color as selected from Manufacturers standards or as scheduled on drawings.
   2. Anodic (Inorganic): Finish all exposed areas of aluminum frames, doors, and components with electrolytically deposited color in accordance with Aluminum

Association Designation AA-M10-C22-A41 or A31. Color shall be clear anodized Class 1 or II, AAMA 611-98.

F. Glazing (Refer to drawing glazing schedule):
   1. Glass: Comply with Section 08 80 00.
   2. Glazing Stops: Dry glazed, snap-in type EPDM or neoprene bulb-type, replaceable, with gaskets on both interior and exterior sides of glazing units. Units shall be glazed from exterior side.

G. Auxiliary Materials:
   1. General: Provide all other materials, not specifically described but required for a complete, weather tight, and proper installation of doors and framing systems, subject to acceptance by the Architect.
      a. Deflection channels: As recommended by system Manufacturer.
      b. Continuous sill flashing sheet metal: 0.040 inch thick aluminum sheet, finish to match mullion sections where exposed.
      c. Column cladding sheet metal: 0.040 inch thick aluminum sheet, finish to match mullion sections where exposed.
      d. Thermal Barrier: Barrier material shall be poured-in-place two part polyurethane. A nonstructural thermal barrier is unacceptable.
   2. Sealant: Comply with Section 07 92 00. Colors to match aluminum framing, unless otherwise indicated.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Take field measurements before fabrication where possible; DO NOT delay job progress.
B. Install materials and systems in accordance with manufacturer's instructions. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.
C. Anchor securely in place to structure; install plumb, level and in true alignment. Isolate dissimilar materials to prevent corrosion.
D. Coordinate with glass and glazing work; install hardware and adjust for smooth, proper operation.
E. Seal frames with an approved sealant, in compliance with Section 07 92 00, in color to match frames, make a neat fully weatherproof job.
F. Clean and protect completed system; repair damage.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 – GENERAL

1.01 SUMMARY

A. Provide door hardware where indicated.

1.02 SUBMITTALS

A. Shop Drawings: None required unless submitting for approved equals.
B. Operating and Maintenance Instructions: None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Qualification of Supplier: The finish hardware supplier shall have in his employ an AHC member of the American Society of Architectural Hardware Consultants.
C. Hardware for Fire-Rated Openings: NFPA 80 and local requirements.
D. Accessibility: ADA, ANSI A117.1, and local requirements.
E. Materials and Application: ANSI A156 series standards.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Schedule: Refer to drawing door hardware schedule. Furnish in amounts and finish indicated or as required for complete and operable facility.
B. Quality and Accessibility Standards: All hardware shall be commercial quality Grade 1 and compliant with project accessibility standards.
C. Manufacturers: Products of the following manufacturers will be considered acceptable provided products are of equivalent weight, function, materials, and design. Submit others for prior approval by Owner.
    1. Cylinders: Schlage (No Substitutes).
    2. Locksets and Deadbolts: Yale, Schlage (No Substitutes).
    3. Storefront Deadbolts and Deadlock Levers: Adams Rite (No Substitutes).
    4. Panic Devices: Yale, Dorma, Von Duprin.
    5. Hinges and Butts: Hager, Soss, Stanley, Mckinney, PBB, Pemko.
    6. Closers: Dorma, Hager, LCN, Norton, Reading, Cal Royal.
    7. Storefront Pivots: Rixon.
    8. Storefront Push/Pulls: EFCO, Kawneer, Oldcastle.
    9. Bumpers, Kick Plates, Stops, Sweeps, Thresholds, and Weather-stripping: Ives, Global, Pemko, Rockwood, Reese, National Guard, Hager, Schlegel.
    10. Latch Guards: Latchguard, Rockwood, Hager.
    11. Door Viewers: Hager, Ives, Pemko, Rockwood, Stanely, Yale.
    12. Knox box for fire emergency keys: As required and approved by local governing agency.

2.02 KEYING

A. Exterior doors with removable core lock cylinders shall be keyed alike. Include construction keying and control keying with removable core cylinders.
B. Supply 2 change keys for each lock.

2.03 FASTENINGS

A. Furnish all necessary screws, bolts, and other fasteners of suitable size and type to properly anchor the hardware.
B. Furnish fastenings, where necessary, with expansion shields, toggle bolts, sex bolts, and other anchors, according to the material to which hardware is to be applied and the recommendations of the hardware manufacturer.
C. Furnish fastenings compatible with both hardware and substrate material and if exposed, matching hardware finish.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Follow guidelines of DHI “Recommended Locations for Builders Hardware” and hardware manufacturer’s instructions.
B. Install materials and systems in accordance with manufacturer’s instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.
C. Drill and countersink units, which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
D. Set thresholds in full bed of butyl-rubber or polyisobutylene mastic sealant.
E. Adjust operation, clean, and protect.

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 – GENERAL

1.01 SUMMARY

A. Provide glazing at the following locations where indicated:
   1. Exterior entrances and storefront.
   2. Exterior windows.
   3. Interior windows and glazed openings.
   4. Doors.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.
B. Submit for approval product data on material to be provided for project conditions.
C. (Florida Projects) Submit current Florida Product Approval documentation and where required Notice of Acceptance (NOA) documentation issued by Miami-Dade County. Contractor shall verify Manufacturer's tested assembly conditions and installation opening types (substrates) are compatible with conditions indicated in the construction documents.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified.
   1. ANSI Z97.1, American National Standard for Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test.
   2. ASCE 7, Minimum Design Loads for Buildings and Other Structures.
   3. ASTM C162-05 (2010), Standard Terminology of Glass and Glass Products.
   4. ASTM C1036-11e1, Standard Specification for Flat Glass.
   5. ASTM C1048-12e1, Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass.
   6. ASTM C1172-09e1, Standard Specification for Laminated Architectural Flat Glass.
   7. ASTM C1249-06a (2010), Standard Guide for Secondary Seal for Sealed Insulating Glass Units for Structural Sealant Glazing Applications.
   8. ASTM C1376-10, Standard Specification for Pyrolitic and Vacuum Deposition Coatings on Flat Glass.
   9. ASTM E1996-12a, Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
   10. ASTM E2188-10, Standard Test Method for Insulating Glass Unit Performance.
   11. ASTM E2189-10e1, Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
   12. ASTM E2190-10, Standard Specification for Insulating Glass Unit Performance and Evaluation.
   13. CPSC 16 CFR 1201, Safety Standard for Architectural Glazing Materials.
   14. GANA 89-1-6, Specification for Environmental Durability of Fully Tempered or

Heat-Strengthened Spandrel Glass with Applied Opacifiers.

C. Perform work in accordance with FGMA Glazing Manual, Laminators Safety Glass Association- Standards Manual for Glazing Installation Methods.

1.04 PERFORMANCE REQUIREMENTS

A. General: Provide glass and glazing capable of withstanding normal thermal movement, wind, and impact loads (where applicable) for project conditions. Watertight and airtight installation of each glazing unit is required. Each installation must withstand normal temperature changes, structural design loading without failure of any kind including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials, and other defects in work.
B. Design Wind Loads: Refer to drawings for project applicable codes and structural design criteria. Structural design of glazing assemblies shall be in accordance with ASCE 7.
C. Provide safety glass (tempered, laminated) complying with requirements of ANSI Z97.1 and 16 CFR 1201. Label each piece of glass indicating compliance with requirements. Do not remove label prior to installation.

1.05 WARRANTY

A. Provide five year warranty including coverage for sealed glass units from seal failure, interpane dusting or misting, or defects exceeding those allowed by ASTM 1172-09e1.
B. Where spandrel glazing product indicated on drawings, provide fire year minimum opacifying coating warranty against defects of adhesion loss, peel, chip, or develop any noticeable color change from date of substantial completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Vitro Architectural Glass, AFG Industries, Cardinal, Libby Owens Ford, Viracon, or approved equal

2.02 GLASS

A. General: Comply with ASTM C1036-11e1, ASTM C1048-12e1, ASTM E2188-10, ASTM E2189-10e1, and ASTM E2190-10, of the types, classes, and forms specified.
    1. Annealed Float Glass: ASTM C1036-11e1, Type I (transparent flat glass), Quality-Q3; of class indicated.
    2. Heat-Treated Float Glass: ASTM C1048-12e1, Type I (transparent flat glass), Quality-Q3; of class, kind, and condition indicated.
        a. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
        b. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in performance requirements.
        c. For uncoated glass, comply with requirements for Condition A.
        d. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
        e. Provide Kind FT (fully tempered) float glass in place of annealed or Kind

HS (heat-strengthened) float glass where safety glass is indicated or required.

3. Tinted Glass: ASTM C1036-11e1, float glass of class, kind, and conditions indicated, with integral mineral admixture incorporated in glass material during manufacturing initial melting process resulting in a degree of color that reduces both visual and radiant transmittance performance requirements.
4. Pyrolitic-Coated Float Glass (Reflective): ASTM C1376-10, float glass with metallic-oxide coating applied by pyrolitic deposition process during initial manufacture, and complying with other requirements specified.
5. Sputter-Coated Float Glass (Low E): ASTM C1376-10, float glass with metallic-oxide or nitride coating deposited by vacuum deposition process after manufacture and heat treatment (if any), and complying with other requirements specified.
6. Spandrel Glass: Float glass, type specified, with applied opacifier coating, minimum 4-5 mils dry, complying with GANA 89-1-6 performance specifications, applied by manufacturer's approved factory fabricators only on Surface 2 or Surface 4 as indicated on drawings. Opacifier coating equal to ICD High Performance Coatings "OPACI-COAT-300" in color to match adjacent glazing system specified, unless otherwise indicated on drawings.
7. Mirror Glass: Type 1, Class 1 (transparent), Quality Q2 (mirror), with silver coating, copper protective coating complying with CS27, and 2 mil thick painting coating, ¼-inch thick.
8. Security Glass: One-way vision (transparent) inside with chemical vapor deposit on one side for a reflective coating, ¼-inch thickness, safety type where indicated.
9. Impact Resistant Glass: Types specified, hurricane resistant, ASTM E1996-12a – large missile, FEMA 361 performance criteria for missile impact resistance (15 lb. wood 2x4 traveling at 100 mph.). Laminated glass reinforced with interlayer polycarbonate or polyvinyl butryal PVB material in thickness and configuration to meet impact resistance design criteria. Interlayer material equal to Solutia "Saflex IIIG" or approved equal.

B. Insulated-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM C1249-06a for Class CBA units and the requirements specified.
   1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual lites and to comply with glass design requirements specified.
   2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated or required.
   3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thickness of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
   4. Insulated Unit Construction: 1 inch thick, composed of 1/4" thick exterior pane of glass type specified, 1/2 inch air space, and 1/4 inch thick interior pane of glass type specified. Air space purged dry hermetic air. Edge with sealing system.
   5. Insulated Unit Construction (Impact Resistant): 1 5/16 inch thick, composed of 7/16 inch thick impact resistant exterior pane of glass specified, 7/16 inch air space, and 7/16 inch thick interior pane of glass type specified.
   6. Sealing System: Comply with requirements of Section 07 92 00 – Joint Sealants. Dual seal, with primary and secondary sealants of polyisobutylene and silicone.
   7. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
      a. Spacer Material: Aluminum with mill or clear anodic finish.
      b. Desiccant: Molecular sieve or silica gel, or blend of both.

c. Corner Construction: Manufacturer's standard corner construction.

8. Sealed Insulating Glass Unit Surface Designations:
   a. Surface 1: Exterior surface of the outer glass lite.
   b. Surface 2: Interspace surface of the outer glass lite.
   c. Surface 3: Interspace surface of the inner glass lite.
   d. Surface 4: Interior surface of the inner glass lite.

2.03 GLAZING SCHEDULE

A. Schedule: Refer to drawing glazing schedule for types, combinations and locations.

2.04 GLAZING MATERIALS

A. Provide materials with proven record of compatibility with surfaces contacted in installation.
B. Glazing Sealants: Elastomeric type. Tremco "Proglaze". Bostik "Chem-Calk 1200", Pecora "836", Sonneborn "Omniglaze", or other approved by system manufacturer.
C. Glazing Tape: Preformed type. Bostik "Chem Tape 60", Pecora "Shim-Seal", or Tremco "Pre-shimmed Tremco 440 Tape".
D. Setting Blocks: Neoprene or other resilient blocks of 70 to 90 Shore A durometer hardness, adhesively backed on one face only, tested for compatibility with specified glazing sealants.
E. Spacers: Neoprene or other resilient blocks of 40 to 50 Shore A durometer hardness, tested for compatibility with specified glazing sealant.
F. Compressible Filler Rod: Closed-cell or waterproof-jacketed foam of polyethylene, butyl rubber, neoprene, polyurethane or vinyl, tested for compatibility with specified glazing sealants, of 5 to 10 psi compression strength (25% deflection), recommended by sealant manufacturer for use in glazing channel to prevent sealant exudation from the channel.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Comply with FGMA "Glazing Manual" and manufacturer's instructions and recommendations. Use manufacturers recommended spacers, blocks, primers, sealers, gaskets and accessories.
B. Clean channel surfaces and prime as recommended by sealant manufacturer.
C. Cut glass to size as required for measured opening, provide adequate edge clearance and glass bite all around. Cut prior to tempering.
D. DO NOT install sheets which have edge damage or face imperfections. Install glass with uniformity of pattern, draw, bow, and roller marks.
E. Miter-cut and bond (weld) ends of channel gaskets at corners to provide a continuous gasket.
F. Install sealants to provide complete wetting and bond and to create a substantial wash away from glass.
G. Seal face gaskets at corners with liquid elastomeric sealant to close openings and prevent withdrawal of gaskets from corners.
H. Remove and replace damaged glass and glazing. Wash, polish and protect all glass supplied under this section.

END OF SECTION

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 – GENERAL

1.01 SUMMARY

A. Provide gypsum board assemblies where indicated. (Note: Cold-Formed Metal Framing specified under Section 05 40 00)
   1. Interior walls, partitions, and ceilings.
   2. Exterior wall, ceiling and soffit substrates for exterior finish materials.
   3. Fire rated assemblies.
   4. Remodeling at existing gypsum board construction.

1.02 SUBMITTALS

A. None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified.
   1. ASTM C442, Standard Specification for Gypsum Backing Board, Gypsum Coreboard, and Gypsum Shaftliner Board.
   2. ASTM C475, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
   3. ASTM C840, Standard Specification for Application and Finishing of Gypsum Board.
   4. ASTM C1002, Standard Specifications for Steel Self Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
   5. ASTM C1047, Standard Specification for Accessories for Gypsum Wall Board and Gypsum Veneer Base.
   6. ASTM C1177, Standard Specification for Glass Matt Gypsum Substrate Used for Sheathing.
   7. ASTM C1280, Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.
   8. ASTM C1396, Standard Specification for Gypsum Board.
   9. ASTM D3273, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
   10. ASTM E90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
   11. ASTM E119, Standard Test Methods for Fire Tests of Building Construction and Materials.

C. Fire Resistant for Fire Rated Assemblies: Where work is indicated for fire-resistance ratings, provide materials and installations identical with assemblies whose fire resistance rating has been determined per ASTM E119 by a testing and inspection organization acceptable to authorities having jurisdiction.

D. Moisture and Mold-Resistant Assemblies: Provide moisture and mold-resistant gypsum board products with surfaces complying with ASTM C1396 and ASTM C1177 in all locations subject to moisture exposure.

E. Performance: Structural and seismic performance meeting requirements of building code and local authorities.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers of Gypsum Board: CertainTeed Gypsum, Inc., Georgia-Pacific Corp., National Gypsum Co., Temple-Inland, United States Gypsum Co., or approved equal.

B. Gypsum Board:
1. Gypsum Wallboard: ASTM C1396, Type X fire-rated type, , tapered edges.
2. Moisture Resistant Gypsum Backing Board: ASTM C1396, Type X fire-rated type.
3. Fiberglass-Mat Faced Gypsum Sheathing: ASTM C1177, Type X fire rated, ASTM D3273, mold resistant 10, fiberglass matt faced gypsum core, square edges.
4. Shaftwall: ASTM C442, Type SLX, Type X beveled edges, width required for blind installation in framing spacing and type indicated.

C. Joint Treatment Materials: ASTM C475 and ASTM C840, 2-coat joint compound, and other materials, paper, or fiberglass tape.

D. Trim Accessories: ASTM C1047. Provide manufacturer's standard trim accessories of types indicated for drywall work, formed of galvanized steel unless otherwise indicated, with either knurled and perforated or expanded flanges for attachment, and beaded for concealment of flanges in joint compound. Provide all corner beads, edge trim-beads, and one-piece control joint beads. Provide decorative profiles factory primed of types indicated.

E. Fasteners: ASTM C1002, self-drilling, self tapping screws for power driving with special head design for gypsum board attachment (Type S), producing surface depression for proper concealment; 1-inch long for single ply, 1-5/8-inch long for double ply, 2-inch long for multiple plies. Use other fasteners as required.

F. Textures: All exposed to view surfaces to be smooth sanded finish, unless otherwise indicated. Where spray application for splatter, knock-down and orange-peel type textures specified, submit samples for Owner's review and approval.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Inspection: Coordinate with carpenter and insulator in placing of backing, blocking, bracing, and insulation where required in walls for acoustical treatment, millwork, fixtures, fittings, and accessories. Examine substrates for proper application of gypsum board systems. Beginning work means acceptance of conditions.

B. General: Install gypsum board assemblies in compliance with ASTM C840. Install gypsum board assemblies true, plumb, level, and in proper relation to adjacent surfaces.

C. Tolerances: Not more than 1/16-inch difference in true plane at joints between adjacent boards before finishing. After finishing, joints shall not be visible. Not more than 1/8-inch in 10 feet deviation from true plane, plumb, level, and proper relation to adjacent surfaces in finished work.

D. Partitions: Install boards vertically parallel to studs. DO NOT allow butt-to-butt joints and joints that do not fall over framing members. Arrange gypsum board joints on opposite sides of partitions to occur on different studs.

E. Ceilings and Soffits: Install boards across framing members in manner which minimizes number of end-butt joints and which avoids end joints in central area of each ceiling and soffit. Stagger end joints at least 24-inches.

F. Fastening: Fasten gypsum board to metal studs with specified screws spaced 16-inches on center for walls and 12-inches on center for ceilings of single layer application, 24-inches on center for wall and 16-inches on center for base layer, and 16-inches on center for wall and 12-inches on center for ceilings of double layer applications.

G. Expansion/Control Joints: Install expansion/control joints in ceilings exceeding 2500 sq. ft. in area and in partition and wall runs exceeding 30-feet unless otherwise indicated. DO NOT exceed a distance of 50-feet in either direction, between ceiling control joints and install a control joint where ceiling framing of furring changes direction. DO NOT exceed a distance of 30-feet between control joints in walls unless otherwise indicated.

H. Transitions, Trim, and Corners:
   1. Provide casing beads where edges of gypsum board meet dissimilar materials.
   2. Treat all internal angles formed by the intersection of either wallboard surfaces with metal trim and/or a taped joint system as indicated or required.
   3. Treat all vertical and horizontal external corners with metal bead corner reinforcement applied in accordance with manufacturer's recommendations.
   4. Where new partitions meet existing construction, remove existing corner beads to provide a smooth transition.

3.02 FIRE RATED SYSTEMS

A. Provide fire rated systems where indicated or where required by authorities having jurisdiction in accordance with ASTM E119.

B. Provided fire rated construction materials and installations identical with requirements of indicated recognized independent testing agency referenced assemblies.

C. Coordinate inspection requirements with authorities having jurisdiction prior to begging work. Upon request, provide documentations of fire-rated construction materials, means, and methods.

3.03 FINISHING

A. Finishing: Comply with ASTM C840. Refer to drawings for finish types and locations.
   1. Level 1: Concealed areas, plenums, service corridors, above ceilings. Except provide higher level of finish as required to comply with fire resistance ratings

and acoustical ratings.

2. Level 2: Areas of water-resistant gypsum backing board under tile, exposed areas where appearance is not critical.
3. Level 3: Areas to receive heavy or medium textured coatings, heavy-grade wall coverings.
4. Level 4: Areas to receive flat sheen or satin paint finish, light textured coatings, lightweight wall coverings.
5. Level 5: Areas to receive gloss, semi-gloss sheen paints, critical lighting conditions.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL TILE CEILINGS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide the following:
   1. Acoustical tile ceilings, trim, and concealed metal suspension system.

1.02 SUBMITTALS

A. None required unless submitting for approved equals.
B. Provide 2% of extra replacement tile matching each type of material provided to Owner at substantial completion.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Performance: Fire, structural, and seismic performance meeting requirements of building code and local authorities. Acoustical performance based on project requirements.

PART 2 – PRODUCTS

2.01 ACOUSTICAL LAY-IN PANELS

A. Manufacturers: Armstrong is specified; equivalent products of BPB Celotex and USG Interiors are acceptable; or approved equal.
B. Type C-1: (Refer drawing finish schedule.)
   1. Style: Armstrong "1729" Fine Fissured.
   2. Size: 24 x 48 inches by 5/8-inch.
   3. Material: Mineral Base Panels, Water Felted.
   4. Edge Detail: Square.
   5. Pattern: Fissured pattern.
   6. Type, Form, and Finish: ASTM E 1264, Type III, Form 2 with painted finish.
   7. Class A Flame Resistance, Class I Flame Spread Rating of 25 or less, STC 35-39, NRC 0.55.
   8. Insulation Value: Average R-Value of 1.5 at 75°.
   9. Weight: 0.60 lbs./sq. ft.

2.02 SUSPENSION SYSTEM MATERIALS

A. Manufacturers: Armstrong is specified; equivalent products of Chicago Metallic, Donn, and National Rolling Mills are acceptable; or approved equal.
B. Type CG-1:
   1. Style: Armstrong "Prelude" 15/16 Exposed Tee System.
   2. Type: Exposed grid system, direct-hung double-web intermediate-duty system, ASTM C 635. Non-Fire-Resistance Rated.
   3. Finish: Steel members, treated and protected against rust and corrosion and factory finished with baked on vinyl enamel or polyester or anodized.

4. Color: White.
5. Wall Molding: Provide wall molding, of types and profiles indicated, of same material and finish as suspension system.

C. Attachment Devices: Type recommended by suspension system manufacturer for attachment or anchorage of ceiling hangers to structure above ceiling, sized for not less than 5 times the hanger design load for the structural classification indicated.
D. Hanger Wire: Minimum No. 12 gage, galvanized annealed steel wire. Provide seismic reinforcing as recommended by suspension system manufacturer for compliance with local building codes.

2.03 MISCELLANEOUS MATERIALS

A. Tile adhesive, staples, and sealant: Provide type recommended by manufacturer for specific project conditions.
B. Hold-down clips, impact clips, and seismic compression bracing: Provide type recommended by manufacturer for compliance with local building codes.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install materials and suspension systems in accordance with manufacturer's instructions and recommendations and ASTM C 636. Coordinate installation with location of mechanical and electrical work to ensure proper locations.
B. Center locate system on room axis, leaving equally spaced border along perimeter. Lay directional patterned units one way with pattern parallel to longest room axis. Level ceiling to within 1/8-inch in 10 feet both directions. Scribe and cut panels to fit accurately. Measure and layout to avoid less than half panel units unless otherwise indicated.
C. Provide hold down clips at all units within 20 feet of an exterior door.
D. Seismic bracing, where required by local building codes, shall be located at 12 feet on center with the first line of bracing 4 feet or less from wall boundary. Seismic bracing shall consist of (4) splay wires at 45° to runner connections and 45° to plane of ceiling, (1) vertical connection wire provided with compression bracing of ½-inch rigid conduit extending full height between connection points. Coordinate with building official for inspection requirements.
E. Removal and reinstallation at existing ceilings: Remove and store materials for reuse. Handle with gloves to avoid damaging corners and edges. Clean tiles and grid system, which have been removed. Provide additional materials to complete the work and to replace damaged existing materials. New materials shall exactly match existing materials as approved.
F. Adjust, clean, and touch-up all system components.
G. Provide wrapped and labeled maintenance stock of new material equal to 2% of ceiling panels, tile, and suspension installed.

END OF SECTION

SECTION 09 65 13

RESILIENT BASE AND ACCESSORIES

PART 1 – GENERAL

1.01 SUMMARY

A. Provide resilient base, trim, edging, transitions, and accessory systems, complete.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.
B. None required unless submitting for approved equals.
C. Provide 2% extra stock matching each type of different material provided at substantial completion.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified.
   1. ASTM E119-12a. Standard Test Methods for Fire Tests of Building Construction and Materials.
   2. ASTM E662-13 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
   3. ASTM F1861-08(2012)e1 Standard Specification for Resilient Wall Base.
C. Performance: Fire performance meeting requirements of building code and local authorities.
D. Provide materials and adhesives which do not contain asbestos.

PART 2 – PRODUCTS

2.01 VINYL BASE AND TRANSITIONS

A. Vinyl base B-1: (Refer drawing finish schedule.)
   1. Manufacturers: VPI specified; equivalent by Johnsonite, Roppe, Afco, or approved equal.
   2. Color: Jet #01.
   3. Type: ASTM F1861-08, Type TV, Vinyl, Thermoplastic
   4. Size: 4-inches by 1/8-inch thick, cove toe.
   5. Fire/Smoke Rating: ASTM E119-12a and ASTM E662-13, flame spread rating 25 or less, smoke development rating 450 or less.
B. Vinyl Transitions:
   1. Manufacturers: VPI specified; equivalent by Johnsonite, Roppe, Afco, or approved equal.
   2. Color: Jet #01.
   3. Type: ASTM F1861-08, Type TV, Vinyl, Thermoplastic
   4. Size: Manufacturer's standard as required for flooring type transitions, not less than 1-inch wide.
   5. Fire/Smoke Rating: ASTM E119-12a and ASTM E662-13, flame spread rating 25 or less, smoke development rating 450 or less.

2.02 MISCELLANEOUS MATERIALS

A. Provide adhesives, primers, seam sealers, crack fillers and other materials required but not specifically described and recommended by the resilient flooring and accessories.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's instructions and recommendations. Install in proper relation to adjacent work.
B. Examine the areas and conditions under which resilient base and accessory work is to be placed. Moisture content of substrates, building air temperature, and relative humidity must be within limits recommended by resilient base manufacturer. DO NOT proceed until unsatisfactory conditions have been corrected. Maintain minimum temperature of 70° F for minimum of 48 hours prior to installation. Maintain 70° F temperature continuously during and after installation as recommended by manufacturer, but in any case not less than 48 hours.
C. Prepare surfaces by cleaning, leveling, and priming as required. Test adhesive for bond before general installation.
D. Resilient Base: Apply resilient base to walls, columns, pilasters, casework, and other permanent fixtures in rooms or areas where base is indicated. Install base in as long lengths as practicable. Tightly bond base to backing throughout the length of each piece, with continuous contact at horizontal and vertical surfaces. DO NOT stretch resilient base during installation.
E. Resilient Edge Strip: Place edge strips tightly butted and secured to flooring with adhesive. Install edge strips at all unprotected edges of flooring unless otherwise indicated.
F. Clean and protect work per manufacturer's recommendations until final acceptance.

END OF SECTION

SECTION 09 77 00

SANITARY WALL & CEILING PANELS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide sanitary wall panels, ceiling panels and surface preparation where indicated.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.
B. Upon request submit for approval samples, product data, and maintenance

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Performance: Fire performance meeting requirements of building code and local authorities.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Fiberglass Reinforced Panel (FRP) Wall Covering:
   1. Manufacturers: Nudo Products, Inc. specified; Equivalent by Crane Composites, Inc., Marlite, Sequentia or approved equal.
   2. Panel Type: “Fiber-Lite” by Nudo.
      a. Model No.: “LP-FR9”.
      b. Surface Burning Characteristics: Fire rating Class A (ASTM E-84-81A), flame spread index 25, smoke development value 335.
      c. Thickness: 0.90 inch minimum., 9000 psi flex strength (ASTM D790), 660,000 psi tensile strength (ASTM D638).
      d. Finish: “Pebble Texture”, embossed, tabor abrasion resistance 0.038.
      e. Water Absorption Percentage: 0.16 (ASTM D570).
      f. Panel sizes: Manufacturer’s standard sizes. Horizontal seams are not permitted
      g. Color: Refer to drawings. Unless otherwise indicated, to be selected by Architect from manufacturer’s standard samples.
   3. Certification: ICBO, USDA/FSIS.
   4. Trim, edges, moldings, flashing, and counterflashing: PVC, vinyl or aluminum as required for moisture resistant assembly. Color to match panel.
   5. Fasteners: Non-corroding type as required for substrate attachment. Stainless nails or screws. Nylon, chrome, or plastic, one-piece rivets, for sanitary maintenance. Colors to match panel.
   6. Adhesive: As recommended by manufacturer for substrate attachment conditions.
   7. Sealant: Comply with Section 07 92 00.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Acclimatize materials; prime and seal substrates; test substrates for moisture content and prepare surfaces in compliance with manufacturer's recommendations. Substrates must be flat, clean, dry and free of all dirt, dust, or grease.
B. Install in accordance with manufacturer's instructions. Apply adhesive and install with seams plumb to ensure tight closure except where pattern would not match. Do not place seams within 6" of corners.
C. Adhesive: Wall panels to be installed with 100% adhesive coverage. Fasteners are used in conjunction with adhesives in certain applications, where needed in high moisture conditions, uneven substrate, high abuse and large panel areas.
D. Expansion: Leave not less than 1/4" gap at ceilings and floor, 1/8" gap between wall panels for normal expansion and contraction. Allow not less than 1/8" gap around pipes, electrical fittings and other projections. Fill gaps with flexible, silicone-based sealant to complete moisture seal.
E. Fastener Position: Install fasteners not farther than 8" apart around outside edges and 12" apart on intermediate 16" centers. Stagger fasteners on opposing panel edges. Outside fasteners should be approximately 1" from panel edge.
F. Sealant: Seal all corner seams, ceiling and base junctures and fastener holes.
G. Remove air bubbles, blisters, wrinkles and other defects; horizontal seams are not permitted. Remove excess adhesive immediately; clean walls and protect surfaces.

END OF SECTION

SECTION 09 90 00

PAINTING

PART 1 – GENERAL

1.01 SUMMARY

A. Provide the following where indicated:
   1. Painting and surface preparation for interior and exterior surfaces as scheduled.
   2. Re-painting and surface preparation at areas of remodeling as scheduled.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Paint Schedule: Submit paint schedule listing each material cross-referenced to finish schedules. Identify by manufacturer's catalog number and general classification.

C. Product Data: Submit manufacturer's data sheets on each paint or coating product to be used shall include:
   1. Product characteristics.
   2. Surface preparation instructions and recommendations.
   3. Primer requirements and finish specification.
   4. Storage and handling requirements and recommendations.
   5. Application methods.
   6. Clean-up information.
   7. Maintenance recommendations and instructions.

D. Samples: Upon request, submit samples of finish types and colors.

E. Mock-Ups: Upon request, finish 24"x24" minimum surface area for verification of products, colors, and sheens. Do not proceed with remaining work without prior written approval.

F. Installer Warranty: Submit warranty specified.

G. Manufacturer Warranty: Submit warranty specified.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of approved manufacturers which have been in satisfactory use in similar service for three years. Deliver, handle, store, and dispose materials in accordance with manufacturer's instructions.

B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect:
   1. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. Architectural Painting Specification Manual by the Master Painters Institute (MPI), including identifiers, evaluation, system, preparation and approved product list.
   3. Test Method for Measuring Total Volatile Organic Compound (VOC) Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).

C. Installer Qualifications: Painting contractor shall have a minimum of five (5) years proven satisfactory experience and maintain direct supervision and qualified personnel throughout duration of the work. Upon request, provide a list of three (3) comparable projects including name, location, designer / specifier, general contractor, value of painting work, and dates of commencement and completion.

D. Testing and Inspections (Where required by Owner):
   1. Owner shall secure the services of a qualified independent testing agency to perform testing, inspections, and documentation of materials used and work performed to confirm adherence to accepted trade practices, standards and specifications.
   2. Contractor shall coordinate the testing and inspection services with the progress of the work. The contractor shall provide sufficient notice to allow proper scheduling of all personnel. The contractor shall provide safe access to work for performing testing and inspections.

1.04 WARRANTIES

A. Installer Warranty: Provide Two (2) year installation warranty that all painting work has been performed in accordance with Master Painters Institute (MPI) Painting Manual requirements for project conditions and material manufacturer's instructions.

B. Manufacturer Warranty: Provide Five (5) year material warranty that products installed per manufacturer's instructions shall be free of peels, blisters, or performance defects and signed by an authorized representative.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers: Sherwin Williams specified. Equal products by PPG Industries acceptable (No substitutes). First-line commercial-quality products for all coating and accessory material systems. All paint and coating materials shall be from a single manufacturer for each system used.

B. Environmental: All materials used shall be lead and mercury free and shall have low VOC content in compliance with EPA standards and regulations for project conditions.

C. Flame Spread and Smoke Development Ratings: Comply with ASTM E84, flame spread rating of 0 to 25, smoke development rating of 0 to 450.

D. Compatibility: All materials used shall be compatible with substrate materials and service use environmental exposure conditions.

E. Coatings: Ready mixed except field catalyzed coatings of good flow and brushing properties, capable of drying or curing free of blemishes, streaks, sags, or air entrapment.

F. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners, and other materials required to achieve the finishes specified for project conditions as recommended by material manufacturer.

2.02 FINISHES, MIXING AND TINTING

A. Finish and Colors: Refer to drawing interior and exterior finish schedules for colors, gloss / sheen, and locations.

B. Mixing and Tinting: All paint shall be ready-mixed and pre-tinted. Re-mix all paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and color and gloss uniformity. Mix in accordance with manufacturer's instructions. Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.

PART 3 – EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Examine the areas and conditions under which painting work is to be preformed. DO NOT proceed with the work until unsatisfactory conditions have been corrected. Starting of painting work will be construed as acceptance of the surfaces within any particular areas.

B. Perform all preparation and cleaning procedures in strict accordance with the MPI standards and paint or coating manufacturer's instructions. Remove all hardware, plates, lighting fixtures, and similar items in place and not to be finish painted or provide protection prior to surface preparation and painting operations. DO NOT finish over equipment identification plates or fire rated assembly labels. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Re-install the removed items by workmen skilled in the trades involved, after painting is complete.

C. Cementitious Materials: Prepare cementitious surfaces to be painted by removing all chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze. Determine the alkalinity and moisture content of the surfaces to be painted by performing appropriate test. If the surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, correct this condition before application of paint.

D. Wood: Clean wood surfaces to be painted of all dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those surfaces exposed to view and dust off. 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, etc. Scrape and clean small, dry seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before application of the priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sandpaper smooth when dried.

E. Gypsum Wall-Board: DO NOT paint over gypsum wallboard work until taped joints are thoroughly dry.

F. Ferrous Metals: Touch-up shop applied prime coats which have damaged or bare areas. Wire-brush, solvent clean, and touch up with the same primer as the shop coat.

G. Galvanized Surfaces: Clean free of oil and surface contaminates with an acceptable non-petroleum-based solvent.

H. Aluminum: Remove film of oil and grease before painting by washing with mineral spirits.

I. Existing Materials to Remain: At existing areas to be re-painted, remove blistered or peeling paint to sound substrates. Remove chalk deposits and mildew and wash all surfaces with mild detergent. Perform related minor preparation including caulk and glazing compounds. Spot prime bare areas before priming and painting as specified.

J. Concrete Masonry Unit (CMU): Individual job applications will require that the Contractor pay particular attention to the weather conditions prior to and during applications of products. A cold weather application is given if the temperatures are such that it is necessary for installation. All manufacturers' application data should be followed on temperature and humidity installation. Upon installation, the Contractor shall confirm a pin hole free surface is achieved of the coating system. After application, the Contractor shall peer down on the wall from the top of the building to make sure all of the ledges are covered and are pin hole free. It is recommended that the products are sprayed up, down and side-to-side. It is required that spray application be back rolled as well for proper coverage. Contractor must also verify mil thickness at each coating prior to applying succeeding coatings.

3.02 APPLICATION

A. Apply paint by brush, roller, spray, or other acceptable practice in accordance with the manufacturer's directions. Paint applied by spray shall be back rolled. Use brushes best suited for the type of material being applied. Use rollers or carpet, velvet back, or high pile sheep wood as recommended by the manufacturer for material and texture required.

B. The number of coats and paint film thickness required is the same regardless of the application method. DO NOT apply succeeding coats until previous coat has completely dried. Sand between each enamel or varnish coat application with fine sand paper or rub surfaces with pumice stone where required to produce an even smooth surface in accordance with coating manufacturer's directions.

C. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance.

D. Give special attention to ensure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a film thickness equivalent of that of flat surfaces.

3.03 STANDARD SCHEDULE OF TREATMENTS

A. General:
   1. Finish and Colors: Refer to drawing interior and exterior finish schedules.
   2. Coverage: Paint or coating material coverage rates shall be in strict accordance with manufacturer's specifications, unless otherwise indicated.

B. Interior gypsum board or plaster walls and ceilings:
   1. One coat of latex primer sealer.
   2. Two coats of acrylic latex paint.

C. Interior Wood- Transparent:
   1. Filler coat (for open grained wood only).
   2. One coat of stain.
   3. One coat of sealer.
   4. Two coats of varnish, satin.

D. Exterior and Interior Wood- Painted:
   1. One coat of acrylic primer sealer.
   2. Two coats of exterior acrylic paint.

E. Exterior and Interior Ferrous Metal:
   1. One coat of rust-inhibiting primer.
   2. Two coats exterior alkyd paint.

F. Exterior and Interior Galvanized Metal:
   1. Chemical wash.
   2. Galvanized iron primer.
   3. Two coats exterior alkyd paint.

G. Exterior and Interior Concrete, Concrete Masonry Units (Not Defined Under Special Schedule of Treatments):
   1. General Application
      a. One coat interior/exterior latex block filler. Sherwin Williams “Pro Industrial Heavy Duty Block Filler B42W150”. Not less than 16 Wet mils thick.
      b. Two coats elastometric coating. Sherwin Williams “CONFLEX XL Smooth High Build Acrylic Coating CF11W51”. Not less than 5.7 Wet mils thick each coat.
   2. Cold Weather Application
      a. One coat Acrylic resin block surfacer. Sherwin Williams “Loxon Block Surfacer”. Not less than 8 Wet mils thick.
      b. Two coats solvent borne masonry coating (waterproof sealer). Sherwin Williams “Ultracrete Solvent Borne Smooth B46”. Not less than 8 Wet mils each coat or 16 mils total.

3.04 SPECIAL SCHEDULE OF TREATMENTS – NEW CONSTRUCTION CONCRETE MASONRY UNIT (CMU) BUILDING EXTERIOR THERMAL ENVELOPE ASSEMBLY

A. General:
   1. Where required: Refer to drawings.
   2. Substrate Conditions: Concrete masonry unit assemblies to have less than Twelve Percent (12%) moisture content, ph less than 13, and mortar cured for Seven (7) days minimum.
   3. Finish and Colors: Refer to drawing finish schedules.
   4. Coverage: Paint or coating material coverage rates shall be in strict accordance with manufacturer’s specifications, unless otherwise indicated.
   5. Application: Each coat specified shall be spray applied and back rolled.

B. Concrete Masonry Unit (CMU) Exterior Surface Coatings:
   1. Primer:
      a. Sherwin Williams “LOXON” Acrylic Block Surfacer “LX01W0200-LXN BLOCK SURF WHT”. Not less than 16 Wet mils thick. Two coats may be required to achieve pinhole free surface.
      b. PPG Industries “Perma-Crete” Concrete Block & Masonry Surfacer / Filler “4-100XI“. Not less than 16 Wet mils thick. Two coats may be required to achieve pinhole free surface. Minimum 16 hour recoat period.
   2. Coat 1:
      a. Sherwin Williams “LOXON” Self-Cleaning Acrylic Coating “LX13W0051-LXN SELF-CLEAN EW”. Not less than 6 Wet mils. thick.
      b. PPG Industries “Perma-Crete” Acrylic High-Build “4-22XI”. Not less than 6 Wet mils thick. Minimum 4 hour recoat period.
   3. Coat 2:
      a. Sherwin Williams “LOXON” Self-Cleaning Acrylic Coating “LX13W0051-LXN SELF-CLEAN EW”. Not less than 6 Wet mils thick.

b. PPG Industries “Perma-Crete” Acrylic High-Build “4-22XI”. Not less than 6 Wet mils thick. Minimum 4 hour recoat period.

C. Concrete Masonry Unit (CMU) Interior Surface Coatings:
   1. Application: Apply prior to installation of interior surface furring, insulation, and gypsum board assemblies.
   2. Primer:
      a. Sherwin Williams “LOXON” Water Blocking Primer “LX12W0050-LXN WTR BLCK PR WH”. Not less than 6 Wet mils thick. Application with overnight drying between Coat 1.
      b. PPG Industries “Perma-Crete” Concrete Block & Masonry Surfacer / Filler “4-100XI“. Not less than 16 Wet mils thick. Two coats may be required to achieve pinhole free surface. Minimum 16 hour recoat period.
   3. Coat 1:
      a. Sherwin Williams “LOXON” Water Blocking Primer “LX12W0050-LXN WTR BLCK PR WH”. Not less than 6 Wet mils. thick.
      b. PPG Industries “Perma-Crete” Acrylic High-Build “4-22XI”. Not less than 6 Wet mils thick. Minimum 4 hour recoat period.
   4. Coat 2:
      a. PPG Industries “Perma-Crete” Acrylic High-Build “4-22XI”. Not less than 6 Wet mils thick. Minimum 4 hour recoat period.

3.05 FIELD QUALITY CONTROL AND STANDARD OF ACCEPTANCE

A. Quality Assurance:
   1. Refer to Testing and Inspection for additional requirements.
   2. Contractor shall utilize industry standard measuring devices during paint and coating applications to verify minimum coverage rates and thickness specified are being provided.

B. Painted surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent:
   1. Brush / roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
   2. Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and reentrant angles.
   3. Damage due to touching before paint is sufficiently dry or any other contributory cause.
   4. Damage due to application on moist surfaces or caused by inadequate protection from the weather.
   5. Damage and/or contamination of paint due to blown contaminates (dust, spray paint, etc.).

C. Painted surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:
   1. Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than Thirty-Nine (39) inches.
   2. Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than Thirty-Nine (39) inches.
   3. Visible defects are evident on ceiling, soffit, or other overhead surfaces when viewed at normal viewing angles.
   4. When the final coat of any surface exhibits a lack of uniformity of color, sheen, texture, and hiding across full surface area.

3.06 REPAIR, PROTECTION AND CLEAN-UP

A. Repair:
   1. Follow MPI standards and paint manufacturer's instructions for repair and painting of existing finishes.
   2. Use finish coat of respective new surface paint or coating system for minor repair of existing finishes. Use system primer where existing finishes are damaged down to substrate surface.

B. Protection:
   1. Protect all surfaces and areas, including landscaping, walks, drives, and adjacent building surfaces (including glass, aluminum surfaces, etc.) and equipment and any labels and signage from painting operations and damage by drop cloths, shields, masking, templates, or other suitable protective means and repair damage caused by failure to provide such protection.
   2. Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work area as required.

C. Clean-Up:
   1. Remove all paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.
   2. Keep work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.
   3. Remove combustible rubbish materials and empty paint containers each day and safely dispose in accordance with requirements of authorities having jurisdiction.
   4. Clean equipment and dispose of wash water / solvents and other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paints thinners, paint removers / strippers in accordance with safety requirements of authorities having jurisdiction.

END OF SECTION

SECTION 10 21 13

TOILET COMPARTMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide toilet partitions, screens and hardware, complete.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Product Data: Submit manufacturer’s detailed technical data for materials, fabrication, and installation, including catalog cuts of anchors, hardware, fastening, and accessories.

C. Shop Drawings: Submit shop drawings for the fabrication and erection of toilet partition assemblies not fully described by manufacturer’s data. Show all anchorages, gages of materials, hardware, fittings and fastenings. Submit setting drawings, templets and instructions for the installation of anchorage devices built into other work. Take field measurements prior to preparation of shop drawings and fabrication where possible, to ensure proper fitting of work. However, allow for adjustments within specified tolerances where taking of field measurements before fabrication might delay work.

D. Samples: Upon request, submit finish samples for Owner and Architect’s approval.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for five years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Comply with current ADA and ANSI A117.1 accessibility standards. Notify Architect of conditions which deviate from governing standards prior to fabrication and installation of construction.

C. Warranty: Provide five (5) year warranty of material and installation defects, including corrosion or discoloration of finishes.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufacturers: Accurate Partitions, Ampco, Bradly, General Partitions, Knickerbocker, or approved equal.

B. Toilet Compartment Type and Mounting:
1. Refer to drawings for partition layout.
2. Compartments: Floor-anchored, overhead braced.
3. Screens: Wall-hung and post mounted.
4. Style: Standard privacy style.
5. Comply with ANSI A117.1 and ADA accessibility standards.

C. Toilet Compartment Materials:
   1. Doors, Panels, Pilasters, Screens: 1” thick minimum, fabricated from tension leveled 22 gauge, type 304 stainless steel bonded to sound deadening honeycomb core with a non-toxic adhesive. All stainless steel components shall be assembled with continuous roll-formed interlocking, 22 gauge stainless steel crown molding welded and ground smooth.
   2. Finish: All components shall be type 304 stainless steel with 34 finish and include a PVC film for protection during shipment and installation.

D. Hardware and Accessories:
   1. Operation: Hardware shall comply with ANSI A117.1 and ADA requirements. Doors shall be gravity actuated with cam action hinges that permit door to remain at desired position when not in use. In swing doors to hold open approximately 30 degrees from closed position when unlatched. Out swing doors to return to fully closed position.
   2. Pilaster shoes: 3 inches high, 20 gage type 302/304 polished stainless steel.
   3. Stirrup Brackets: Manufacturer’s standard design for attaching panels to walls and pilasters of stainless steel or chrome-plated brass to match hardware finish.
   4. Hardware and Accessories: Polished stainless steel or chrome-plated brass hardware and accessories, including cutout inset type (not surface mounted), gravity or spring action cam type hinges, latch/keeper, coat hook, and door pull. Concealed latch assembly to allow emergency access. Doors for accessible compartments shall be supplied with paddle handles. Overhead bracing headrail shall be provided with anti-grip profile. Pilasters to be provided with integral leveling hardware to provide height adjustments.
   5. Anchorages and Fasteners: Exposed fasteners of stainless steel, chromium plated steel or brass finished to match hardware. Use torque type heads and nuts for exposed screws. Use hot-dip galvanized, cadmium plated, or other rust resistant protective-coated steel for concealed anchors.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction, plumb, level and with uniform appearance.

B. Provide blocking and backing for proper anchoring. Coordinate with work of other sections.

C. Attach with concealed anchoring devices and brackets as recommended by manufacturer to suit supporting structure. Set units to provide support and resist lateral impact.

D. Limit openings between panels, doors and pilasters to less than ½", and not more than 1" between panels and walls.

E. Adjust hardware, lubricate, clean, and protect work.

END OF SECTION

SECTION 10 28 13

TOILET ACCESSORIES

PART 1 – GENERAL

1.01 SUMMARY

A. Provide toilet accessories and metal framed mirrors.

1.02 SUBMITTALS

A. None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Regulations: ADAAG and local accessibility requirements.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers: Bobrick specified; equivalent by American Specialties Inc., Bradley Corp., GAMCO, Fort Howard, Accessory Specialties, Seachrome Corporation, or approved equal.
B. Schedule: Refer drawing toilet accessories schedule for types and model numbers.
C. Materials and Finishes:
    1. Stainless Steel: ASTM A 167, AISI Type 302 or 304, No. 4 polished finish; 22 gage minimum.
    2. Chromium Plated Brass or Steel: ASTM B 456, type SC 2.
    3. Baked Enamel on Steel: Factory-applied gloss white.
    4. Sheet Steel: ASTM A366.
    5. Tubing: ASTM A269 stainless steel.
    6. Adhesive: Contact, waterproof, as recommended by accessory manufacturer.
    7. Fasteners, screws, and bolts: Hot dip galvanized steel, tamper-proof. Sizes and spacing as recommended by accessory manufacturer.
    8. Glazing: Mirror glass, ¼-inch thick, ASTM C 1036.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.
B. Install units plumb and level, firmly anchored in location and at heights indicated or directed by Architect.
C. Coordinate with carpenter for installation of required fire treated blocking in framing.
D. Restore damaged finishes and test for proper operation. Clean and protect work from damage.

END OF SECTION

SECTION 10 73 00

PROTECTIVE COVERS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide pre-engineered protective awning and canopy cover systems and erection.
   1. Structural steel or aluminum frames, secondary framing, bracing, engineered and fabricated by the pre-engineered protective cover supplier.
   2. Aluminum roof system including flashing, soffits, trim, closures, flashing, counterflashing, fasteners, accessories, gutters, downspouts, engineered and fabricated by the pre-engineered protective cover manufacturer.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Submit for approval shop drawings, product data, test reports.
   1. Submit shop drawings including complete details and schedules for fabrication and shop assembly of the members, details, schedules, procedures and diagram showing the sequence of erection. 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. Provide setting drawings, templates, and directions for the installation of anchor bolts and other anchorages to be installed by others.
   2. Perform design under direct supervision of a professional structural engineer licensed in the state where the project is located. Drawings shall be sealed, signed and dated.

C. Submit for approval samples of manufacturer’s full range of custom and standard colors and textures.

D. Submit manufacturer’s 20 year warranty of defects in materials, finishes, and workmanship.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Use experienced installers. Receive, handle, store and install materials in accordance with manufacturer's instructions.

B. Structural Performance: Refer drawings for governing codes and structural load requirements. Construction shall withstand the effects of design load stresses under conditions indicated without permanent deformation of sunshade components, mounting brackets, or damage to fasteners and anchors.

C. Thermal Movements: Provide construction that allows for thermal movements resulting from a maximum change in ambient and surface temperature for project conditions without buckling, overstressing of components, failure of connections, or other detrimental effects.

D. Field Measurements: Confirm field dimensions prior to preparation of shop drawings and fabrication of assemblies.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufacturers: Architectural Shade Products, Childers, Dittmer, Fashion Inc., FenWall Fabrication & Manufacturing, Mapes, Nelson Adams, Protective Architectural Systems, Superior or approved equal.

B. Structural Framing: Pre-engineered structural steel or extruded aluminum shapes, primary, secondary, framing including beams, purlins, girts, struts and bracing.

C. Hanger, Tension Rods, Turnbuckles, and Adjustable Connections: Pre-engineered galvanized steel or aluminum pipe or solid rod with cast or machined metal clevis and reducers at ends for attachment to the wall and canopy framing. Turnbuckles and rod connections shall be adjustable for leveling and load balancing.

D. Roof Deck: Pre-engineered roll-formed aluminum (0.032 min.) interlocking self flashing, “W” profile or manufacturer’s standard shape. Sections shall be designed to proper length to withstand the design loads indicated.

E. Related Materials:
   1. Gutters and Downspouts: Aluminum (26 ga. min.).
   2. Fasteners: Stainless steel or cadmium plated. Sizes as specified by pre-engineered protective cover design engineer.
   3. Sealants: Comply with Section 07 92 00.
   4. Aluminum sheet metal (26 ga. min.) flashing, counterflashing, trim, closures, and accessories.

2.02 FINISHES

A. Pre-Finishing: High-performance organic 2-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat, or powder coating with 3 mils. min. thickness complying with ASTM D3451-06 and AAMA 2605. Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.

B. Field Finishing: Comply with Section 09 90 00. All metal materials exposed to weather or ultraviolet exposure shall be painted.

C. Colors and Textures: Refer to drawings or as selected by Architect from manufacturer's full range of custom and standard samples.

PART 3 - EXECUTION

3.01 INSPECTION

A. Confirm that surrounding area is ready for pre-engineered protective cover installation.

B. Field modification of parts shall be in accordance with the best standard procedures and require the approval of the pre-engineered protective cover manufacturer’s engineer and shall be the responsibility of the Contractor.

3.02 ERECTION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

B. Erect framing in accordance with manufacturer’s instructions and approved submittals.

C. The erector shall furnish temporary guys and bracing where needed for squaring, plumbing, and securing the structural frame against loads, such as wind loads, acting on the exposed framing and seismic forces, as well as loads due to erection equipment and erection operations, but not including loads resulting from the performance of work by others. Bracing furnished by the manufacturer for the protective covering system cannot be assumed to be adequate during erection. The temporary guys, braces, falsework and cribbing are the property of the erector, and the erector shall remove them immediately upon completion of erection.

D. Do not field cut or alter structural members without approval of the manufacturer’s engineer.

E. After erection, prime welds, abrasions, and surfaces not shop primed.

F. Exercise care when cutting prefinished material to ensure cuttings do not remain on the finish surface. Fasten cladding system to structural supports, align level and plumb.

G. Install gutters and downspouts in strict accordance with manufacturer’s instructions.

H. Field break and install manufacturer’s sheet metal stock as required at flashing, counter-flashing, trim, closure, and other locations where preformed parts are not provided by the pre-engineered metal building manufacturer. Install per SMACNA standards (latest revision).

I. Seal wall, roof, and trim accessories weathertight.

END OF SECTION

SECTION 10 80 00

MISCELLANEOUS SPECIALTIES

PART 1 – GENERAL

1.01 SUMMARY

A. Provide miscellaneous specialties, complete:
   1. Fire extinguisher and mounting brackets.
   2. Interior building signage.
   3. Exterior vinyl building address lettering.

1.02 SUBMITTALS

A. None required unless submitting for approved equals.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Standards: UL and FM listed products, NFPA 10.
C. Accessibility Regulations: Current ADA and ANSI A117.1 specifications and design standards.

PART 2 – PRODUCTS

2.01 FIRE EXTINGUISHERS

A. Manufacturers: Ansul Sentry specified; equivalent by J.L. Industries, Larsen's Manufacturing, Potter-Roemer, or approved equal.
B. Fire Extinguishers:
   1. Model: # SY-1014.
   2. Type: Multipurpose dry chemical type.
   3. Rating: UL listed ABC.
   4. Capacity: 10 lbs. heavy duty steel extinguisher.
   5. Surface Mounting: Manufacturer's model 30865 metal mounting brackets and fasteners as recommended by manufacturer for substrate attached.

2.02 INTERIOR SIGNS

A. Manufacturers: ASI, APCO, Best, Compliance Signs, Kroy, Kaltech, Mohawk, National Signage, Rockwood, Seton, or approved equal.
B. Interior Signs:
   1. Model: Refer drawing toilet accessories schedule.
   2. Type: Raised or engraved acrylic or plastic.
   3. Size: 8 inch by 8 inch.
   4. Color: Manufacturers standard colors contrasting from background and as indicated on drawings or selected by Architect.
   5. Copy: Sans Serif upper case, character height 5/8-height minimum for viewing distance less than 6 feet, Braille (Grade 2 contracted), and accessibility graphics meeting requirements of ADA and ANSI A117.1 specifications.

6. Fasteners, Tape, and Adhesive: As recommended by sign manufacturer for substrate attached.

2.03 EXTERIOR VINYL BUILDING ADDRESS LETTERING

A. Vinyl lettering indicating building address number, white, Helvetica Medium 6-inch high copy. Attached to glazing per lettering manufacturer's recommendations with non-staining or non-yellowing adhesive.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.
B. Install fire extinguishers with wall-hung brackets at locations and heights indicated and acceptable to authorities having jurisdiction.
C. Install interior signs at locations and height indicated and acceptable to authorities having jurisdiction. Comply with current ADA and ANSI A117.1 specifications.
D. Install exterior vinyl lettering per manufacturer's recommendations. Ensure attachment to withstand local wind load requirements.
E. Restore damaged finishes and test for proper operation. Clean and protect work from damage.

END OF SECTION

SECTION 20 01 00

GENERAL PROVISIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings
   2. General Conditions

1.02 WORK INCLUDES

A. The work to be performed under this Division shall include all labor, materials, equipment, and transportation necessary to provide a complete and satisfactory system ready to use. The words "the Contractor" or "this Contractor" refers to the Contractor for the work specified in that Section. This Contractor shall examine all Drawings and all Sections of the Specifications and shall be responsible for ascertaining to what extent other Drawings and Sections affect the work herein specified.
B. Unless noted on the drawings otherwise, work shall also include:
   1. The procurement of and payment for all fees, permits and licenses required for the performance of the work.
   2. All fees and direct expenses involved in any inspection required for the project.
   3. All hoists, scaffolds, staging, runways, and equipment required for the performance of the work.
   4. All job measurements and shop layouts required for the proper installation of material and equipment included in the work.
   5. All lights, guards, and signs as required by safety regulations applicable to the work.
   6. The removal from the premises, as it accumulates, of all dirt and refuse resulting from the performance of the work.
C. The work shall include revisions, modifications, and rework of existing work as required for installation of new work and as required for connections of new work to existing systems, and as required for connections of existing work to new systems.

1.03 CODES, REGULATIONS, AND STANDARDS

A. All work must be performed in accordance with the requirements of local, county, state and national codes and regulations including the requirements of the following:
   1. Building Code, Latest Edition.
   2. National Electrical Code.
   3. Mechanical Code, Latest Edition.
   4. Occupational Safety and Health Act. of 1970.
   5. Life Safety Code, N.F.P.A. No. 101.
   6. For work not specifically listed above, use standards and codes of the National Fire Protection Association.
   7. Plumbing Code, Latest Edition.

1.04 ABBREVIATIONS

A. All equipment, apparatus and systems shall be rated, tested, fabricated and/or installed in accordance with the applicable industry standard mentioned. The following list will serve to clarify abbreviations that appear in other sections of this specification:

1. AABC-Associated Air Balance Council
2. FS-Federal Specifications
3. ADC-Air Diffusion Council
4. NFPA-National Fire Protection Association
5. AGA-American Gas Association
6. NSC-National Safety Council
7. ASHRAE-American Society of Heating, Refrigerating and Air Conditioning Engineers
8. ASME-American Society of Mechanical Engineers
9. IEEE-Institute of Electrical and Electronics Eng.
10. NSF-National Sanitation Foundation
11. AMCA-Air Moving and Conditioning Assoc.3. ASE-Association of Safety Engineers
12. ASTM-American Society for Testing and Matl
13. MCAA-Mechanical Contractors' Association of Amer.
14. AWWA-American Water works Association
15. ANSI-American National Standards Institute
16. SMACNA-Sheet Metal and Air Conditioning Contractors National Association
17. NEBB-National Environmental Balancing Bureau
18. ARI-Air Conditioning and Refrigeration Inst.
19. UL-Underwriters Laboratories
20. NEMA-National Electrical Manufacturers Assoc.
21. OSHA- Occupational Safety & Health Administration
22. EPA-Environmental Protection Agency

1.05 SUBMITTALS

A. See Section 01 33 00 "SUBMITTALS" for requirements for shop drawings and product data.

1.06 SUBSTITUTION OF EQUIPMENT

A. All proposed substitutions for specified products on this project (except as listed above) require approval in advance of bidding. Approval will not be granted after award of contract. Substitutions must be submitted for review no later than five (5) working days prior to the bid date to be considered.
B. In the event of Owner’s approval of a substitution of equipment, notification will be given by the Owner (or authorized representative), by the issuance of an amendment to the contract documents incorporating the equipment by name and model number.

1.07 CONTRACT DRAWINGS

A. The layout shown on the Contract Drawings is necessarily diagrammatic but shall be followed as closely by actual construction as work will allow

1.08 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.
B. Follow manufacturer's directions in delivery, storage, protection and handling of all equipment and materials.
C. Deliver and store equipment and materials to the site in original containers, suitably sheltered from the elements and mechanical injury, but readily accessible for inspection until installed.

PART 2 – PRODUCTS - (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and requirements of the actual equipment to be connected.

3.02 MECHANICAL INSTALLATIONS

A. Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment.

3.03 DEFECTIVE WORK AND MATERIAL

A. All materials or work found to be defective or in non-conformance with the drawings or different from the requirements of the drawings and specifications or damaged through negligence of Contractor or his employees, or through action of fire or weather will be rejected and shall be immediately removed from premises by Contractor and satisfactory materials and work substituted without delay.

3.04 COOPERATION AND COORDINATION

A. Contractor shall confer with other contractors at the site before installing his work to avoid interferences so that maximum head room and clearances may be maintained
B. Particular attention shall be paid to situations where recessed equipment, such as pipes and lights occur, or where the work of several trades occurs together above suspended ceilings, in pipe shafts or in areas where space is limited.
C. All fixtures, equipment, devices, switches, outlets, pumps, etc., shall be positioned to avoid all interferences with and to assure proper coordination with work of all other trades, cases, partitions, wall, floor and ceiling patterns, architectural features, etc.

3.05 CUTTING AND PATCHING

A. Perform cutting and patching in accordance with techniques acceptable to the owner. Restore all finishes to as-new condition.

3.06 PROTECTION OF EQUIPMENT AND SYSTEMS

A. Keep pipe openings closed by means of plugs or caps to prevent entrance of foreign matter, and cover all fixtures, equipment and apparatus as required to protect them against dirt, water, chemical or mechanical damage both before and after installation.
B. Fixtures, equipment or apparatus damaged prior to final acceptance of work shall be restored to original condition or replaced by Installer.
C. Equipment shall be inherently safe and moving parts shall be covered with guards which meet OSHA requirements.
D. Provide protective guards for devices such as or similar to thermostats, valves, and switches which are so located as to be readily subject to tampering, accidental damage, or vandalism.
E. Provide safety railings as required.

END OF SECTION

SECTION 20 02 00

CONTRACT CLOSEOUT & COMMISSIONING

PART 1 - GENERAL

1.01 MAINTENANCE MANUAL AND OPERATING INSTRUCTIONS (20 01 00)

A. All switches, controls, and safety devices shall be clearly and permanently marked with embossed or printed plates as to purpose and as to operation and shall be tested to ensure function and purpose.
B. Upon completion of the work, Contractors shall put the systems into service. Contractors shall be entirely responsible for the equipment during all testing operations including the lubricating and turning on and off of such apparatus.

1.02 PROJECT RECORD AND CLOSEOUT DOCUMENTS (20 01 00)

A. See Division 01 Section "RECORD DOCUMENTS" for red lining of all documents during construction to reflect "as-built" conditions.
B. In addition to the requirements specified in Division 01, indicate the following installed conditions:
   1. Ductwork mains and branches,size and location, for both exterior and interior; locations of dampers and other control devices; filters, boxes, and terminal units requiring periodic maintenance or repair.
   2. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Refer to Section 20 03 00 - "MATERIAL AND METHODS". Indicate actual inverts and horizontal locations of underground piping.
   3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
   4. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
   5. Contract Modifications, actual equipment and materials installed.

1.03 CLEANING EQUIPMENT AND SYSTEMS (20 01 00)

A. All equipment, piping systems and duct systems shall be thoroughly cleaned internally and externally before being placed in service.
B. The Contractor is charged with the responsibility for maintaining all systems and equipment clean and free of foreign matter during the processes of assembly and erection.
C. Pipe strainers and air filters shall be cleaned and serviced immediately prior to final inspection.
D. When flushing systems, all control, thermal and other elements subject to blocking by foreign matter shall be removed.
E. When piping systems are flushed with fluids other than that normally contained, the Contractor shall take adequate precautions to insure that the normal contents of the piping will not be contaminated when placed in service.

2.01 FIRESTOPPING (20 03 00)

A. Where ducts and/or pipes penetrate fire-rated ceilings, walls, floors, and any other fire rated assembly the cavity shall be sealed with intumescent material capable of expanding 5 to 10 times when exposed to temperatures of 250°F. It shall be ICBO, BOCA, and SBCCI (NRB 243) approved ratings per ASTM E-814 (U.L. 1479). Acceptable materials:

DOW-CORNING 3-6548 silicone RTV foam or 3-M fire barrier caulk, or 3-M fire barrier 2001 silicone RTV foams.

3.01 MECHANICAL PIPING SYSTEM IDENTIFICATION (20 06 00)

A. General: Install pipe markers on each system indicated to receive identification, and include arrows to show normal direction of flow.
B. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
   1. Near each valve and control device.
   2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
   3. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
   4. At access doors, manholes and similar access points which permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
   7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

4.01 COMMISSIONING SPRINKLER SYSTEMS (21 13 13) (required if installed)

A. Starting Procedures: Follow manufacturer's written procedures. If no procedures are prescribed by manufacturer, proceed as follows:
   Verify that specialty valves, trim, fittings, controls, and accessories have been installed correctly and operate correctly.
   Verify that specified tests of piping are complete.
   Check that damaged sprinklers and sprinklers with paint or coating not specified have been replace with new, correct type of sprinkler.
   Check that sprinkler are correct type have correct finish and temperature ratings, and have guards where required for applications.
   Check that potable water supplies have correct type of backflow preventer.
   Check that hose valves and fire department connections have threads compatible with local fire department equipment and have correct pressure settings.
   Fill wet-pipe sprinkler systems with water.
   Adjust operating controls and pressure settings.
B. Coordinate the fire alarm systems tests. Operate systems as required.

5.01 DISINFECTION OF DOMESTIC WATER SYSTEMS (22 00 00)

A. General:
   1. Before being placed in service and after testing is completed, all potable water piping shall be chlorinated as specified herein, in accordance with AWWA Standard C601-54 and as required by the local Health Department codes.
   2. Chlorine may be applied by the use of chlorine gas-water mixture, direct chlorine-gas feed or a mixture of calcium hypochlorite and water. If calcium hypochlorite is used, it shall be equivalent to commercial products such as Perchloron, HTH or Maxochlor. The powder shall be mixed with water to form a paste thinned to a slurry and pumped or injected into the lines.
   3. If direct chlorine-gas feed is used, it shall be fed with either a solution-feed chlorinator or by a pressure-feed chlorinator.
   4. The lines and fixtures shall be flushed thoroughly after chlorination to remove all foreign matter.

5. Injection shall start only when all fixtures are connected and ready for operation.
6. A service cock or riser (3/4" to at least 1-1/4") shall be provided by the Contractor and located at the point of connection to water service. The disinfecting agent shall be injected into and through the system from this cock or riser only.
7. Chlorine, either gas or liquid, or calcium hypochlorite (liquid or powered) shall be used as a disinfecting agent as approved in federal and AWWA procedures.
8. The disinfecting agent shall be injected by a proportioning pump or device through the service cock or riser slowly and continuously at an even rate.
9. All outlets shall be fully opened and closed at least four times during injection and the residual checked with orthotolidine solution.
10. When the chlorine residual concentration indicated not less than 50 parts per million at all outlets, all fixtures and water supply valves shall be closed.
11. The residual shall then be retained for a period of not less than eight hours.
12. After retention, the residual upon checking at most outlets, shall not be less than ten parts per million. If less, the disinfection must be repeated as described above.
13. If satisfactory, all fixtures shall be flushed until residual or orthotolidine tests are not greater than the water supply.
14. Contractor shall furnish Engineer or his authorized representative with sterilization report indicating potable water to be safe from contamination.

5.02 FLUSHING WATER PIPING (22 00 00)

A. After the piping has been chlorinated, each run of pipe shall be thoroughly flushed out so as to remove all foreign matter from the lines. Flushing will ordinarily be done by opening drain valves along the lines.
B. Sufficient flushing water shall be introduced into the mains to produce a velocity of not less than 4 ft. per second, and this flow rate shall be continued until the discharge is clean and clear and does not show evidences of silt or foreign matter when a sample is visually inspected.

6.01 FIELD QUALITY CONTROL OF GAS PIPING SYSTEMS (23 11 00)

A. Inspect, test, and purge gas systems according to NFPA 54, Part 4 "Gas Piping Inspection, Testing, and Purging" and local gas utility requirements as applicable.
B. Repair leaks and defects with new materials, and retest system until satisfactory results are obtained.
C. Verify capacities and pressure ratings of gas meters, regulators, valves, and specialties.
D. Verify correct pressure settings for pressure regulators.
E. Verify that specified piping tests are complete.

7.01 COMMISSIONING REFRIGERANT PIPING (23 23 00) (REQUIRED ON SPLIT SYSTEMS ONLY)

A. Charge system using the following procedure:
   1. Install core in filter dryer after leak test but before evacuation.
   2. Evacuate refrigerant system with vacuum pump; until temperature of 35 deg F is indicated on vacuum dehydration indicator.
   3. During evacuation, apply heat to pockets, elbows, and low spots in piping.
   4. Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system.
   5. Break vacuum with refrigerant gas, allow pressure to build up to 2 psi.
   6. Complete charging of system, using new filter dryer core in charging line. Provide full operating charge.

8.01 CLEANING AND ADJUSTING OF HVAC EQUIPMENT

A. Cleaning: Upon completion of installation, inspect units and associated components. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.
B. Adjusting: Make control and other adjustments for optimum heating, cooling and/or efficiency.

9.01 STARTUP OF CONDENSING UNITS (23 81 26)

A. Start-up condensing unit, in accordance with manufacturer's start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

10.01 COMMISSIONING OF HEAT AND COOL UNITS (23 74 00)

A. Start-up Services:
   1. Start-up HVAC units, in accordance with manufacturer's written start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

10.02 CONTROL EQUIPMENT LABELING (25 00 00)

A. Labels shall be installed wherever necessary to clarify functions of components and facilitate adjustment and servicing. Labels shall be required on, but not limited to the following:
   1. Control panels.
   2. Automatic damper motors.

10.03 FINAL ADJUSTMENT OF CONTROLS (25 00 00)

A. After completion of the installation, adjust all thermostats, control valves, motors and other equipment provided under this contract and place them in complete operating condition subject to approval of Engineer.

11.01 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS (23 05 93)

A. HVAC systems shall be tested and balanced by the HVAC Contractor, as called for in Section 23 05 93.
B. The HVAC Contractor shall put all heating, ventilating and air conditioning systems and equipment into operation and shall continue the operation of same during each working day of testing and balancing and shall place the automatic temperature control system in satisfactory operation.
C. The Contractor shall make all necessary corrections within 48 hours and within 10 working days for items that require replacement or installation.

END OF SECTION

SECTION 20 03 00

MATERIALS AND METHODS

PART 1 - GENERAL

1.01 WORK INCLUDES

A. Provide the materials as specified in this Section when required by this project.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Hangers, Supports, and Inserts (Insulated or non-insulated piping)
   1. Elcen - 12X.
   2. Grinnell - #65.

2.02 FLUES, VENTS, AND CHIMNEYS

A. Vent Connectors from Individual Equipment:
   1. May be single-wall vent pipe unless otherwise called out on plans. Single-wall vent connectors must be totally exposed in the mechanical room, and may not penetrate any wall, ceiling, or chase. Vent connectors for water heaters (where permitted by the recommendations of the manufacturer) shall be 22 gauge galvanized, minimum. All joints shall be made with proper fittings. Cut-in “Taps” will not be permitted.
   2. Vent connectors shall be the same size as the appliance outlet, unless shown larger on the drawings. They shall pitch upward at ¼” per foot minimum. Length shall not exceed that allowed by the applicable mechanical code. Two vent connectors shall not be combined before connecting to the vent or chimney.
B. Combined Vent - Type B:
   1. The gas vent system shall be so constructed as to develop a positive flow adequate to exhaust all flue gases to outside atmosphere, without condensation within the vent or spillage at any appliance draft hood.
   2. All flue-gas carrying parts of the vent system shall be Selkirk Metalbestos Type B double-wall gas vent piping, and such piping shall be continuous from the appliances vent connector to the vent top.
   3. Gas vent piping shall be installed in full compliance with the terms of its Underwriters Laboratories, Inc. listing, with the manufacturer’s installation instruction, and with nationally recognized building codes.
C. Concentric Vent/Intake Piping for Condensing Equipment :
   1. This applies to condensing gas-fired furnaces & unit heaters:
   2. Vent/intake piping and fitting materials:
      a. Schedule 40 NSF-PW PVC 1120 ASTM D1785 or
      b. Schedule 40 PVC ASTM D1785 and D2665 (dual marked)or
      c. DWV ASTM D2665
      d. Schedule 40 CPCV ASTM D1785 (where required).
   3. Where required by manufacturer’s instructions, use CPVC vent piping.
   4. Arrangement of vent fittings must conform to National Fuel Gas Code ANSI: Z223.1-“latest edition”.
D. Positive Pressure Vent – Stainless Steel:
   1. This applies to Air Turnover Units (Thermal Economizers).
   2. The gas vent system shall be Metalbestos Galva-Temp series or approved equal.
   3. 304 stainless steel inner liner, 1” solid pack insulation, galvanized steel outer casing.

4. Rated for 1,000°F continuous operating temperature.
5. Listed UL – 103.
6. Clearance of 2” is required to combustibles.

2.03 HVAC CONDENSATE PIPING

A. HVAC Condensate Piping:
   1. Horizontal condensate lines longer than 5 feet (such as in ceiling spaces) shall be 1 ½” Schedule 40 PVC DWV. Connections to units shall be ¾”, equipped with a trap.
   2. Condensate lines which pass through return air plenum ceiling spaces shall be 1” type “L” hard-drawn copper in lieu of PVC as stated above.
   3. Vertical condensate lines which are not downstream of larger piping shall be ¾” PVC, Schedule 40, DWV.
   4. Condensate lines which penetrate outside walls and spill to grade shall be hard-drawn copper tube, Type “L”.
   5. Exterior condensate lines shall be PVC Schedule 40, electrical conduit, ultra-violent resistant. Size per plans.

2.04 PIPING MATERIALS

A. All piping and fittings shall be manufactured in the United States. Each length of pipe and each fitting shall be marked with the manufacturer's name or trademark and the specification code to which it conforms.

2.05 VALVES

A. Refer to Section 20 05 00 "Valves" for globe, ball, butterfly, and check valves.

2.06 PIPE SPECIALTIES

A. Unions in copper pipe 2 in. and smaller shall be Mueller, Anaconda or Chase Brass, brass solder joint unions constructed for 150 psi working pressure.
B. Unions 2-1/2 in. in size and larger shall be companion flanges. (ANSI B16.1). Flanged unions shall be Van Stone, Grinnell or Crane Lap flanges over welding nipples welded into pipelines.
C. Dielectric unions suitable for dielectric service shall be provided at pipe connections between steel or cast iron piping and copper tubing.

2.07 HANGERS, SUPPORTS AND INSERTS

A. Hangers and supports shall conform to the recommendations of Standard Practice SP.58 of the Manufacturers' Standardization Society of the Valve and Fitting Industry.
B. All hangers for insulated piping shall be oversized to allow the insulation to run through the hanger uninterrupted. Insulation shall be protected from crushing by sheet metal shields.
C. Hanger rods shall conform to the following:

Pipe Size	Rod Diameter
Up to 2"	3/8"
2-1/2" to 5"	1/2"

Trapeze hanger rods shall be of sufficient size to carry weight of trapeze channel, piping and contents, insulation supports and an additional 200 lb. load.
D. Wire or perforated strap iron hangers, expansion anchors, and power actuated fasteners will not be permitted.

2.08 SLEEVES

A. Provide pipe sleeves for all penetrations of piping through walls.
B. Wall sleeves for exterior foundation walls shall be cast iron, standard weight galvanized steel or PVC schedule 40 fabricated sleeves flush with wall inside and outside. Caulk with oakum and lead wool or otherwise adequately waterproof opening between pipe and sleeve.

2.09 FIRESTOPPING

A. Where ducts and/or pipes penetrate fire-rated ceilings, walls , floors and any other fire rated assembly the cavity shall be sealed with intumescent material capable of expanding 5 to 10 times when exposed to temperatures of 250° F. It shall be ICBO, BOCA, and SBCCI (NRB 243) approved ratings per ASTM E-814 (U.L. 1479). Acceptable materials: DOW-CORNING 3-6548 silicone RTV foam or 3-M fire barrier caulk, or 3-M fire barrier 2001 silicone RTV foams.

2.10 ESCUTCHEONS

A. Provide set-screw chrome plated escutcheons (not friction-dependent) on all exposed pipe or pipe insulation passing through or into finished walls, partitions, ceiling and floors. Escutcheons at insulated pipes shall be large enough to encircle insulation without penetrating vapor barrier or jacket.

2.11 STARTERS

A. Each piece of equipment requiring a motor starter integral or factory installed, shall incorporate a motor starter.
B. Starter heater coil sizes shall be determined by motor nameplate.
C. Motor starter control circuits and devices shall be 120 volt, 60 hertz characteristic regardless of power circuit voltage serving motor.
D. Provide auxiliary contacts where required for interlocking, intermittent starting, pilot control, remote control, motor shut-down and safety features.

2.12 CONDUIT AND WIRING

A. Wiring systems provided under Sections 20, 21, 22, 23 & 25 shall be as specified in Section 26.
B. All electrical terminals shall be labeled.
C. Provide wiring diagrams inside each cabinet.
D. Conduit shall comply with all requirements of Section 26.
E. Final connections to equipment shall be flexible.

2.13 BELT AND COUPLING GUARDS

A. Guards shall be provided for all belt-driven units and at chains, gears, couplings, keys, projecting set screws, and other rotating or moving parts.

PART 3 - EXECUTION

3.01 FLUE, VENT, AND CHIMNEY INSTALLATIONS

A. Install in accordance with all requirements of the applicable mechanical code.
B. Comply with applicable requirements of NFPA 54, fuel gas code, latest edition.
C. Any joint in the system which cannot be assembled using factory-fabricated fittings shall be welded gas-tight.

3.02 PIPE AND FITTINGS APPLICATIONS

A. Use pipe, tube, fittings, and joining methods are specified within each specific individual section.

3.03 JOINTING OF PIPING

A. Threads shall be full and clean cut, and ends of pipe shall be reamed. When screwed joints are assembled, the male thread shall be thoroughly coated with appropriate thread compound to serve as a joint sealer and as a prime coat of paint for the exposed threads. (Teflon tape may be used at contractor's option.)
B. Soldered or brazed joints made with fittings having pre-inserted rings of solder or brazing alloy shall have the tube and fittings cleaned bright and fluxed. Flux shall be water soluble binder flux.
C. In potable water systems, the use of solder and flux exceeding 0.2 percent lead content is prohibited.

3.04 EXPANSION AND CONTRACTION

A. Provisions shall be made for expansion and contraction in all piping. Piping shall be installed in a manner such that joints will not develop leaks.

3.05 INSTALLATION OF PIPING

A. Piping shall be installed on long continuous lengths, with a minimum number of joints. Joints, where necessary shall be carefully made to insure against leakage.
B. All piping shall be firmly supported using hangers, brackets and braces to prevent sagging and/or lateral movement. All hangers, brackets, and other supports shall be securely fastened to the construction as may be required and in a manner acceptable to the Engineer.
C. All piping shall be installed to maintain maximum head room.
D. Nothing shall be suspended from the roof deck.
E. Arrangement of all piping shall be as shown on plans. It is especially necessary that all mains be installed with view to accessibility in case of repair and location of pipe lines and spacing between same shall be so made that there will be no conflict between pipe lines by the several trades.
F. Under no circumstances shall the size of piping shown on the drawings be changed without written approval of the Engineer.
G. Unions or flanges are to be installed on the equipment side of all valves in pipe connections from mains to equipment, to enable equipment to be drained and disconnected without necessitating the draining of mains.
H. Valves must be arranged for easy access.

3.06 WELDING

A. When welding is to be performed, precautionary measures must be taken to prevent fire.
B. Welded joints shall be made by the oxy-acetylene or electric process in accordance with Code for Pressure Piping ANSI B31.l.
C. Filler metal for the oxy-acetylene welding process shall conform to the American Society for Testing and Materials Specification for Iron and Steel Gas-Welding Rods, ASTM Designation A251-46T, Classification GA60. Filler metals for the metallic arc welding process shall conform to the American Society for Testing and Materials Specification for Mild Steel Arc-Welding Electrodes, ASTM Designation A233-58T.

Classification of electrodes shall be one of the following: E6010, E6015, E7016, E7018.

D. Welding shall be done with good quality modern welding equipment by competent operators, and in a thorough, first class, workmanlike manner. Preparation, fabrication welding and installation shall be in accordance with ANSI B31.3 - 1962.

3.07 HANGERS, SUPPORTS AND INSERTS

A. Provide all hangers, supports, bracing, inserts, beams, anchors, guides, sleeves and miscellaneous steel for the proper support, alignment, expansion and contraction of piping and equipment.
B. Hanger supports shall be securely fastened to structural members by approved beam clamps and clips, concrete inserts, anchors, or other appropriate methods agreed upon with the Engineer.
C. Maximum spacing of hangers and supports for steel and copper piping shall be as follows:

Pipe Size	Spacing
1/2" thru 1-1/4"	Not over 8'-0"
l-1/2" thru 3"	Not over 10'-0"

3.08 OPENINGS IN CONSTRUCTION

A. The Contractor shall be responsible for arranging the work so that minimum cutting or provision of openings will be required.

3.09 CONCRETE EQUIPMENT PADS

A. The Contractor shall supply all concrete pads and machine bases required for his equipment noted otherwise.

3.10 VALVES

A. Install ball valves with the stem above body in accessible position.
B. The necessary valves shall be installed within the systems to provide the following:
   1. Required shut-off.
   2. Flow control service.
   3. Isolation for inspection.
   4. Maintenance repair of each piece of equipment.
   5. Maintenance and repair of each fixture.
   6. Each main and branch service loop.
C. Each valve shall be installed so that it is easily accessible for operation, visual inspection and preventative maintenance.

3.11 MOTORS

A. Unattached electric motors (motors furnished loose with equipment) shall be set by the contractor.

3.12 CLEANING THE PIPING SYSTEMS

A. Before pipe covering is applied and final tests are made, flush the water piping systems thoroughly to remove grit, sand, oil, etc., to thoroughly clean apparatus and piping.

END OF SECTION

SECTION 20 04 00

TESTING PIPING SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings.
   2. General Conditions.

1.02 WORK INCLUDES

A. Provide pressure tests on soil, waste, and vent piping systems.
B. Provide pressure tests on domestic cold and hot water piping systems.
C. Provide pressure tests on gas piping system (if a gas system has been installed).

1.03 RELATED WORK

A. Section 33 00 00 “SITE PIPING”
B. Section 20 03 00 "MATERIALS AND METHODS".
C. Section 22 07 19 "PIPING INSULATION"
D. Section 22 00 00 "PLUMBING".
E. Section 23 23 00 “REFRIGERANT PIPING”.

1.04 QUALITY ASSURANCE

A. Piping systems where required, shall be pressure tested for leaks in accordance with the Code for Pressure Piping, ANSI B31.1.0, and as specified herein.
B. All tests shall be performed and all piping defects shall be corrected prior to insulating, inaccessible concealing or back filling. Leaks shall be repaired; all repaired piping shall be retested. All defective pipe, materials and workmanship shall be removed and replaced and tests shall be repeated until systems are proven entirely tight.
C. The tests shall not be performed until after cleaning the piping systems.

PART 2 - PRODUCTS

2.01 TESTING MATERIALS

A. All materials, pumps, compressors and equipment required for testing shall be provided by the Contractor installing the piping system.
B. Where water is used in hydrostatic testing, only potable water shall be used.

PART 3 - EXECUTION

3.01 TESTING OF PIPING SYSTEM - GENERAL

A. Devices or equipment, or parts thereof regulators, gauges, thermometers, etc., which may be damaged by test pressures shall be removed or protected during tests.
B. Fabricated piping shall not be connected to equipment until testing has been completed. Before applying test pressure, provide restraining devices as required to prevent distortion of piping system during testing.
C. Welding and screwed joints and other potential leak sources of the systems to be

hydrostatically tested shall be painted with a powdered blue chalk and water mixture and allow to dry before testing begins.

D. All joints in the piping systems shall be inspected during the test period. All defective joints shall be removed, repaired and replaced.
E. Where air is used for pressure testing, the air pressure shall be gradually applied. All leak sources shall be checked for leaks by applying a coating of soap suds to the source.
F. After tests have been completed and piping systems proven tight, piping and equipment shall be tested for complete drainage through unions, caps, plugs, faucets or hose valves at low points. If piping and equipment do not drain properly, piping and equipment shall be regraded and drain points added until system can be completely drained. Systems shall be left dry in freezing weather.

3.02 SOIL, WASTE, AND VENT PIPING SYSTEM

A. All stacks and underfloor sewers of all kinds shall be tested by capping outlets 5'-0" outside building wall, capping all connections, providing a 10'-0" high tight pipe extension and filling with water to top of extension.
B. Water shall remain in each system for at least 2 hours without dropping more than 1". Leaks shall be repaired and tests repeated until system is proven watertight. System may be tested in sections, but every joint between sections must be tested.

3.03 DOMESTIC COLD AND HOT WATER PIPING SYSTEMS

A. Domestic cold and hot water piping shall be hydrostatically tested to a pressure of 100 psig registered at ground floor level.
B. Testing shall be considered complete when systems hold the test pressure for a minimum period of one hour without variation in pressure except that which is due to changes in temperature.

3.04 WET PIPE SPRINKLER SYSTEMS (required, if installed)

A. All fire sprinkler piping shall be tested in accordance with NFPA No. 13, Chapter 8, System Acceptance.
B. Per NFPA No. 13, Chapter 8, the required minimum hydrostatic test pressure is 200 psi. Test pressure is to be maintained without loss for 2 hours.
C. See NFPA No. 13, Chapter 8 for test exceptions and interim air test requirements.

3.05 GAS SYSTEM

A. All gas piping shall be tested in accordance with NFPA No. 54 (the minimum test).
B. Pressure for air-pressure test shall be 20 psi and the minimum test duration shall be two (2) hours.

END OF SECTION

SECTION 20 05 00

VALVES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings.
   2. Supplementary Conditions.
   3. General Conditions.

1.02 WORK INCLUDES

A. This Section includes general duty valves common to most mechanical piping systems.
   1. Special purpose valves are specified in individual piping system specifications.

1.03 RELATED WORK

A. Section 20 01 00 - "GENERAL PROVISIONS".
B. Section 20 03 00 - "MATERIALS AND METHODS".

1.04 QUALITY ASSURANCE

A. Single Source Responsibility.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Valves:
   Bell and Gossett
   Conbraco (Apollo)
   Crane
   Flowdesign
   Grinnell
   Jomar
   Keystone
   Nibco
   Stockham
   Victaulic
   Watts

2.02 VALVE FEATURES - GENERAL

A. Pressure and Temperature Ratings: As scheduled and required to suit system pressures and temperatures.
B. Sizes: Same size as upstream pipe, unless otherwise indicated.
C. Operators: Provide the following special operator features:
   Lever handles, on quarter-turn valves 6-inch and smaller, except for plug valves.
   Provide plug valves with square heads; provide one wrench for every 10 plug valves.
D. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.

2.03 GATE VALVES

A. Do Not Use Gate Valves in Building Piping Systems.

2.04 BALL VALVES

A. Ball Valves, 2 Inches and Smaller: Rated for 150 psi saturated steam pressure, 400 psi WOG pressure; two-piece construction; with bronze body conforming to ASTM B 62, standard (or regular) port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout-proof stem, and vinyl-covered steel handle.

2.05 CHECK VALVES

A. Swing Check Valves: MSS SP-80; Class 125, cast-bronze body and cap conforming to ASTM B 62; with horizontal swing, Y-pattern, and bronze disc; and having threaded or solder ends. Provide Class 150 valves meeting the above specifications, with threaded end connections, where system pressure requires or where Class 125 valves are not available.

PART 3 - EXECUTION

3.01 VALVE ENDS SELECTION

A. Select valves with the following ends or types of pipe/tube connections:
   1. Copper Tube Size, 2-Inch and Smaller: Solder ends.
   2. Steel Pipe Sizes, 2-Inch and Smaller: threaded or grooved end.
   3. Steel Pipe Sizes 2-1/2 Inch and Larger: grooved end or flanged.

3.02 VALVE INSTALLATIONS

A. General Application: Use ball and butterfly valves for shut-off duty; globe, and butterfly for throttling duty. Refer to piping system specification sections for specific valve applications and arrangements.
   1. Locate valves for easy access and provide separate support where necessary.
   2. Install valves and unions for each fixture and item of equipment arranged to allow equipment removal without system shutdown. Unions are not required on flanged devices.
   3. Install valves in horizontal piping with stem at or above the center of the pipe.
   4. Install valves in a position to allow full stem movement.

B. Installation of Check Valves: Install for proper direction of flow as follows:
   1. Swing Check Valves: Horizontal position with hinge pin level.

3.03 FIELD QUALITY CONTROL

A. Tests: After piping systems have been tested and put into service, but before final adjusting and balancing, inspect valves for leaks. Adjust or replace packing to stop leaks; replace valves if leak persists.

3.04 ADJUSTING AND CLEANING

A. Cleaning: Clean mill scale, grease, and protective coatings from exterior of valves and prepare valves to receive finish painting or insulation.

END OF SECTION

SECTION 20 06 00

MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings
   2. General Provisions of the Contract
   3. Solicitation Documents
   4. General Conditions
   5. Section 01

1.02 WORK INCLUDES

A. Provide identification of all systems and equipment installed under Sections 20, 21, 22, 23 & 25.

1.03 RELATED WORK

A. Section 01 - "GENERAL REQUIREMENTS".
B. Section 20 01 00 - "GENERAL PROVISIONS".

1.04 QUALITY ASSURANCE - (Not Applicable)

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Allen Systems, Inc
B. Brady (W.H.) Co.; Signmark Div.
C. Industrial Safety Supply Co., Inc.
D. Seton Name Plate Corp.

2.02 PLASTIC PIPE MARKERS

A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.
B. Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers, complying with ANSI A13.1.
C. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
   1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
   2. Adhesive lap joint in pipe marker overlap.

2.03 UNDERGROUND-TYPE PLASTIC LINE MARKERS

A. General: Manufacturer's standard permanent, bright-colored, continuous-printed detectable tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried pipe.
   1. Provide multi-ply tape consisting of solid aluminum foil core between 2-layers of plastic tape.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.02 PIPING SYSTEM IDENTIFICATION

A. See Section 20 02 00 - “Contract Close-out & Commissioning”.

3.03 UNDERGROUND PIPING IDENTIFICATION

A. General: During back-filling/top-soiling of underground gas piping, install continuous underground-type detectable type line marker, located directly over buried line at 6" to 8" below finished grade.

END OF SECTION

SECTION 20 07 00

EXISTING SYSTEMS AND OWNER FURNISHED EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings.
   2. General Provisions of the Contract.
   3. Solicitation Documents.
   4. General Conditions.
   5. Architectural Division.

1.02 WORK INCLUDES

A. Contractor shall perform all work on all existing systems and equipment that require expansion, relocation, modification, and/or repairs as per the drawings and/or specifications.

PART 2 - PRODUCTS - NOT APPLICABLE

PART 3 - EXECUTION

3.01 RELOCATED OR SERVICED EQUIPMENT

A. From the time that the equipment is disconnected, or taken out of service, until the time that the equipment is started up and commissioned, the equipment shall be the responsibility of the contractor. Any damage occurring during the disconnecting, storing, relocating, re-installing or start-up shall be repaired by the contractor so that the condition of the equipment will be at least as good as when disconnected in the judgment of the engineer.
B. Contractor is responsible to ascertain and submit in writing to the engineer operating condition of existing equipment prior to being taken out of service. If contractor fails to provide a report o n the condition and operation of the existing equipment, then it will be assumed that the existing equipment was fully functional and operating correctly at its full intended capacity at the time of being taken out of service.
C. Accessory items necessary for the proper operation of existing relocated equipment shall be relocated and re-installed per manufacturer's recommendations. The contractor shall verify proper operation of such accessories before disconnecting the equipment. Notify engineer of any accessory items which need to be replaced before relocation the equipment.

3.02 EXPANDED SYSTEMS

A. Any existing system which is expanded as a part of this project (HVAC duct, hydronic piping, plumbing etc.) shall be expanded per the sizes and/or flows indicated in the contract documents.
B. Materials used for the expansion of any existing system shall meet the specifications in Section 20 03 00, and shall also meet the requirements of local codes.
C. Commissioning of any expanded system means the commissioning of the entire system, both the existing and new components.
D. The contractor shall install refrigerant and oil as required by any affected existing refrigeration system.

3.03 OWNER FURNISHED EQUIPMENT REQUIRING PLUMBING AND HVAC CONNECTIONS AND CONTROLS

A. Provide rough-ins and final connections to all Owner furnished equipment including shut off valves, piping, traps, ducts etc. necessary to connect up equipment after it has be installed in place.
B. Install all faucets, sinks drains, tailpieces, overflows, traps, etc. furnished loose with all Owner furnished equipment.
C. All exposed piping readily visible for Owner furnished equipment shall be chrome plated red brass pipe and fittings. Braces for support of exposed piping shall be chrome plated.
D. Pending installation of Owner furnished equipment; all service lines shall be suitably capped, plugged and protected. All water lines shall be valved.
E. Furnish vacuum breakers, pressure regulators solenoid valves, traps, piping and controls, etc. as required for installation of equipment.

END OF SECTION

SECTION 22 00 00

PLUMBING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings.
   2. General Conditions.

1.02 WORK INCLUDES

A. All piping, fittings, meters, valves, hangers and other accessories specified and shown on the drawings for a complete:
   1. Domestic cold and hot water piping system.
   2. Sanitary waste and vent piping system, including all necessary excavating and backfilling to 5'-0" outside building foundation.
   3. All floor drains, and cleanouts.
   4. Roughing in and final connection to equipment provided by Owner.
   5. All non-freeze wall hydrants, hose bibbs, and required vacuum breakers.
   6. Testing, flushing, and cleaning, for all piping systems and chlorination of the domestic water piping system.
   7. Gas piping system (if required).
   8. All water heaters.
   9. All backflow preventers.
B. Fees, permits and licenses; see Section 20 01 00, 1.02 “Work Includes”.

1.03 RELATED WORK

A. 33 00 00 “Site Piping”
B. 20 01 00 “General Provisions”
C. 20 03 00 “Materials and Methods”
D. 20 04 00 “Testing Piping Systems”
E. 20 05 00 “Valves”
F. 20 06 00 “Mechanical Identification
G. 22 07 19 “Piping Insulation”
H. 22 40 00 ”Plumbing Fixtures and Trim”
I 23 11 00 “Gas Piping Systems” (If Required)

1.04 SUBMITTALS

A. None required unless submitting for approved equals.

1.05 QUALITY ASSURANCE

A. Codes and Standards: Comply with current edition of following:
   1. Pipe and fittings shall conform to applicable ANSI, AWWA, ASTM, and USASI standards referenced for those products.
B. No plumbing fixture, special equipment, device or piping shall be installed which will provide cross connection or interconnection between distributing supply for drinking water or domestic water and polluted supply or waste so as to make possible backflow or back-siphonage of sewage or polluted water into potable water supply system.
C. Where possibility of back-siphonage exists, water supplied to fixture shall be introduced through a suitable vacuum breaker installed at code minimum distance above fixture.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Water Hammer Arrestors
   1. Souix Chief.
B. Unions (in copper pipe 2 in. and smaller)
   1. Anaconda.
   2. Mueller.
   3. Chase Brass.
C. Flanged Unions
   1. Cranelap.
   2. Van Stone.
   3. Grinnell.
D. Flange Connections
   1. Cranite.
   2. Garlock.
E. Cleanouts, Floor Drains
   1. Jay R. Smith.
   2. Wade.
   3. Josam.
   4. Zurn.
F. Hose Bibbs
   1. Chicago Faucet.
   2. Woodford.
G. Water Heater - Electric
   1. A.O. Smith.
   2. State.
   3. Bradford White.

2.02 DOMESTIC COLD AND HOT WATER PIPING SYSTEMS

A. All piping and fittings shall be manufactured in the United States. Each length of pipe and each fitting shall be marked with the manufacturer's name or trademark and the specification code to which it conforms.
B. At each location indicated on the drawings, install a water hammer arrestor. Air chambers are not acceptable.
C. All supply connections to plumbing fixtures and equipment shall be galvanized or copper piping up to face of wall and chromium plated brass piping and fittings for exposed connections. Supply piping shall have screwed connections on both ends for piping through wall. Each fixture shall have a shut off valve at the fixture.
D. Each water connection to a plumbing fixture or item of equipment having a submerged inlet or hose end attached shall be provided with a vacuum breaker to prevent back-siphonage of contaminated water into drinking supply, approved by local and state health authorities.

2.03 PIPE AND TUBE MATERIALS

A. See Part 3 Article "Pipe and Fittings Applications" for the application of the following pipe, tube, and fitting materials and joining methods required for plumbing piping systems:
   1. Hard Copper Tube: ASTM B 88, Types K, and L, water tube, drawn temper.
   2. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.

3. Hubless, Cast-Iron Soil Pipe: CISPI 301.
4. Poly(Vinyl Chloride (PVC) Plastic, DWV Pipe: ASTM D 2665, Schedule 40 or PVC-DWV "Foam Core" - ASTM-F-891; plain ends.
5. Schedule 40 Black Steel: A53 ERW, Grade B.
6. Schedule 10 Black Steel: A135 ERW or A795 ERW, Grade B.

2.04 PIPE AND TUBE FITTINGS

A. Wrought-Copper, Solder-Joint Pressure Fittings: ASME B16.22.
B. Copper Tube, Grooved-End Mechanical Fittings: ASTM B 75, copper tube and ASTM B 584 bronze castings.
C. Copper Unions: ASME B16.18, cast-copper-alloy body, hexagonal stock, with ball-and-socket joint, metal- to-metal seating surfaces, and solder-joint, threaded, or solder-joint and threaded ends.
   1. Threaded Ends: Threads conforming to ASME B1.20.1.
D. Mechanically Formed Outlets: Manufacturer's standard written procedure for forming tee-branch outlet from pipe and tube.
E. Malleable-Iron Unions: ASME B16.39, Class 150 hexagonal stock, with ball-and-socket joint, metal-to-metal bronze seating surfaces, and female threaded ends having threads conforming to ASME B1.20.1.
F. Malleable-Iron Threaded Fittings: ASME B16.39, Class 150, standard pattern, with threads conforming to ASME B1.20.1.
G. Hubless, Cast-Iron Soil Pipe Fittings: CISPI 301.
H. Poly Vinyl Chloride (PVC) Plastic, DWV Pipe Fittings: ASTM D 2665, made to ASTM D 3311; socket-type; drain, waste, and vent pipe patterns.
I. Poly Vinyl Chloride (PVC) Plastic, Schedule 40, Socket-Type Pipe Fittings: ASTM D 2466.

2.05 JOINING MATERIALS

A. Solder, brazing, and welding filler metals are specified in Part 3 of this Section.
B. Cast-Iron Soil Pipe and Fittings: ASTM C 564 neoprene rubber gaskets and lubricant.
C. Ductile-Iron Pipe and Ductile-Iron or Cast-Iron Fittings: The following materials apply:
   1. Push-On Joints: AWWA C111 rubber gaskets and lubricant.
   2. Mechanical Joints: AWWA C111 ductile-iron or gray-iron glands, high-t\strength steel bolts and nuts, and rubber gaskets.
   3. Flanged Joints: AWWA C115 ductile-iron or gray-iron pipe flanges, rubber gaskets, and high-strength steel bolts and nuts.
D. Gasket-Type couplings for Plain-End, Nonpressure System Pipe: Rubber or elastomeric compression gasket, made to match pipe inside diameter or hub and adjoining pipe outside diameter.
   1. Gaskets: ASTM C 564, rubber for cast-iron soil pipe and ASTM F 477, elastomeric seal for plastic pipe. Gaskets for dissimilar or other pipe materials shall be compatible with pipe materials being joined.
E. Couplings for Grooved-End Copper Tube and Grooved- End Copper Fittings: ASTM A 536 ductile-iron or ASTM A 47 malleable-iron housing having copper-colored enamel finish, with synthetic-rubber gasket having central- cavity, pressure-responsive design and suitable for hot water, with ASTM A 183 carbon-steel bolts and nuts.
F. Schedule 40 Black Steel Pipe and Fittings - 2" and Smaller: Screwed joints with malleable-iron threaded fittings.
G. Schedule 40 Black Steel Pipe and Fittings - 2-1/2" and Larger: Welded joints with standard weight welding fittings.
H. Couplings for Schedule 10 Black Steel Pipe 2" and Larger: ASTM A 536 ductile-iron or ASTM A 47 malleable-iron housing having orange-colored enamel finish, with synthetic-rubber gasket having central-cavity, pressure responsive design and suitable for hot water, with ASTM A 183 carbon-steel bolts and nuts.

2.06 PIPE SPECIALTIES

A. Unions in copper pipe 2 in. and smaller shall be brass solder joint unions constructed for 150 psi working pressure.
B. Unions in steel pipe 2 inch and smaller shall be screwed, malleable iron, brass to steel type (F.S. WW-U-531c Class 1) for 150 psi working pressure.
C. Unions 2-1/2 in. in size and larger shall be companion flanges. (ANSI B16.1). Flanged unions shall be over welding nipples welded into pipelines.
D. Flanges shall be forged steel flanges (ANSI B16.5) constructed for 150 psi. working pressure. Bolts for flanged joints shall be made of bolt steel and shall have clean cut threads with upset square heads and semi-flush hexagonal cold pressed nuts (F.S. WW-F406b).
E. Flange connections shall be made up with high pressure special type graphited 1/16 in. sheet packing (ANSI B16.21); or rubber, for temperature up to 200°F (F.S. HH-G-156 class A).
F. Dielectric unions suitable for dielectric service shall be provided at pipe connections between steel or cast iron piping and copper tubing.

2.07 GAS PIPING

A. See Section 23 11 00 – ”GAS PIPING SYSTEMS” for gas piping materials.

2.08 TRAPS

A. Trap all fixtures having waste connections with a water seal placed as close to fixture as possible. Provide all required traps including traps not furnished in combination with fixture and equipment.
B. Traps for lavatories or sinks shall be chrome plated 17 gauge brass unless noted otherwise on drawings.

2.09 WATER HEATER - ELECTRIC

A. Water heater shall be electric storage type, U.L. listed and in compliance with ASHRAE 90A energy efficiency requirements.
B. Tank shall be glass-lined with a working pressure of 150 psi and shall be equipped with magnesium anodes.
C. Heater shall have a steel jacket with baked enamel finish and shall be fully insulated. Heater shall be equipped with thermostat with automatic overheat safety control, immersion aquastat and single heating element. Provide ASME pressure and temperature relief valve.

PART 3 - EXECUTION

3.01 PIPE AND FITTINGS APPLICATIONS

A. The following applications are for only inside and below the building and ending at a point 5’-0” outside the perimeter building walls. For piping from 5’-0” outside the building to the utility point of connection (POC), see Section 33 00 00 “Site Piping”.
B. Use pipe, tube, fittings, and joining methods for piping systems according to the following applications:
    1. Domestic Water Distribution Piping Below Ground: Use the following:
        a. All interior domestic water piping shall be type "K" hard drawn copper tubing (SIL-FOS 2, FOS-FLO 7 or other silver brazing material). This is required for the water service line from the shut-off valve in the building to a point 5 feet outside the building.

b. All copper piping shall be installed with wrought copper fittings. Field-fabricated "T-Drill" taps are acceptable on piping 1" and larger, if silver-brazed (above-ground piping only).
c. Soft temper copper tubing may be used for small pipe in concealed spaces only to permit bends for roughing in.
d. Do not use tin-lead solder on domestic water piping. Use only approved lead-free solder or brazing material.

2. Domestic Water Distribution Piping Above Ground: Use the following:
   a. Hard copper tube, Type L; wrought-copper or cast-copper-alloy pressure fittings; copper unions; bronze flanges; and solder joints with Alloy Sn95 solder.
   b. Fittings Option: Mechanically formed outlets, brazing filler alloy, and brazed joints.
   c. Fittings Option: Grooved fittings for copper piping.
3. All Exterior Domestic Water Piping Below Ground:
   a. From 5'-0" outside the building to the utility water main, see Section 33 00 00 "Site Piping"
4. Soil, Waste, and Vent Piping Below Ground: Use either of the following:
   a. Schedule 40 poly vinyl chloride (PVC) plastic DWV pipe; PVC socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.
5. Soil, Waste, and Vent Piping Above Ground: Use either of the following:
   a. Hubless cast-iron soil pipe; hubless cast-iron soil pipe fittings; stainless-steel, cast-iron, or FM-type heavy-duty couplings for hubless cast-iron soil pipe and fittings; and hubless joints.
   b. Poly vinyl chloride (PVC) plastic DWV pipe; PVC socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.
   c. PVC piping is not permitted in air-handling ceiling spaces, use only cast-iron or ductile iron pipe in these locations. See paragraph 5.a. above for cast-iron pipe specifications.
6. All Exterior Soil and Waste Piping Below Ground:
   a. From 5'-0" outside the building to the utility sewer main: See Section 33 00 00 "Site Piping".

3.02 JOINTING OF PIPING

A. See section 20 03 00 - "MATERIALS AND METHODS", Part 3 - Execution.

3.03 EXPANSION AND CONTRACTION

A. See section 20 03 00 - "MATERIALS AND METHODS", Part 3 - Execution.

3.04 INSTALLATION OF PIPING

A. See section 20 03 00 - "MATERIALS AND METHODS", Part 3 Execution.

3.05 DISINFECTION OF DOMESTIC WATER SYSTEMS WITHIN THE BUILDING

A. See Section 20 02 00 - "Contract Close-out & Commissioning".

3.06 FLUSHING WATER PIPING

A. See Section 20 02 00 - "Contract Close-out & Commissioning".

3.07 SOIL, WASTE, AND VENT SYSTEMS

A. Size of soil, waste and vent stacks and branch piping shall be as indicated on the drawings, but in no case less than required by the provisions of the applicable codes.

B. Where possible, sewers and branches shall pitch down 1/4" per foot, but not less than 1%. Branches, arms and connections, shall be sloped 1/4" in 1'-0" where possible and provide with adequate hangers as specified elsewhere.
C. Interior underground, underfloor or on-ground piping, shall be continuously bedded with depressions for hubs on compacted sand or gravel to undisturbed soil for a minimum depth of 6" under pipe.
D. Connections to soil, waste and drain stacks shall be at 45 degrees; those to vent stacks may be at 45 degrees or 90 degrees except vent stacks shall be connected at 45 degrees to soil, waste or drain stack.
E. Connections to stacks and sewers shall be arranged so that operation of any fixture will not cause fluctuation of water level in traps of other fixtures.
F. Interior downspout shall be connected to roof drains; and provided with ample offsets or expansion joints below or integral with roof drains.
G. All thread joints shall be made up with red lead applied to male thread only. Threads exposed after joints are made up shall be painted with red lead to prevent rust. Teflon tape may be used at Contractor's option.
H. Junctions of screwed pipe to bell and spigot cast iron shall be made with ring or half coupling screwed to end of galvanized pipe to form spigot end.
I. Junctions in all drainage lines shall be made with "Y" branches or 1/8" bends, unless closeness of connection prevents it, in which case, where direction of flow is from horizontal to vertical, sanitary tees may be used upon the approval of the Engineer's superintendent.
J. Compression joint installation for cast iron soil pipe:
    1. Fold and insert the one piece neoprene rubber gas-ket into the hub which has been properly cleaned.
    2. Apply gasket lubricant to the spigot and inside of the gasket.
    3. Push, draw or drive the spigot into the gasketed hub with a pulling tool or suitable device.
K. Do not install pvc piping in air-handling ceiling spaces.

3.08 STACKS

A. Stacks shall impose no stress or strain on branches or connections, be plumb and straight and supported at base with 18" x 18" concrete or brick pier to undisturbed soil.
B. Unless otherwise noted, soil, waste, drain, and vent stacks shall be concealed in walls, pipe chases, pipe shafts, etc., with cleanouts extended to accessible locations.

3.09 VENTING

A. All plumbing fixtures shall be vented to prevent siphoning of traps. Venting shown on plans is minimum required and vents and vent stacks shall be increased in size and/or number and relocated as required, to prevent trap siphoning and to comply with applicable codes, ordinances, statutes, regulations of all governmental bodies, without increase in contract price.
B. A vent stack shall be run parallel to each soil or waste stack to receive branch vents from fixtures and traps. Each vent stack shall originate from a soil or waste pipe at its base. Each soil or waste stack and each vent stack shall be carried through the roof. Where possible, soil, waste, or vent stacks shall be combined before passing through the roof so as to have as few roof openings as possible. Pipes running close to walls shall be offset away from such walls before passing through the roof to permit proper flashing. All vent pipes passing through the roof shall be sized as indicated on the drawings, and shall extend 12" above roof.
C. All horizontal vent pipes shall grade up to meet the requirements of the local and state codes.
D. Vent risers and branches shall connect to the soil and waste risers above waste of highest fixture.

3.10 ROOF FLASHINGS

A. All plumbing piping passing through the roof membrane shall be flashed under the roofing specifications.
B. Contractor shall insure all such items are properly flashed and made watertight.

3.11 CLEANOUTS

A. Cleanouts for indoor sanitary and storm drainage systems shall be installed not more than 50 feet apart, including the developed length of the cleanout pipe, in all horizontal drainage lines. A cleanout shall be provided at, or no more than two feet above the base of each vertical soil or waste stack and storm water conductor. Cleanouts shall be installed at such other points as may be necessary for adequate rodding out of drainage piping systems. Cleanouts shall be set flush with floor or wall surfaces.

3.12 INSTALLATION OF WATER HEATER

A. General: Install water heater in accordance with manufacturer's installation instructions. Install unit plumb and level, firmly anchored in location indicated, and maintain manufacturer's recommended clearances.
B. Support: Orient so controls and devices needing service and maintenance have adequate access.

END OF SECTION

SECTION 22 07 19

PIPING INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings.
   2. General Conditions.

1.02 WORK INCLUDES

A. Provide all materials, equipment, apparatus, services, methods, tools, labor, transportation, etc., required to complete the insulation of the piping systems as specified.
B. Cold piping requiring insulation:
   1. Domestic cold water piping.
C. Hot piping requiring insulation:
   1. Domestic hot water piping.

1.03 CODES AND STANDARDS

A. The Fire Hazard Classification of the materials herein specified shall be listed and inspected by Underwriters Laboratories, Inc. The flame spread rating, fuel contributed and smoke developed as shown in the listing shall be determined by ASTM E84 "Method of Tests for Surface Burning Characteristics of Building Materials". Each product shall bear the label of Underwriters' Laboratories. All products used on this project shall be classified as "non- combustible" in the Building Code or NFPA National Fire Code.

1.04 DEFINITION

A. The term "piping" as used in this section of the specifications shall include pipe, fittings, valves, specialties, strainers, flanges, unions, runouts, final connections, etc.

1.05 PROTECTION

A. Protect insulation against dirt, water, chemical or mechanical damage before, during and after installation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Insulation
B. Adhesives, Lagging, and Sealers
   1. Certain-Teed/Saint Gobain Corp.
   2. Benjamin Foster.
   3. Owens-Corning Fiberglass Corp.
   4. Insul-Coustic.
   5. Manville Corp.
   6. Chicago Mastic Co.
   7. Knauf Fiberglass.
C. PVC Premolded Fitting , and PVC JacketingValve Covers

D. Closed Cell Elastomeric

1. Insul-Coustic Corp.
2. Armstrong.
3. Zeston, Inc.
4. Halstead Industrial Products.
5. Certain-Teed/Saint Gobain Corp.

E. Cellular Glass Insulation
1. P.I.C. Plastics
2. Pittsburg Corning Corporation (PCC)
3. Ceel-Co.
4. Johns-Manville

2.02 COLD AND HOT WATER PIPING AND EQUIPMENT INSULATION

A. "Fiberglass": Minimum 3-1/2 pounds per cubic foot density, fiberglass factory molded or spun pipe insulation with a "K" factor of 0.24 at 75°F. mean temperature and a factory applied fire retardant self sealing vapor barrier "ASJ" jacket.
B. "Armaflex": At the Contractor's option (for interior piping only), 25/50-rated, closed-cell elastomeric thermal insulation equal to "Armstrong - Armaflex" may be used. Install in full accordance with the manufacturer's recommendations, including provisions for cementing joints and insulating fittings.

2.06 ADHESIVES, LAGGING, AND SEALERS

A. Adhesives, lagging and sealers shall be as recommended by the insulation manufacturers.
B. Jacket (PVC) adhesive, lagging and sealers shall be as recommended by the manufacturers. Jackets (PVC) shall be sealed with an all white welding adhesive on all longitudinal and circumferal seams.

2.05 PREMOLDED FITTING AND VALVE COVERS

A. Pre-molded fitting and valve covers shall be factory made of one piece polyvinyl chloride - 30 mil minimum. Covers shall overlap the adjoining pipe insulation.

PART 3 - EXECUTION

3.01 PREPARATION/GENERAL REQUIREMENTS

A. Clean thoroughly to remove rust, plaster, and dirt before insulation is applied. Insulation shall be applied on clean dry surfaces only. Piping shall have been tested and approved before covering.
B. Provide saddles, shields, metal protectors and other appurtenances necessary to prevent crushing of insulation at hangers, rollers, supports and anchors. Provide rigid insulation blocks at saddles.

3.02 PIPING INSULATION

A. Insulate all above-ground piping systems, except gas piping and sprinkler piping, with piping insulation of specified type and thickness:

Type of System or Pipe

1. Domestic cold water piping, domestic hot water piping, tempered water piping---

Insulation Thickness	
Pipes less than 1”	Pipes 1” to less than 4”
------- 1” thick	----------1-½” thick

B. Runouts are individual branches to units/fixtures, not exceeding 12’-0” in length.

C. Installation of insulation shall be as follows:

1. Pipe: Butt all joints firmly together. Cover joints with 3" butt strips. Smoothly secure all jacket laps and joints strips with adhesive. Self-sealing laps shall be applied according to manufacturer’s recommendations. Ends of pipe insulation shall be sealed off with a vapor barrier coating at all fittings and valves and at intervals of 21 feet on continuous runs.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings.
   2. General Conditions.

1.02 WORK INCLUDES

A. All plumbing fixtures, including supply and waste fittings, stops, trim, brackets, carriers, etc. required for complete installation.
B. All piping, fittings, valves, trim, stops, etc. specified, required for rough-in and final connection to Equipment furnished by Owner.

1.03 SUBMITTALS

A. None required. Contractor shall select from and install only the manufacturers listed in paragraph 2.01-ACCEPTABLE MANUFACTURERS.

1.04 QUALITY ASSURANCE

A. Codes and Standards: Comply with current edition of the following:
   1. Vitreous china fixture, NBS-CS-CS20.
   2. Plumbing fixtures (land use), FS-WW-P-541.
   3. Enameled iron fixtures, NBS-CS-CS77.
B. No plumbing fixture, special equipment, device or piping shall be installed which will provide cross connection or interconnection between potable water system and polluted water or sewage system so as to make possible backflow or back siphonage of sewage or polluted water into the potable water supply system.
C. Where possibility of back siphonage exists, water supplied to fixture shall be introduced through a suitable vacuum breaker installed at code minimum height.
D. The water system of electric water coolers shall be manufactured of pure copper components only (completely lead free material). The water ways shall not contain any internal plating or coatings. All joints shall be made using silver solder brazing alloy. No lead or soft solder shall be used.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

Contractor shall select from and install only the manufacturers listed below.

A. Brass
   1. American Standard.
   2. Moen Commercial.
   3. Chicago Faucet.
   4. T & S Brass.
B. Drench Shower and Eyewash Units
   1. Bradley.
   2. Haws.
C. Electric Water Coolers
   1. Elkay.

2. Halsey-Taylor.
3. Oasis.

D. Mop Service Basins
1. Fiat.
2. Williams.

E. Seats
1. Beneke.
2. Olsonite.
3. Church.

F. Sinks
1. Elkay.
2. Moen.
3. Just.

G. Valves
1. Ames.
2. Keystone.
3. Apollo.
4. Magnetrol.
5. ASCO.
6. Stockham.
7. Febco.
8. Watts.

2.02 PLUMBING FIXTURES AND TRIM

A. All fixtures shall be vitreous china, acid resisting enamel cast iron or stainless steel as specified complete with brass piping, fittings, supplies, stops, flush pipes, trim and brackets. Exposed brass piping and fittings shall be chrome plated.
B. Where manufacturer's numbers for a complete assembly are called for, such assembly shall be modified as specified in this section.
C. Fixtures shall have water, drain, waste, soil, vent, and other connections as called for. Each water connection fixture shall have an air gap or vacuum breaker as required by local and state departments of health. Water connection sizes are minimum and must be increased to correspond to manufacturer's standards.
D. Carriers for wall hung fixtures shall be selected for the particular fixture, piping arrangement and building conditions prevailing at each location.
E. Where lavatories without legs are specified, each shall be supported on a chair type carrier with concealed arms.
F. Fixture Carriers:
1. Lavatories, urinals, and wall-mounted water closets shall be supported by floor-mounted carriers. Urinal carriers may be omitted where urinals are mounted on masonry walls 6" thick or more.

2.03 WATER CLOSET-HANDICAPPED

A. For water closets in stalls or rooms intended to be accessible to the handicapped, the ADA requires the flush handle to be located on the wide side of the stall. For tank-type water closets, furnish units with the handle on the proper side of the tank. For flush valve water closets, install the flush valve with the handle on the proper side.

PART 3 - EXECUTION

3.01 PLUMBING FIXTURES AND TRIM

A. All fixtures shall be set firm and true, connected to all piping services ready for use.
B. Fixtures shall be installed per manufacturer’s recommendations.

C. Fixtures intended to meet ADA requirements shall be installed at recommended heights and with appropriate clearances.
D. Sinks and lavatories for handicapped access shall be installed with offset tailpieces and insulated traps.

3.02 OWNER FURNISHED EQUIPMENT

A. Provide rough-ins and final connections to all Owner furnished equipment including shut off valves, piping, traps, etc. necessary to connect up equipment after it has be installed in place. See also Section 20 07 00 “Existing Systems and Owner Furnished Equipment”.

END OF SECTION

SECTION 23 05 93

TESTING ADJUSTING & BALANCING OF HVAC SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings.
   2. General Conditions.

1.02 WORK INCLUDES

A. HVAC systems shall be tested and balanced by the HVAC Contractor.

PART 2 - PRODUCTS - (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 TESTING, ADJUSTING, AND BALANCING OF HVAC

A. HVAC systems shall be tested and balanced by the HVAC Contractor.
B. Certified testing and balancing is not required on this project. The Contractor shall measure all air flows and record his measurements on Test and Balancing Forms similar to those at the end of this section. Any necessary adjustments and/or ductwork modifications necessary to achieve the specified air flows shall be made by the Contractor promptly at no additional cost to the Owner. See sample “NEBB Sample Test and Balancing Forms” at the end of this section.
C. Flowrates of outside air shall be reported for each mechanical unit.
D. The HVAC Contractor shall perform the balancing and testing of the HVAC in accordance with the procedures of AABC or NEBB to analyze, balance, adjust and test air distribution systems.
E. The HVAC Contractor shall put all heating, ventilating and air conditioning systems and equipment into operation and shall continue the operation of same during each working day of testing and balancing and shall place the automatic temperature control system in satisfactory operation before testing and balancing.
F. The Contractor shall replace all air filters with new filters prior to the start of testing and balancing activity.

CERTIFIED TEST, ADJUST, AND BALANCE REPORT

DATE:_____

PROJECT:

NAME_____

ADDRESS_____

_____

DESIGN ENGINEER:

NAME_____

HVAC CONTRACTOR:

NAME_____

NEBB TAB FIRM:

NAME_____

ADDRESS_____

_____

TAB CERTIFICATION NUMBER: _____

AIR HANDLING UNIT TEST REPORT
(Packaged/Unitary Belt Drive)

PROJECT _____ SYSTEM/UNIT _____

LOCATION _____ DATE _____

UNIT DATA	
Unit Designation	
Manufacturer	
Model Number	
Serial Number	

MOTOR DATA	DESIGN	ACTUAL
HP (Kw)		
RPM		
Rated Volts		
Rated Amps		
Phase		
Operating Hz		
Service Factor		
Operating Volts		
Operating Amps		

FAN DATA	DESIGN	ACTUAL
Supply Air CFM (L/s)		
Outside Air CFM (L/s)		
Return Air CFM (L/s)		
Total Outlet Air CFM (L/s)		
External Discharge S.P. in. (Pa)		
External Suction S.P. in. (Pa)		
External S.P. in. (Pa)		
Fan RPM		

OTHER DATA	DESIGN	ACTUAL
Motor Sheave OD		
Motor Sheave Bore		
Fan Sheave OD		
Fan Sheave Bore		
Sheave Center Distance		
Number of Belts		
Belt Size		

REMARKS:

TEST DATE: _____

READINGS BY: _____

AIR HANDLING UNIT TEST REPORT
(Packaged/Unitary Direct Drive)

PROJECT _____ SYSTEM/UNIT _____

LOCATION _____ DATE _____

UNIT DATA	
Unit Designation	
Manufacturer	
Model Number	
Serial Number	

MOTOR DATA	DESIGN	ACTUAL
HP (Kw)		
RPM		
Rated Volts		
Rated Amps		
r Phase		
Operating Hz		
Service Factor		
Operating Volts		
Operating Amps		

FAN DATA	DESIGN	ACTUAL
Supply Air CFM (L/s)		
Outside Air CFM (L/s)		
Return Air CFM (L/s)		
Total Outlet Air CFM (L/s)		
External Discharge S.P. in. (Pa)		
External Suction S.P. in. (Pa)		
Fan RPM		

OTHER DATA	DESIGN	ACTUAL

REMARKS:

TEST DATE: _____

READINGS BY: _____

AIR OUTLET TEST REPORT

PROJECT _____ SYSTEM DESIGNATION_____

OUTLET MANUFACTURER _____ TEST APPARATUS_____

AREA SERVED	OUTLET				DESIGN		FINAL	
	NO	TYPE	SIZE	AK*	VEL	FLOW	VEL	FLOW

*** NOTE: If AK = 1.00, velocity information and measurements are not required.**

REMARKS:

TEST DATE _____

READINGS BY _____

 National Environmental Balancing Bureau Page ____ of ____

END OF SECTION

SECTION 23 11 00

GAS PIPING SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings.
   2. General Conditions.
   3. Refer to Section 01 11 00-Summary of Work.

1.02 WORK INCLUDES

A. This Section includes piping, specialties, and accessories for gas systems within the building and outdoors.
B. Fees, permits and licenses; see Section 20 01 00, 1.02 “Work Includes”.

1.03 RELATED WORK

A. Section 20 03 00 - "MATERIALS AND METHODS"

1.04 SUBMITTALS

A. No submittals required when using specified materials. Otherwise, comply with Section 26 00 10 "SUBMITTALS" and “SUBSTITUTION OF EQUIPMENT”.
B. Upon request test reports specified in "Field Quality Control" Article in Part 3, Section 23 11 00.

1.05 QUALITY ASSURANCE

A. Comply with NFPA 54 "National Fuel Gas Code" for gas piping materials and components; installations; and inspection, testing, and purging.
B. Comply with the International Mechanical Code, latest edition, for all fuel gas piping installation.
C. Provide listing/approval stamp, label, or other marking on equipment made to specified standards.
D. Listing and Labeling: Provide equipment and accessories that are listed and labeled.

1.06 DEFINITIONS

A. Low-Pressure Gas Piping System: Operating at pressure of 7" W.C. or 1/2 psi, or as indicated on drawings.
B. Medium-Pressure Gas Piping System: Operating at a pressure of above ½ psi to 10 psi.
C. Gas Service: Pipe from the street main or LP gas storage tank to point of delivery for the building being served. Piping includes gas service piping, gas valve, service pressure regulator.
D. Gas Piping System: Pipe within the building that conveys gas from point of delivery to points of usage. Piping includes dielectric fitting and gas valve immediately downstream from point of delivery.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Gas Pressure Regulators
   1. American Meter Co.
   2. Jordan Valve Div., Richards Industries, Inc.
   3. Fisher Controls.
   4. Lancaster by National Meter Parts, Inc.
   5. Gas Energy, Inc., Subsid., Brooklyn Union Gas.
   6. Maxitrol Co.
B. Low-Pressure Gas Stops
   1. Hammond Valve Corp.
   2. Lancaster by National Meter Parts, Inc.
   3. Jomar International, Ltd.
   4. Rockford-Eclipse Div., Eclipse, Inc.
C. Gas Valves, 2 Inches and Smaller
   1. Homestead by Olson Technologies, Inc.
   2. Mueller Co., A Grinnell Co.
   3. Lancaster by National Meter Parts, Inc.
   4. Mueller Steam Specialty Div., Core Industries, Inc.
   5. Lunkenheimer Co.
   6. Nordstrum Valves, Inc.
   7. Milliken Valve Co., Inc.
   8. Rockford-Eclipse Div., Eclipse, Inc.
D. CSST (Corrugated stainless steel tubing)
   1. Titeflex.

2.02 PIPES AND TUBES

A. Refer to "Pipe Applications" Article in Part 3 for identification of systems where the following materials are used.
B. Steel Pipe: ASTM A 53, Type E, Electric-Resistance Welded or Type S, Seamless, Grade B, Schedule 40, black.
C. Plastic Pipe: ASTM D-2513, polyethylene pipe, SR-11, labeled for gas system use.
D. CSST: Corrugated stainless steel tubing with polyethylene jacketing; 304 stainless steel.

2.03 PIPE AND TUBE FITTINGS

A. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threads conforming to ASME B1.20.1.
B. Unions: ASME B16.39, Class 150, black malleable iron; female pattern; brass-to-iron seat; ground joint.
C. Steel Fittings: ASME B16.9, wrought steel, butt-welding type; and ASME B16.11, forged steel.
D. Transition Fittings: Type, material, and end connections to match piping being joined.
E. ESST Mechanical Fittings: Type, material, and end connections to match piping being joined.

2.04 JOINING MATERIALS

A. Common Joining Materials: Refer to Section 20 03 00- "MATERIALS AND METHODS" for joining materials not included in this Section.

2.05 VALVES

A. Manual Valves: Conform to standards listed, or where appropriate, valves according to ANSI Z21.15 and ANSI Z21.15a.
B. Low-Pressure Gas Stops, 2 Inches and Smaller: AGA- certified design for 2 psig or less gas, with AGA stamp, plug or ball type, bronze body and bronze plug or chrome-plated

brass ball. Include flat head, square head, or lever handle and threaded ends.

C. Gas Valves, 2-1/2 Inches and Larger: MSS SP-78, Class 125 or 175 WOG, lubricated plug type, semi steel body, wrench operated, with flanged ends.

2.06 PIPING SPECIALTIES

A. Gas Pressure Regulators: comply with ANSI Z21.18. ,For appliance regulators or ANSI/U.L. 144 for second-stage regulators. (This applies only to regulators furnished and installed as part of the project, and not regulations furnished by others).
B. Flexible Connectors: ANSI Z21.24 or ANSI Z21.24a, copper alloy.

PART 3 - PRODUCTS

3.01 PREPARATION

A. Precautions: Close equipment shutoff valves before turning off gas to the premises or section of piping. Perform leakage test as specified in Section 20 02 00 - “Contract, Closeout & Commissioning” “Field Quality Control" Article to determine that all equipment is turned off in the piping section to be affected.
B. Comply with NFPA 54 "Prevention of Accidental Ignition."

3.02 SERVICE ENTRANCE PIPING

A. Extend gas piping and connect to the gas service piping in location and size indicated for gas service entrance to building.

3.03 PIPE APPLICATIONS

A. Flanges, unions, transition and special fittings, and valves with pressure ratings same or higher than system pressure rating may be used in applications below, except where specified otherwise.
B. Low-Pressure Gas Systems, above Ground within or outside Building: Use the following:
   1. 2 Inches and Smaller: Steel pipe, malleable-iron, threaded fittings, and threaded joints.
   2. 2-1/2 Inches and Larger: Steel pipe, butt-welding fittings, and welded joints.
C. Low-pressure gas systems, below ground within the buildings: Use the following:
   1. 1 inch and smaller: CSST tubing inside a schedule 40 PVC plastic sleeve.
D. Medium pressure (greater than ½ PSI up to 10 PSI) Gas Systems, Below Ground outside the buildings:
   1. 1/2 “ and larger: Polyethylene, ASTM D2513.
E. Medium pressure (greater than ½ PSI up to 10 PSI) gas systems above ground within the building and/or on the roof:
   1. Steel pipe, butt-welding fittings, welded joints

3.04 VALVE APPLICATIONS

A. Use low-pressure gas stops, tapered plug or ball type, for shutoff to appliances with 2-inch or smaller low- pressure gas supply.
B. Use gas valves for shutoff to appliances. Where the appliance input exceeds one million BTUH, use a lubricated plug valve.
C. Use gas valves of sizes indicated for other gas shut-off applications where indicated.

3.05 JOINT CONSTRUCTION

A. For steel pipe, refer to Section 20 03 00 - "MATERIALS AND METHODS" for basic piping joint construction.

B. Use materials suitable for gas service.
C. Joints and connections in underground polyethylene gas piping shall be made by butt-fused heat fusion methods, only by qualified personnel.

3.06 PIPING INSTALLATIONS

A. Refer to Section 20 03 00 - "MATERIALS AND METHODS" for basic piping installation requirements.
B. Above-Ceiling Locations: Gas piping may be installed in accessible above-ceiling spaces (subject to approval of the authority having jurisdiction), whether or not such spaces are used as a plenum. Do not locate valves or unions in such spaces.
   1. Prohibited Locations: Do not install gas piping in or through circulating air ducts, chimneys or gas vents (flues), or ducts.
   2. Concealed locations: Gas piping may be installed in concealed (inaccessible) locations as permitted by the International Mechanical Code only if all joints in the piping are welded.
C. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of gas meters. Locate where readily accessible to permit cleaning and emptying. Do not install where condensate would be subject to freezing.
   1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.
D. Install gas piping at a uniform grade of 1/4 inch in 15 feet, upward toward risers. Install piping upward from the service point to equipment.
E. Connect branch piping from top or side (not bottom) of horizontal piping.
F. Install unions in pipes 2 inches and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.
G. Anchor piping to ensure proper direction of piping expansion and contraction. Install expansion joints, expansion loops, and pipe guides as indicated.
H. Install vent of gas pressure regulators pointing down, in accordance with manufacturer's instructions.

3.07 HANGER AND SUPPORT INSTALLATION

A. Refer to Section 20 03 00 - "MATERIALS AND METHODS" for hanger and support devices.
B. Install hangers for horizontal piping at 10' on centers or otherwise as called for on the drawings.
C. Do Not support gas piping by extending it to stand on the floor.
D. Install vent of gas pressure regulators pointing down, in accordance with manufacturer's instructions.

3.08 VALVE INSTALLATION

A. Install valves in accessible locations, protected from physical damage.
B. Install a gas valve upstream of each gas pressure regulator.

3.09 CONNECTIONS

A. Install gas piping near gas-utilizing equipment and appliances so as to allow servicing and maintenance.
B. Connect gas piping to gas-utilizing equipment and appliances with shutoff valves and unions. Make connections downstream of valves and unions, with flexible connectors where indicated.

3.10 TERMINAL EQUIPMENT CONNECTIONS

A. Install a gas valve upstream and within 6 feet of each gas-utilizing appliance. Install a union or flanged connection downstream from the valve to permit removal of controls.
B. Sediment Traps: Install as described above, as close as practical to gas appliance inlets, downstream of the shut-off valve for the appliance.

3.11 ELECTRICAL BONDING AND GROUNDING

A. Install above-ground portions of gas piping systems that are upstream from equipment shutoff valves, electrically continuous and bonded to a grounding electrode according to NFPA 70.
B. Do not use gas piping as a grounding electrode.

3.12 FIELD QUALITY CONTROL

A. See Section 20 02 00- “Contract Close-out & Commissioning”.

3.13 ADJUSTING

A. Adjust controls and safety devices. Replace damaged and malfunctioning controls and safety devices.

END OF SECTION

SECTION 23 30 00

AIR DISTRIBUTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings.
   2. General Conditions.

1.02 WORK INCLUDES

A. Provide all ductwork with extractors, dampers, turning vanes, hangers, etc., as indicated on the drawings, as specified and as required to complete this portion of the work in conjunction with the air distribution system.
B. Provide factory fabricated units, exhaust fans, wall louvers, access doors, fire dampers, security grilles, grilles, registers, diffusers, etc., as specified and as shown on the drawings.
C. Provide control dampers, fire dampers, and balancing dampers as shown on drawings or as required for proper duct system operation.

1.03 SUBMITTALS

A. No submittals required when using specified materials, otherwise: Submit shop drawings in accordance with Section 20 01 00 - "GENERAL PROVISIONS" for the following equipment:
   1. Registers, grilles and diffusers.
   2. Duct liner.
   2. Fire dampers.
   4. Sealing materials.
   3. Exhaust fans.
   6. Fire stopping materials.
B. NFPA Compliance: Comply with the following:
   1. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," except as indicated otherwise.

1.04 QUALITY ASSURANCE

A. Codes and Standards: Duct lining materials, separately and in combination shall be UL listed and shall have maximum fire hazard classifications of flame spread 25 and smoke development 50.
B. Units shall be factory assembled and tested. Fan ratings to be based on current AMCA Standards.
C. Roof exhaust fans shall bear AMCA seal.
D. Fire dampers shall conform to requirements of National Fire Protection Association and the state and local fire marshal.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Grilles and Registers
   1. Anemostat.

2. Titus.
3. Carnes.
4. Tuttle and Bailey.
5. Price

B. Louvers and Dampers
1. Airline.
2. Louvers & Dampers Co.
3. Carnes.
4. Nailor.
5. Greenheck.

C. Flexible Ducts
1. Atco.
2. Wiremold.
3. Thermoflex.

D. Acoustical Duct Lining
1. Certain-Teed "ToughGard_R_ Duct Liner".
2. Owens-Corning "QuietR Roatary Duct Liner".
3. Johns-Manville "Linacoustic RC Duct Liner".

E. Duct Wrap Insulation
1. Certain-Teed “SoftTouch Duct Wrap.”
2. Owens-Corning “SoftR Duct Wrap.”
3. Johns-Manville “Microlite EQ Duct Wrap.”

F. Branch Duct Fittings
1. Buckley #BMD. (Bellmouth type for rectangular duct)
2. Air-Tite #CATDR (Commercial saddle type for round duct)

G. Fire Dampers
1. Air Balance.
2. Ruskin.
3. Cesco.
4. Vent Products.

H. Air Filters
1. Airguard Industries - DP-40-2.
2. Continental Filters Company - Areopleat.
3. American Air Filter - AM AIR 300X.
4. Farr - 30/30.

I. Fans
1. Cook
2. Greenheck
3. Carnes
4. Penn

2.02 DUCTS - GENERAL

A. Ductwork, unless otherwise shown, shall be galvanized steel sheets (F.S. QQ-S-775 Type I, Class e) or aluminum alloy 3003 (F.S. QQ-A-250/2c Temper H-14).

B. Exposed ducts that are noted as painted, use "Paint-Grip" galvanized steel. Ducts, unless otherwise approved by the Engineer, shall conform accurately to the sizes indicated on the drawings and shall be straight and smooth on the inside, with joints neatly finished. Ducts shall be securely anchored to the building in an approved manner and shall be installed so as to be completely free from vibration under all conditions of operation.

C. Turning vanes shall be installed in all elbows, in both supply and return ducts. Do not install any radiused elbows (applies to fabricated rectangular duct only). Sheet metal ducts shall be properly braced and reinforced. Specific ducts require sealing of joints. See paragraph “Duct Sealing”

2.03 DUCTS - RECTANGULAR

A. Rectangular ducts shall be lined as per Section 23 30 00, 2.08 “Acoustical Duct Lining”.
B. Ducts (unless noted otherwise on drawings) shall be constructed in accordance with SMANCA low pressure duct construction standards for 1" w.c. pressure. For convenience, they may be constructed per the following table:

DIMENSION	GAUGE	REINFORCING	MAX SPACING
0" - 12"	26	None	
13" - 26"	26	1" standing "S"	5'0"
27" - 42"	24	1" standing "S"	4'0"
43" - 60"	22	1" x 1" x ⅛" angle	2'6"

Install reinforcing on four sides of duct where depth exceeds 16"; install on two sides only where duct depth is 16" or less.

C. All rectangular duct with dimensions over 12" shall be cross-broken to prevent "oil-canning."
D. At the Contractor's option, the rectangular ducts may be assembled with transverse joints made with the "Ductmate" system or an approved equal. If used, the Ductmate joints shall be assembled with corners, cleats and gasket tape per the manufacturer's instructions. Additional duct sealant is not required with the “Duct Mate” system. Duct metal gauges may be reduced per the ductmate recommendations.

2.04 DUCTS - ROUND

A. Round low-pressure ductwork shall be galvanized steel "Snaplock" pipe, insulated as per Section 23 30 00, 2.09 “Duct Wrap Insulation”. Tape all transverse joints. See also “DUCT SEALING.”

Round ducts:
1. This section supersedes the latest SMACNA standards.

Construct round ducts from steel sheets of the following U.S. gauge thickness, using the seam method shown:

INNER DIAMETER DIMENSION	GAUGE	SEAM TYPE
3” to 8”	28 gauge	Longitudinal
9” through 26”	26 gauge	Longitudinal

2.05 EXTERIOR DUCT

A. Exterior duct shall be:
   1. Minimum 22 ga. Galvanized sheet metal with 1” x 1” x 1/8” angle reinforcing at maximum spacing of 2’6” centers.
   2. Lined with 1” thick, 1 ½ lb./cw. ft. density acoustical duct lining, unless specified otherwise on drawings.
   3. Insulate duct with Armacell closed cell foam insulation (2” thick) with “Armacell White” jacket and matching tape.

2.06 FLEX DUCT

A. UL listed Class I preinsulated flex duct (sheathed in a seamless vinyl jacket) may be

used, subject to approval of submittals. It shall be used only for runouts to supply or return diffusers and only in lengths of 8' or less. Provide nylon, self-extinguishing, locking clamps to secure flexible duct.

2.07 EXHAUST DUCTS

A. Exhaust ducts shall be round or rectangular galvanized steel as shown on the plans. Flexible duct is not permitted. Do not line or insulate exhaust ducts, except as called for on the drawings and as specified below.

2.08 DUCT SEALING

A. All transverse duct joints shall be sealed during or after assembly with "United" “Uni-Seal” (synthetic elastomeric duct sealer or equal. No leakage shall be detectable when the duct is pressurized to 1" water column above the maximum working pressure to be experienced by the system. Un-Sealed duct joints are not acceptable.
B. Duct tape, if used, shall be equal to “Venture Tape” #1502, silver. Metalized, polyethylene cloth tape with pressure sensitive adhesive. Minimum 10 mil. Thickness.
C. See PART 3 -EXECUTION, “DUCT SEALING”, for application.

2.09 ACOUSTICAL DUCT LINING (RECTANGULAR DUCTS)

A. Acoustical duct lining shall be 2" thick, minimum 1-½ lb./cu. ft. density. Minimum R-Value of 8.0.

2.10 DUCT WRAP INSULATION (ROUND DUCTS)

A. Duct wrap insulation shall be 2" thick, 1-½ lb./cu. ft. density, fiber glass type, with foil scrim kraft facing. The insulation shall have a minimum R-value of 8.0 @ 75°F. mean temperature.
B. FLEXIBLE CONNECTIONS: Where sheet metal connections are made to fan or where ducts of dissimilar metal are connected, a noncombustible flexible connection of approved noncombustible material approximately 6 inches in width, conforming to ASTM Specification D1571-67, shall be installed.

2.11 INSPECTION AND ACCESS DOORS

A. Doors shall be 15" x 15" unless otherwise indicated. Where size of duct will not accommodate this size, the doors shall be made as large as possible without weakening duct. Man-size access doors shall be rigid, and shall be provided with airtight neoprene gaskets. Doors shall be provided with galvanized piano hinges and two Camlock brass fasteners. Man-size access doors shall be provided with door handles operable from both sides. Doors in insulated ducts shall be of the insulated type.

2.12 HANGERS AND SUPPORTS FOR DUCTS

A. Install rigid round, rectangular, and flat oval metal duct with support systems indicated in SMACNA "HVAC Duct Construction Standards," Tables 4-1 through 4-3 and Figures 4-1 through 4-8.
B. Support horizontal ducts within 2 feet of each elbow and within 4 feet of each branch intersection.
C. Support vertical ducts at a maximum interval of 16 feet and at each floor.
D. Upper attachments to structures shall have an allowable load not exceeding ¼ of the failure (proof test) load but are not limited to the specific methods indicated.

2.13 REGISTERS AND GRILLES

A. Registers and grilles shall be of the size indicated on the drawings. Registers and grilles shall have vanes slanted to prevent direct sight into grille.
B. Anything visible through grille in customer contact and office areas shall be painted flat black.
C. Provide anti-smudge rings on all ceiling diffuser located in gypsum board and lay-in ceilings. Where ceiling height permits.

2.14 BELLMOUTH FITTINGS

A. Supply air branch duct bellmouth fittings with dampers shall be of the locking quadrant type and shall clearly indicate damper position. Extension rods shall be installed where necessary. Each branch duct shall be provided with a bellmouth fitting damper. Bellmouths shall be heavy-duty galvanized steel with neoprene gasket and low-leak 26 gauge galvanized damper.
B. "Spin-in" fittings or job-fabricated units are not acceptable for supply air ducts.

2.15 FIRE DAMPERS

A. Fire dampers shall have the following features:
   1. UL #555 listed and labeled to close, if activated, even if air distribution system is in operation.
   2. One piece steel frame.
   3. Steel blades with interlocking joints. Blades in airstream.
   4. Stainless steel negator closure spring if required for horizontal mounting.
   5. 160 degree F. U.L. listed fusible links and blade locks.

2.16 FANS

A. Inline Exhaust:
   1. Ceiling ventilator shall be direct drive, forward curved, centrifugal blower type. Fan wheel shall be constructed of galvanized steel and shall be dynamically balanced. The housing shall be constructed of galvanized steel and acoustically insulated for quiet operation. An integral aluminum backdraft damper shall be standard. Blower and motor assembly shall be easily removable from the housing without disturbing the ductwork. The motor shall be permanently lubricated with built-in thermal overload protection and shall be factory tested prior to shipment. The unit shall be supplied with an internal wiring box and receptacle. The discharge position shall be adjustable by moving interchangeable panels supplied with removable fasteners.
   2. Ceiling ventilators shall be certified and licensed to bear the AMCA Seal for Air and Sound Performance. Ceiling ventilator performance shall be based on tests and procedures performed in accordance with AMCA publication 211 and comply with the requirements of the AMCA Certified Ratings Program. Fan sound power level ratings shall be based on tests and procedures performed in accordance with AMCA publication 311 and comply with the requirements of the AMCA Certified Ratings Program. Ceiling ventilators shall be UL Listed.

2.17 AIR FILTERS

A. Air filters shall be 2" thick medium efficiency, pleated disposable type. Each filter shall consist of cotton media wire bonded to a heavy duty paperboard frame. Filters shall have not less than 4.25 sq. feet of gross media area per sq. ft. filter area.
B. Filters shall have an average efficiency of 25-35% when tested in accordance with ASHRAE 52-76 standard.

C. Initial clean resistance shall be no more than 0.14 inches W.G. when passing air at the rate of 300 feet per minute.
D. The air filters shall be listed by Underwriters Laboratories as UL Class 2.
E. Provide clean set of air filters prior to final acceptance and complete extra set left on site.
F. Install filters in filter grilles and remove filters from units so equipped, but only at completion of construction.

PART 3 - EXECUTION

3.01 DUCTWORK

A. Duct System Pressure Class: Construct and install each duct system for the specific duct pressure classification indicated.
B. Ducts shall be of the internal dimensions shown on the Drawings. In no case shall the Contractor change the indicated size of the ductwork without approval of the Engineer. Wherever necessary to change the shape of the duct, it shall be done gradually and the full area retained.
C. Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight (5% leakage for systems rated 3" and under; 1% for systems rated over 3") and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. All joints shall be sealed with duct sealant. Align ductwork accurately at connections, within ⅛" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor.
D. Ducts 24 inch or greater in width or height shall be stiffened with galvanized structural angle reinforcing, not to exceed 4 ft. on centers and on all four surfaces, to prevent sagging or buckling and to provide a rigid installation and freedom from vibration and noise. Where angle cleats are made of same gauge metal as ducts (or heavier) the angle cleats will serve as reinforcing members on two surfaces of the ducts at joints in the ducts. Additional reinforcing angles shall be provided adjacent to branch duct connections which are of less width or depth than the surface of the main duct at point of connection, and at all other locations as necessary to make the duct work free from noise and vibration when fans are operating.
E. This Contractor shall carefully check the arrangement of ducts and dimensions for all working spaces at the building so that there will not be interference with the running of ducts.
F. Where ducts pass through walls and ceilings (exposed and concealed), this Contractor shall provide bent angle collar (as required to cover annular space) having flanges at corners lapped and riveted and the other leg of angle cut short and bent around corner of duct. Collars shall serve to confine sound barrier packing and shall fit tight around ducts. Where more than one duct passes through the same opening the collars shall form a complete seal of the spaces between and around all such ducts. This shall apply to concealed ductwork as well as exposed ductwork. The space between the duct and wall shall be packed with fiberglass duct-seal to provide an effective sound and dust barrier. Where the bent angle collar in any wall opening must support masonry in the wall above the opening, the top member of the bent angle collar shall be reinforced with rolled section steel angles suitable for the weight to be carried as approved by the Engineer and placed so as to be concealed in the wall in all locations where exposed in finished rooms.

3.02 FLEXIBLE CONNECTIONS

A. Flexible connections shall be securely fastened by zinc-coated iron clinch-type draw bands, for round ducts. For rectangular ducts, flexible connections locked to metal

collars shall be installed using normal duct construction methods.

3.03 ACCESS DOORS

A. Access doors in ductwork shall be provided at all fire dampers, motorized dampers, and where indicated on the drawings. Unless otherwise indicated, doors shall swing so that fan pressure or suction holds the door closed. Access doors in ductwork with duct liner or insulation shall be insulated.

3.04 HANGING OF DUCTS

A. Horizontal ducts shall be supported with angle and rod or strap iron trapeze hangers. Strap iron hangers shall be placed around sides and bottom of ducts with sheet metal screws in sides and bottom. Trapeze hangers shall be securely fastened to ducts and to the construction above. Horizontal duct supports shall be spaced not to exceed 8 ft. apart and not less than one trapeze support per section of duct.
B. Special hanging systems, where indicated, will be installed in lieu of duct supports specified above.
C. No equipment or ductwork shall be hung from roof deck.

3.05 BELLMOUTH FITTING

A. Install bellmouth fitting with damper in each supply air branch takeoff. Mark damper open and closed positions on side of duct with black paint.
B. Fittings shall be secured in duct with screws. Operators shall be outside the duct system. All holes shall be carefully covered and sealed.

3.06 FIRE DAMPERS

A. Fire dampers shall be installed as required by NFPA 90A, and as indicated on the drawings. Fire dampers must be installed in 10 ga. sleeve above ceiling terminal air devices or in masonry wall. Steel retaining angles, 10 ga., shall be bolted or welded to sleeve on both sides of wall, with duct connected to sleeve on both sides with slip connector held with not less than one No. 8 sheet metal screw on each vertical side of duct.

3.07 INSTALLATION OF EQUIPMENT

A. Install all fans, fire dampers, registers, grilles, etc., per manufacturer's recommendation and instructions.
B. Care shall be taken with installation of roof exhaust fans and roof vents to prevent damage. Any fan or vent dented or damaged in any other way during construction shall be repaired or replaced.

3.08 DUCT TAPE AND SEALANT - INSTALLATION

A. Duct Tape shall be installed at the following locations:
   1. All.
B. Duct Sealant shall be installed on all transverse joints at the following locations:
   1. All sheet metal rectangular ducts.
   2. All medium and high pressure round metal ducts.

3.09 ACOUSTICAL DUCT LINING – INSTALLATION (RECTANGULAR DUCT ONLY)

A. Acoustically line sheet metal rectangular supply, outside, return air ducts and return air plenums with duct liner and install as called for in latest edition of manufacturer's installation manual and/or as called for or shown in the SMACNA HVAC Duct

Construction Manual.

B. Adhere liner with coated side toward air stream to all interior sides of duct with 100% coverage of fire-resistant insulation bonding adhesive. Adhesive shall completely cover sheet metal at each end of each section of ductwork. Provide Z bar liner retainer on leading edge of liner in the first fitting downstream of any fan.
C. When duct width or height exceeds 12" further secure the liner to these surfaces with mechanical fasteners at 16" o.c.
D. Velocities - 1500 to 4000 FPM: Install as above but additionally paint all joints of liner and butter the edges of liner where sections of ductwork will be joined with fire-resistant mastic.
E. Note: All duct sizes shown are inside of linings. Increase sheet metal sizes as required.
F. Acoustical duct lining shall be installed at the following locations:
    1. All sheet metal rectangular supply, outside, return air ducts, and return air plenums.

3.10 DUCT WRAP – INSTALLATION (ROUND DUCTS ONLY)

A. Wrap all round supply, return, and outside air ducts with duct wrap and install as called for in latest edition of manufacturer's installation manual and/or as called for in SMACNA HVAC Duct Construction Manual.
B. Adhere duct wrap with vapor barrier outward to all sides of duct with 100% coverage of fire-resistant insulation bonding adhesive. Adhesive shall completely cover sheet metal at each end of each section of ductwork.
C. When duct width or height exceeds 24" further secure the duct wrap to these surfaces with mechanical fasteners at 16" o.c.
D. Duct wrap shall be installed at the following locations:
    1. All round return, supply, and outside air ducts.

3.11 EXTERIOR DUCT INSTALLATION

A. Support exterior ducts with heavy-duty supports as detailed on drawings or as required for a permanent installation. Secure all supports as required. Use no light-gauge components.
B. Seal all duct joints as specified.
C. Insulate with closed-cell foam insulation as specified above. Secure all insulation with adhesive and fasteners as recommended by the manufacturer. Cement all joints and seams. Cover all joints and seams with matching tape applied per the manufacturer’s instructions for a smooth and finished installation. No duct surface shall pond water, and sloppy work will be rejected and re-insulated.

3.12 EXHAUST DUCTS - UNINSULATED

A. Exhaust ducts shall not be insulated or lined.

3.13 ADJUSTING AND CLEANING

A. Adjust volume control devices as required by the testing and balancing procedures to achieve required air flow. Refer to Section 23 05 93 - "TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS" for requirements and procedures for adjusting and balancing air systems.

END OF SECTION

SECTION 23 74 00

ROOFTOP HEATING/COOLING UNITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings.
   2. General Conditions.
   3. Refer to Section 01 11 00 – Summary of Work

1.02 WORK INCLUDES

A. Rooftop heating/cooling unit and accessories. Equipment support curbs by General Contractor and metal building supplier.
B. Room thermostat and installation of control wiring and conduit from thermostat to unit is by Section 25 00 00 – “CONTROLS AND INSTRUMENTATION”.
C. General Contractor to provide and install rooftop unit roof curb. Mechanical Contractor to provide and install internal curb framing for duct support.

1.03 RELATED WORK

A. Section 20 01 00 – “GENERAL PROVISIONS”.
B. Section 20 06 00 – “MECHANICAL IDENTIFICATION”.
C. Section 23 30 00 – “AIR DISTRIBUTION”.

1.04 SUBMITTALS

A. None required on owner furnished equipment.

1.05 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of rooftop units, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
B. Codes and Standards:
   1. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
   2. Testing and rating of rooftop shall be in accordance with ARI 240 and 270 and provide Certified Rating Seal. Sound testing and rating of units shall be in accordance with ARI 270 "Standard for Sound Rating of Outdoor Unitary Equipment". Units shall bear Certified Rating Seal.
   3. Refrigerating system construction of rooftop units shall be in accordance with ASHRAE 15 "Safety Code for Mechanical Refrigeration".
   4. Energy Efficiency Ratio (EER) of rooftop units shall be equal to or greater than prescribed by ASHRAE 90A "Energy Conservation in New Building Design".
   5. Rooftop units shall be listed by UL and have UL label as a unit.
   6. Rooftop units shall be designed, manufactured, and tested in accordance with UL requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle rooftop units and components carefully to prevent damage. Replace damaged

rooftop units or components with new.

B. Store rooftop units and components in clean dry place, off the ground, and protect from weather, water, and physical damage.
C. Rig rooftop units to comply with manufacturer's rigging and follow installation instructions for unloading rooftop units, and moving them to final location.

1.07 SCHEDULING AND SEQUENCING

A. Coordinate installation of roof mounting curb with roof structure.
B. Coordinate roof opening locations for mechanical and electrical connections.

1.08 WARRANTY-LABOR ONLY

A. Warranty: Provide written labor only warranty, signed by contractor, agreeing to replace/repair, within warranty period, inadequate and defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period.
   1. Warranty Period: 1 year from date of substantial completion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Carrier Air Conditioning; Div. of Carrier Corp.

2.02 HVAC CONDENSATE PIPING

A. See Section 20 03 00 – Materials and Methods, Part 2, “HVAC Condensate Piping”, for the type of condensate piping materials.

2.03 ROOFTOP UNITS – GAS FIRED (SEE PLANS FOR TYPE REQUIRED)

A. General: Factory assembled single piece, gas heating electric cooling rooftop unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, refrigerant charge (R-410A), and special features required prior to field start-up.
B. Unit Cabinet:
   1. Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a prepainted baked enamel finish.
   2. Indoor blower compartment interior cabinet surfaces shall be insulated with a minimum 1/2 in. thick, flexible glass fiber insulation, coated on the air side. Aluminum foil faced glass fiber insulation shall be used in the heating compartment.
   3. Cabinet panels shall be easily removable for servicing.
   4. Filters will be accessible through a hinged access panel.
   5. Holes shall be provided in the base rails for rigging shackles to facilitate overhead rigging.
C. Fans:
   1. Indoor blower (Evaporator Fan):
      a. Fan shall be belt driven with an adjustable motor pulley.
      b. Fan wheel shall be made from steel, be double inlet type with forward curved blades with a corrosion resistant finish and dynamically balanced.
      c. Bearings shall be sealed, permanently lubricated, or extended lubricating lines provided to exterior of units.
   2. Outdoor (condenser) fan shall be of the direct driven propeller type with aluminum blades, riveted to corrosion resistant steel spiders, dynamically balanced, and discharge air vertically upwards.

D. Compressors:
    1. Semi-hermetic or hermetic type with internal and external vibration isolation.
    2. Equipped with factory-installed crankcase heater to prevent refrigerant dilution of oil.
E. Coils:
    1. Evaporator and condenser coils shall have aluminum plate fins mechanically bonded to seamless copper tubes with all joints brazed.
    2. Tube sheet openings shall be belled to prevent tube wear.
F. Refrigerant Components:
    1. Expansion device.
    2. Sight glasses
    3. Filter driers.
    4. Service valves.
G. Filter Section:
    1. Standard filter section shall consist of one size of factory-installed low-velocity, disposable 2 in. thick glass fiber filters of commercially available sizes.
    2. Filter face velocity shall not exceed 400 FPM at nominal airflows.
H. Furnace Section:
    1. Induced draft combustion type with intermittent spark ignition pilot and redundant main gas valves.
    2. Heat exchanger of minimum 20 gauge aluminized steel.
I. Controls and Safeties:
    1. Unit Controls:
        a. Unit shall be complete with factory installed self-contained solid state control system for cooling, economizer, and heating control.
    2. Safeties: Unit shall incorporate a solid-state compressor protector which provides reset capability at the space thermostat, should any of the following safety devices trip and shut off compressor.
        a. Compressor overtemperature, overcurrent.
        b. Airflow switch (Heating Section).
        c. Low-pressure switch.
        d. Temperature limits (Heating Section).
        e. Freezestat, evaporator coil.
        f. Flame rollout switches.
        g. High-pressure switch.
        h. Pilot flame proving switches.
        i. Ground fault.
        j. Induced draft fan centrifugal switch.
J. Operating Characteristics:
    1. Unit shall be capable of starting and running at 115 degrees F ambient outdoor temperature per maximum load criteria of ARI Standard 240.
    2. Compressor with standard controls shall be capable of operation down to 45 degrees F ambient outdoor temperature in cooling duty.
K. Electrical Requirements: All unit power wiring shall enter unit cabinet at a single location.
L. Motors:
    1. Compressor motors shall be of the refrigerant cooled type with line break thermal and current overload protection.
    2. All fan motors shall have permanently lubricated bearings, and inherent automatic reset thermal overload protection.
M. Special Features:
    1. Roof Curb:
        a. Provided as noted on drawings.
        b. Capable of supporting entire unit weight.
    2. Compressor Cycle Delay: Compressor shall be prevented from restarting for a minimum of 5 minutes after shutdown.

2.04 ROOFTOP UNITS – HEAT PUMPS (SEE PLANS FOR TYPE REQUIRED)

A. General: Factory assembled single piece, electric heat pump heating and cooling rooftop unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, refrigerant charge (R-22), and special features required prior to field start-up.
B. Unit Cabinet:
    1. Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a prepainted baked enamel finish.
    2. Indoor blower compartment interior cabinet surfaces shall be insulated with a minimum 1/2 in. thick, flexible glass fiber insulation, coated on the air side. Aluminum foil faced glass fiber insulation shall be used in the heating compartment.
    3. Cabinet panels shall be easily removable for servicing.
    4. Filters will be accessible through a hinged access panel.
    5. Holes shall be provided in the base rails for rigging shackles to facilitate overhead rigging.
C. Fans:
    1. Indoor blower (Evaporator Fan):
        a. Fan shall be direct driven.
        b. Fan wheel shall be made from steel, be double inlet type with forward curved blades with a corrosion resistant finish and dynamically balanced.
        c. Bearings shall be sealed, permanently lubricated, or extended lubricating lines provided to exterior of units.
    2. Outdoor (condenser) fan shall be of the direct driven propeller type with aluminum blades, riveted to corrosion resistant steel spiders, dynamically balanced, and discharge air vertically upwards.
D. Compressors:
    1. Semi-hermetic or hermetic type with internal and external vibration isolation.
    2. Equipped with factory-installed crankcase heater to prevent refrigerant dilution of oil.
E. Coils:
    1. Evaporator and condenser coils shall have aluminum plate fins mechanically bonded to seamless copper tubes with all joints brazed.
    2. Tube sheet openings shall be belled to prevent tube wear.
F. Refrigerant Components:
    1. Expansion device.
    2. Sight glasses
    3. Filter driers.
    4. Service valves.
G. Filter Section:
    1. Standard filter section shall consist of one size of factory-installed low-velocity, disposable 2 in. thick glass fiber filters of commercially available sizes.
    2. Filter face velocity shall not exceed 400 FPM at nominal airflows.
H. Controls and Safeties:
    1. Unit Controls:
        a. Unit shall be complete with factory installed self-contained solid state control system for cooling, outdoor air, and heating control.
        b. Defrost control: time initiated, temperature terminated, adaptive demand.
    2. Safeties: Unit shall incorporate a solid-state compressor protector which provides reset capability at the space thermostat, should any of the following safety devices trip and shut off compressor.
        a. Compressor overtemperature, overcurrent.
        b. Airflow switch (Heating Section).
        c. Low-pressure switch.
        d. Temperature limits (Heating Section).
        e. Freezestat, evaporator coil.

f. High-pressure switch.
g. Ground fault.

I. Operating Characteristics:
1. Unit shall be capable of starting and running at 115 degrees F ambient outdoor temperature per maximum load criteria of ARI Standard 240.
2. Compressor with standard controls shall be capable of operation down to 0 degrees F ambient outdoor temperature in cooling duty.

J. Electrical Requirements: All unit power wiring shall enter unit cabinet at a single location.

K. Motors:
1. Compressor motors shall be of the refrigerant cooled type with line break thermal and current overload protection.
2. All fan motors shall have permanently lubricated bearings, and inherent automatic reset thermal overload protection.

L. Special Features:
1. Roof Curb:
a. Provided as noted on drawings.
b. Capable of supporting entire unit weight.
2. Compressor Cycle Delay: Compressor shall be prevented from restarting for a minimum of 5 minutes after shutdown.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which rooftop units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION

A. General: Install rooftop units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

B. Support: Install and secure roof curb to roof structure, in accordance with National Roofing Contractors Association (NRCA) installation recommendations and shop drawings. Install and secure rooftop units on curbs and coordinate roof penetrations and flashing.

C. Thermostat installation and wiring by Section 25 00 00.

3.03 DEMONSTRATION

A. See Section 20 02 00 - “Contract Close-out & Commissioning”.

END OF SECTION

SECTION 25 00 00

CONTROLS AND INSTRUMENTATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings.
   2. General Conditions.

1.02 WORK INCLUDES

A. This Section includes all HVAC controls, and accessories for a complete electric electronic temperature control system within the building.
B. Provide as herein specified, a complete electric electronic temperature control system. The control system shall be installed by competent control mechanics. The control system shall consist of all thermostats, automatic dampers, damper operators, switches, control panels and other accessory equipment along with a complete system of electrical wiring to fill the intent of the specification and provide for a complete and operable system. All wiring and conduit shall comply with requirements of Division 26.
C. The contractor shall install controls as indicated on the drawings for the purpose of automatically controlling each HVAC system. This contractor shall acquaint himself with the desired sequence of control, and it shall be his responsibility to bring about this result.
D. The control system must be installed by an experienced contractor who is regularly engaged in installations of similar size and description in his normal course of business, and has existing installations that have been fully operational for a period of not less than three years. Proof of such installations may be required prior to contract approval by the Owner.

1.03 RELATED WORK

A. Section 20 03 00- "MATERIALS AND METHODS".

1.04 SYSTEM DESCRIPTION

A. The system shall be as indicated in the control diagram. Exact duplication of the arrangements shown in the diagram is not required. System design is the responsibility of the controls subcontractor, and he shall arrange the system to accomplish the objectives of control which are indicated by the diagrams and the sequence of operation herein.

1.05 ELECTRIC WIRING

A. Control wiring, regardless of voltage, is the responsibility of the contractor, including all conduit and outlet boxes for controls. All line voltage and low voltage control wiring shall be installed in accordance with the requirements of the Electrical Specifications. No control wiring shall be installed inside any duct. In general, corridor ceiling spaces on this project are considered to be air handling.
B. Control wiring which operates at more than 24 volts nominal shall be copper wire installed in EMT conduit. Low voltage control wiring in accessible locations above ceilings may be jacketed plenum cable. No wire smaller than 18 gauge shall be used.

Such wiring shall be neatly strapped in place with plastic wire ties. Attach to electrical conduits, top chords of bar joists, or top rows of joist bridging. Do not attach to or lay on ceilings or bottom chords of bar joists. Low voltage wiring where exposed to view shall be installed in EMT conduit.

C. Outlet boxes or other recessed enclosures for control wiring shall be installed as indicated and the contractor shall assure that the proper boxes are available in time to avoid delaying the masonry work or other trades.
D. Line voltage wiring which provides power to the main motor of any piece of HVAC equipment, including manual switch wiring, is considered power wiring and is specified under the electrical work. Circuits to motorized dampers are control wiring.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Carrier.

2.02 CONTROL DEVICES

A. Thermostats, room sensors, temperature controllers, damper motors, relays, switches, and all other control devices shall be provided as required to achieve the control sequences called for. All control system elements require the Engineer's approval of submittals. All equipment and devices used shall be of first quality, the best offered by the control system being used.
B. Provide guards for thermostats as noted on the drawings.

PART 3 - EXECUTION

3.01 CONTROL DEVICES

A. Transformers, control module, and motor interface devices shall be mounted on a plywood base adjacent to air handling unit.
B. Install room thermostats furnished with HVAC units and unit heaters, wire, test and calibrate controls.

3.02 TRAINING

A. The contractor shall conduct a training session for the Owner's operating and maintenance personnel to familiarize them with the control system. This session shall be held after the system is fully operational.

3.03 EQUIPMENT LABELING

A. See Section 20 02 00 - “Contract Close-out & Commissioning”.

3.04 FINAL ADJUSTMENT OF CONTROLS

A. See Section 20 02 00 - “Contract Close-out & Commissioning”.

END OF SECTION

SECTION 26 00 10

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings.
   2. General Conditions.

1.02 SUMMARY

A. This Section includes requirements for electrical installations:
   1. Submittals.
   2. Rough-ins.
   3. Record documents.
   4. Electrical installations.
   5. Maintenance manuals.
   6. Cutting and patching.

1.03 WORK INCLUDES

A. The work to be performed under this Section shall include all labor, materials, equipment, transportation, and facilities necessary to provide a complete and satisfactory system ready to use. Wherever the words "the Contractor" or "this Contractor" appear in this Section, they refer to the Contractor for the work specified in that Section. This Contractor shall examine all Drawings and all Sections of the Specifications and shall be responsible for ascertaining to what extent other Drawings and Sections affect the work herein specified.'
B. Unless noted on the drawings otherwise, work shall also include:
   1. The procurement of and payment for all fees, permits and licenses required for the performance of the work.
   2. All fees and direct expenses involved in any inspection required for the project.
   3. All hoists, scaffolds, staging, runways, and equipment required for the performance of the work.
   4. All job measurements and shop layouts required for the proper installation of material and equipment included in the work.
   5. All lights, guards, and signs as required by safety regulations applicable to the work.
   6. The removal from the premises, as it accumulates, of all dirt and refuse resulting from the performance of the work.
   C. The work shall include revisions, modifications, and rework of existing work as required for installation of new work, and as required for connections of new work to existing systems, and as required for connections of existing work to new systems.

1.04 CODES, REGULATIONS, AND STANDARDS

A. All work must be performed in accordance with the requirements of local, county, state and national codes and regulations including the requirements of the following:
   1. National Electrical Code, Latest Edition

2. Occupational Safety and Health Act. of 1970.
3. Life Safety Code, N.F.P.A. No. 101.
4. NFPA 17/17A, 72, 72E, 54, and 96.
5. For work not specifically listed above, use standards and codes of the National Fire Protection Association.

1.05 ABBREVIATIONS

A. All equipment, apparatus and systems shall be rated, tested, fabricated and/or installed in accordance with the applicable industry standard mentioned. The following list will serve to clarify abbreviations that appear in other sections of this specification:
   1. AABC Associated Air Balance Council
   2. ADC Air Diffusion Council
   3. ANSI American National Standards Institute
   4. ASE Association of Safety Engineers
   5. ASTM American Society for Testing and Materials
   6. EPA Environmental Protection Agency
   7. IEEE Institute of Electrical and Electronics Engineers
   8. NEMA National Electrical Manufacturers Association
   9. NFPA National Fire Protection Association
   10. NSC National Safety Council
   11. UL Underwriters Laboratories

1.06 SUBMITTALS

A. See also Section 01 33 00 "SUBMITTALS" for requirements for submittals, shop drawings and product data.

1.07 SUBSTITUTION OF EQUIPMENT

A. All proposed substitutions for specified products on this project (except as listed above) require approval in advance of bidding. Approval will not be granted after award of contract. Substitutions must be submitted for review five (5) working days prior to the bid date to be considered.
B. In the event of Engineer's approval of a substitution of equipment, the requesting entity will be notified by telephonic message or FAX by the Engineer (or authorized representative), and/or by the issuance of an amendment to the contract documents incorporating the equipment by name and model number.

1.08 CONTRACT DRAWINGS

A. The layout shown on the Contract Drawings is necessarily diagrammatic but shall be followed as closely as actual construction and as other work will allow.

1.09 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver equipment in time to maintain approved construction schedule.
B. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.
C. Store in safe, dry location. Protect from dust, moisture, weather and extreme temperatures.
D. Follow manufacturer's recommendation for transportation, handling and storage.

1.10 GUARANTEES AND WARRANTIES

A. Submit to the Owner, two copies of all warranties and guarantees specified in the General Conditions, Supplementary Conditions, the individual sections of the specifications, or as provided by the various subcontractors and material suppliers. All such documents shall show the name and location of the project and the name of the purchaser.
B. This Contractor shall provide to the Owner a non-prorated guarantee of all materials and workmanship for a period of not less than one year from the date of the Owner's final certificate.
C. Exclusions: lamps furnished by the Contractor shall be guaranteed for their rated life, not to exceed one year from the date of final acceptance. Lamps failing to meet the rated life shall be replaced by the Contractor. Replacement lamps shall be furnished to the Owner and installation of the replacement lamps shall be by the Owner.

PART 2 - PRODUCTS - (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

3.02 ELECTRICAL INSTALLATIONS

A. Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment.

3.03 DEFECTIVE WORK AND MATERIAL

A. All materials or work found to be defective or not in strict conformity with the drawings or different from requirements of the drawings and specifications or defaced or injured through negligence of Contractor or his employees, or through action of fire or weather will be rejected and shall be immediately removed from premises by Contractor and satisfactory materials and work substituted without delay.

3.04 COOPERATION AND COORDINATION

A. Contractor shall confer with other contractors at the site before installing his work to avoid interferences so that maximum head room and clearances may be maintained
B. Particular attention shall be paid to situations where recessed equipment, pipes and lights occur, or where the work of several trades occurs together above suspended ceilings, in pipe shafts or in areas where space is limited.
C. All fixtures, equipment, devices, switches, outlets, pumps, etc., shall be positioned to avoid all interferences with and to assure proper coordination with work of all other trades, cases, partitions, wall, floor and ceiling patterns, architectural features, etc. All recessed devices, fixtures, etc., shall be coordinated with all wall, floor and ceiling patterns.

3.05 CUTTING AND PATCHING

A. Perform cutting and patching in accordance with techniques acceptable to the owner. Restore all finishes to as-new condition.

END OF SECTION

SECTION 26 00 20

CONTRACT CLOSEOUT & COMMISSIONING

PART 1 - GENERAL - NOT APPLICABLE

PART 2 - PRODUCTS - NOT APPLICABLE

PART 3 - EXECUTION

3.01 OPERATING INSTRUCTIONS

A. All switches, controls, and safety devices shall be clearly and permanently marked with embossed or printed plates as to purpose and as to operation and shall be tested in the presence of the Owner designated representative to ensure that he understands their function and purpose.
B. Upon completion of the work, Contractors shall put the systems into service. Contractors shall be entirely responsible for the equipment during all testing operations including the lubricating and turning on and off of such apparatus.

3.02 PROJECT RECORD AND CLOSEOUT DOCUMENTS

A. See Section 01 20 00 for red lining of all documents during construction to reflect "as-built" conditions.

3.03 WIRES & CABLES FIELD QUALITY CONTROL

A. Inspect wiring for physical damage and proper connection.
B. Torque test conductor terminations to manufacturer's recommended values.
C. Perform continuity test on all power and branch circuit conductors. Verify proper phasing.

3.04 ELECTRICAL EQUIPMENT IDENTIFICATION PLATES

A. Provide plates for all equipment consisting of machine engraved laminated plastic. Plate field shall be black with white core.
    1. Size of plate shall be commensurate with lettering thereon.
    2. Lettering for major items of equipment, such as a disconnect or panelboard, shall be 1/2" in height. Lettering for smaller items, such as light or timer switches shall be 1/4" in height.
    3. Wording on plate shall contain the following information as appropriate and approved by the Engineer.
        a. Equipment served, such as RTU-1.
        b. Originating or controlled circuit number, such as AL 1, 3, & 5.
        c. Voltage.
        d. Maximum fuse size (if applicable).

3.05 ELECTRICAL EQUIPMENT INSTALLATION (26 24 00)

A. Provide engraved plastic nameplates for each switch in main panel, for each panelboard, and for each safety switch. Indicate type of load and maximum fuse size. Provide schedule of nameplates with submittals.

3.06 SECONDARY GROUNDING FIELD QUALITY CONTROL

A. Measure ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Resistance shall not exceed 10 ohms. When resistance exceeds 10 ohms drive and bond an additional ground rod, one rod length away. Ground resistance test shall be made a minimum of 48 hours after rainfall.

3.07 LIGHT FIXTURES (26 50 00)

A. Remove all dirt, paint and foreign matter from fixture lenses and frames between substantial completion and final acceptance of the building.

3.08 CONTINUITY TESTS

A. Test branch circuits and control circuits to determine continuity of wiring and connections.

3.09 VOLTAGE TESTS

A. Make and record voltage tests and recorded at the following listed points. Conduct tests under normal load conditions.
   1. Service entrance at main panelboard.

3.10 TESTING PHASE RELATIONSHIP

A. Examine connections to equipment for proper phase relationships. Verify proper motor rotation.

3.11 TESTING CORRECTION OF DEFECTS

A. When tests disclose any unsatisfactory workmanship or equipment furnished under this Contract, correct defects and retest. Repeat tests until satisfactory results are obtained.
B. When any wiring or equipment is damaged by tests, repair or replace such wiring or equipment. Test repaired items to ensure satisfactory operation.

END OF SECTION

SECTION 26 00 25

LIGHTING SYSTEM COMMISSIONING
(ONLY REQUIRED IN THE STATES OF CALIFORNIA AND WASHINGTON)

PART 1 - GENERAL

1.01 WORK INCLUDES

A. Lighting Commissioning shall be performed by an independent agency under contract directly with the General Contractor.
B. The following shall be performed by the Contractor.
   1. Validation of proper installation of Lighting systems and equipment.
   2. Prefunctional test checklists.
   3. Systems and equipment testing and startup.
   4. Assist the Commissioning Authority in performing functional testing.
   5. Functional testing of control systems.
   6. Documentation of tests, procedures and installations.
   7. Coordination of training.
C. The following shall be performed by the Commissioning Authority hired by the General Contractor.
   1. Verification of correct equipment models, sizes and capacities.
   2. Systems verification.
   3. Equipment performance verification.
   4. Preparation of the Commissioning Plan.

1.02 SUMMARY

A. Related sections include the following:
   Section 26 00 20 Contract Close-Out & Commissioning - Systems Check-Out.
   Section 26 50 00 Lighting.

1.03 SCOPE INCLUDES

A. Systems to be commissioned include the following:
   1. Lighting Systems
   2. Lighting Control Systems

1.04 RELATED DOCUMENTS

A. Commissioning Plan - This plan is part of the As-Built and Project Closeout Documents, and outlines many responsibilities, procedures and tasks throughout the commissioning process.
B. Division 26 - Individual Sections stipulate installation, startup, warranty and training requirements for the system or device specified in that Section.
C. Commissioning Compliance Checklist – See copy at the end of this section.

1.05 REFERENCES

A. See 2013 Non-Residential Compliance Manual (by California Energy Commission) for specific requirements on buildings over and under 10,000 sq. ft.
B. Washington State Energy Code – 2009 Section 1513.8: Commissioning Requirements for Lighting.

1.06 GENERAL DESCRIPTION

A. Commissioning is a process to assure all lighting systems are installed and perform interactively according to the design intent; the systems are efficient, cost effective and meet the Owner's operational needs; the installation is adequately documented; and operating personnel are adequately trained. Commissioning serves as a tool to minimize post-occupancy operational problems. It establishes testing and communication protocols in an effort to advance building systems from installation to fully-optimized operation.
B. The Commissioning Authority, hired by the General Contractor, will work with the Contractor and Design Engineer to coordinate, oversee and document the commissioning process during the Construction Phase of this project.
C. The Commissioning Plan is prepared by the Commissioning Authority and outlines the commissioning process. It is part of the Close-out Documents. Refer to the Commissioning Plan for a summary explanation of the commissioning process.
D. Commissioning plan shall include:
    1. A general description of the commissioning process activities including the systems to be commissioned;
    2. The scope of the commissioning process including system functional testing, and supporting documentation;
    3. Roles and responsibilities of the commissioning team;
    4. A schedule of activities including systems testing and balancing, functional testing, and supporting documentation;
    5. Functional test procedures and forms.
E. This Section expands on the Commissioning Plan and provides detailed test requirements and procedures for the commissioning process. This Section defines responsibilities of the Contractor to facilitate the commissioning process particularly during the Construction Phase of the project.

1.07 DEFINITIONS

A. Acceptance Phase - The phase of the project when the facility and its systems and equipment are inspected, tested and verified. Most of the functional performance testing and formal training occurs during this phase of the project. It will generally occur after the Construction Phase is complete including execution of checklists and startup. The Acceptance Phase typically begins with Substantial Completion and ends with Functional Completion.
B. Commissioning (Cx) - The process of verifying all lighting systems are installed and perform interactively according to the design intent; the systems are efficient, cost effective and meet the Owner's operational needs; the installation is adequately documented; and operating personnel are adequately trained.
C. Commissioning Authority (CA) - An individual or company who will oversee the commissioning process; stipulate many of the commissioning requirements; and verify that systems and equipment are designed, installed and tested to meet the Owner's requirements.
D. Commissioning Team - A group of individuals who will collaborate to ensure the lighting is fully and completely commissioned. This team will include the Commissioning Authority, the Owner's representative, and a commissioning coordinator provided by the Contractor. Generally, the installing contractor, subcontractor and manufacturer will also be integral members of the team for any given system or equipment.
E. Construction Phase - The phase of the project during which the facility is constructed and/or systems and equipment are installed and started. During this phase Contractors complete installation startup forms, submit operation and maintenance (O&M) information, establish trends, etc. The Construction Phase will generally end upon the completed startup of systems and equipment.
F. Contractor - As used herein is a general reference to the applicable installing party,

but usually the mechanical contractor but can refer to the general contractor, other subs or vendors.

G. Deficiency - An installation or condition that is not in conformance with the construction documents and/or the design intent.
H. Functional Completion - A milestone that marks the successful completion of the Acceptance Phase. It generally includes the functional performance testing of the systems in the initial season.
I. Functional Performance Testing (FPT) - The dynamic testing of systems and equipment under various modes of operation and different conditions. Both component performance and environmental objectives will be monitored during this testing.
J. Party - Individual, company or entity involved in the construction and commissioning activities of the project. Refer to the Commissioning Plan for names, roles and responsibilities.
K. Scheduled Outage - A period of time scheduled by the Owner in which the system is out of service or not in use by the components.
L. Startup - A process whereby the Contractor verifies the proper installation of a device or piece of equipment, executes the manufacturer's starting procedures, completes the startup checklist, and energizes the device or system, and verifies it is in proper working order.
M. Warranty Phase - Includes the early occupancy of the building and continues through the warranty period into the opposite season from when the system was initially tested.

1.08 DOCUMENTATION

A. Contractor shall send Commissioning Authority one copy of the following per the procedures specified in the Commissioning Plan and other sections of the Specification:
   1. Shop drawings and product data related to systems and equipment to be commissioned on this project. CA will review and incorporate comments via the Design Engineer.
   2. Initial draft of equipment startup checklists along with manufacturer's startup procedures. CA will assist in development and recommend approval.
   3. System Test Reports. CA will review and compile prior to FPT.
   4. Completed equipment startup certification forms along with the manufacturer's field or factory performance and startup test documentation. CA will review and approve prior to FPT.
   5. Equipment Warrantees.
   6. Training Plans.
   7. O&M documentation per requirements of the Commissioning Plan and the Specifications.
   8. Record Drawings.
   9. Completed Prefunctional Checklists.
B. Record Drawings: Contractor shall maintain at the site and updated set of record or "as-built" documents reflecting actual installed conditions. As-builts drawings will be updated by the Contractor and submitted to the CA on a regular basis per the Commissioning Plan.

1.09 SEQUENCING AND SCHEDULING

A. Systems can be in various stages of the commissioning process where appropriate, in order to expedite close out of the facility. The CA and Contractor shall cooperate to schedule Cx tasks to minimize the duration of Cx activities. Sequential priorities shall be followed per the Cx Plan.
B. Commissioning Schedule - Contractor shall incorporate the commissioning process into the project schedule. Startup and FPT shall be itemized as applicable for each

system. The CA will dictate durations for each task.

1.10 COMMISSIONING AUTHORITY RESPONSIBILITIES

A. Construction Phase
   1. Plan and conduct commissioning scoping meeting.
   2. Review applicable project documentation (shop drawings, product data, O&M information, record drawings, etc.) for adequacy and to verify system functionality.
   3. Review and approve startup checklist forms.
   4. Inspect equipment and system installations periodically.
   5. Attend selected planning meetings to observe progress and help expedite completion.
   6. Witness selected tests, startups and equipment training.
   7. Compile O&M information with systems overview and format the O&M manuals.
   8. Provide owner with copies of all meeting minutes, inspection reports and start up test reports.

B. Acceptance Phase
   1. Verify (spot check) control component calibration.
   2. Verify (spot check) equipment performance certifications.
   3. Analyze trend logs.
   4. Functionally test systems and equipment.
   5. Review training plan.
   6. Coordinate training activities.
   7. Record commissioning procedures.
   8. Compile a systems manual

1.11 CONTRACTOR RESPONSIBILITIES

A. Construction Phase
   1. Include commissioning requirements in price and plan for work.
   2. Attend coordination meetings scheduled by the CA.
   3. Remedy deficiencies identified during the construction period.
   4. Prepare and submit required draft forms and equipment information requested by the CA.
   5. Thoroughly complete and inspect installation of systems and equipment in accordance with the Contract Documents, reference or industry standards and specifically Part 3 of this Section.
   6. Startup, test and adjust systems prior to verification and performance testing by the CA. Startup procedures shall be in accordance with Contract Documents, reference or industry standards, and specifically Part 3 of this Section.
   7. Record startup and test procedures on startup forms or checklists and certify the systems and equipment have been started and tested in accordance with the Contract Documents, reference or industry standards, and specifically part 3 of this Section. Each form shall be signed and dated by the individual responsible for the startup or test. Tag equipment started with individual's name and date.
   8. Complete pre-approved startup checklists and submit along with other installation certification documentation such as balancing reports, warrantees, test results, etc.
   9. Schedule and coordinate Cx efforts required by appropriate subcontractors and vendors. Participate in respective portions of startups and training.
   10. Demonstrate the systems as specified.
   11. Certify systems have been installed and are operating per Contract Documents.
   12. Maintain and update set of record documentation.
   13. Copy CA on indicated documentation.
   14. Conduct equipment operation, maintenance, diagnosis and repair training as required by the respective section of the Specifications.

B. Acceptance Phase
   1. Assist CA in verification and performance testing. Assistance will generally include the following:
      a. Manipulate systems and equipment to facilitate testing.
      b. Provide instrumentation necessary for verification and performance testing.
      c. Manipulate control systems to facilitate verification and performance testing.
   2. Correct any work not in accordance with Contract Documents.
   3. Participate in the systems and operational training as it relates to O&M information and the Preventative Maintenance (PM) program.

C. Warranty Phase
   1. Provide warranty service.
   2. Correct any deficiencies identified.
   3. Update record documentation to reflect any changes made throughout the Warranty Phase.

1.12 CONTRACTOR NOTIFICATION

A. Contractor shall completely install, thoroughly inspect, startup, test and adjust systems and equipment. All activities shall be documented on specified forms. Contractor shall notify Design Engineer, Owner and CA in writing that systems are complete and ready for verification and functional performance testing.
B. Contractor shall notify CA at least 14 days in advance of any tests, startups or training. CA shall witness selected tests and startups.

1.13 STARTUP CHECKLISTS'

A. Startup checklists for each type of equipment and system shall be submitted to CA for approval prior to startup. The forms shall be designed by the appropriate subcontractors or vendors to meet the requirements of the Contract Documents. Forms shall be developed for the specific equipment being installed for this project.
B. Startup checklists shall generally include the following for each (as applicable):
   1. Project specific designation, location and service.
   2. Pertinent nameplate data.
   3. Indication of the party performing the test.
   4. Place for signature of the startup technician along with the date.
   5. Clear explanation of the inspection, test, measurement, etc. with a pass/fail indication and a record of measurement parameters.
   6. Checklist space indicating all O&M instructions, warranties and record documents have been completed and submitted.
   7. Checklist space that proper maintenance clearances have been maintained.
   8. Checklist space indicating that any required special tools and/or spare tools were turned over to the Owner.
   9. Checklist space items indicating that required prerequisite equipment and systems were successfully started.
C. Startup checklists shall incorporate the manufacture-specified procedures. Contractor shall compile the startup and checkout procedures indicated in the manufacturer's documentation prior to designing the forms. Include specified acceptance criteria as applicable. The manufacturer's startup and checkout procedures shall be submitted to the CA along with the draft startup checklists.
D. Refer the Cx Plan for examples and minimum required content.
E. Completed startup checklists for all pieces of equipment shall be submitted to CA prior to verification and performance testing.

1.14 FUNCTIONAL PERFORMANCE TESTING (FPT)

A. Participation: CA will coordinate test and/or witness functional performance tests after

the successful startup and documentation of systems and equipment is complete. Conceptual procedures for the FPT are outlined in the Cx Plan. CA will generally witness and coordinate the test. Contractor shall generally assist, as described above, with manipulation of the systems or equipment; provision of supporting equipment or materials (lifts, ladders, specialty test equipment, etc.); and on the spot remediation of minor identified deficiencies. Required participation is outlined in the Cx Plan.

B. Detailed Test Forms: CA will prepare detailed testing procedures and forms to conduct and document the FPT. Theses will be developed during the Construction Phase and completed during the Acceptance Phase.
C. Completeness: All systems must be complete and ready for FPT. The control systems must be tested and started for the respective system or component.
D. Test Documentation: CA will record test results on the forms developed for the testing. CA will Pass or Fail the testing and record the date and time of the test. Deficiencies shall clearly be indicated when the test has failed. CA shall recommend acceptance of the system or component after all related testing is successfully complete.
E. Deficiencies and Retesting: When deficiencies are identified during testing, depending on their extent or magnitude, they can be corrected during the test and the testing can continue to successful completion. Significant deficiencies will fail the test and require retesting. Deficiencies of this magnitude will result in an action item on the Action List. The CA will subsequently track the resolution of the deficiency via the Action List. All tests shall be repeated until successful completion.

1.15 FPT ACCEPTANCE CRITERIA

A. Acceptance criteria for tests are indicated in the Specification sections applicable to the systems being tested. Generally, unless indicated otherwise, the criteria for acceptance will be that which is specified for the individual system, equipment, component or device.

1.16 TRAINING

A. Contractors shall prepare and conduct training sessions on the installed systems and equipment they are responsible for.
B. Contractor shall compile the training plans of the subcontractors and vendors and present a comprehensive training plan as outlined in the Cx Plan.
C. Training sessions should typically start and end in a classroom setting. Field demonstrations shall be conducted to demonstrate the hands-on aspects of the required tasks.
D. Equipment Specific Training: The appropriate Contractor shall instruct the Owner's designated representative on the safe and proper operation, maintenance, diagnosis and repair of each piece of equipment. Submitted O&M information shall be used during training. Sessions shall include as a minimum:
    1. Conceptual overview of how the equipment works.
    2. Contact Information including names, addresses, phone numbers, etc. of sources for equipment information, tools spare parts, etc.
    3. Details of warranty or guarantee.
    4. Intended sequences of operation in all modes of operation.
    5. Limits of responsibility (ex: unit mounted control vs. building management system).
    6. Sources of utility support.
    7. Routine operator tasks involving monitoring and operation covering all modes of operation and mode switching as applicable.
    8. Relevant health and safety practices/concerns.
    9. Common problems and their diagnosis and repair.
    10. Proper maintenance schedules, tasks and procedures with demonstrations.
    11. Emergency response, documentation and recovery procedures.

E. Controls Contractor Training Involvement: Training on the proper use and operation of the control system is specified in the control section of the Specification. Controls contractor shall also participate in the overall systems training.

PART 2- PRODUCTS (NOT USED)

PART 3- EXECUTION

3.01 GENERAL

A. This Section outlines specific startup, checkout, testing and training requirements for systems and equipment. Generally, these procedures are the direct responsibility of the Contractor as a basic element of validating that the installation is correct. These requirements along with those specified in the individual Section provide a minimum guideline for development of startup procedures, checklists and tests. Contractor shall synthesize these requirements with that of the manufacturer's and/or applicable codes and standards to develop specific and itemized startup procedures specific to that installed on this project.
B. Refer to all Division 26 Specifications for tests performed on installed lighting and control equipment.

3.02 LIGHTING AND LIGHTING CONTROLS

A. General: After construction and painting is complete, clean unit exposed surfaces.
B. Repair scratched and marred surfaces of factory-finished cabinets using finish materials furnished by manufacturer.
C. Inspect the installation of lighting and controls including electrical connections.
D. Verify adequate access for maintenance.
E. Verify lighting is secure on mountings and supporting devices and that electrical are complete. Check power and control voltages.
F. Check calibration and operation of the lighting controls.
G. Training: Train Owner's maintenance personnel on the following:
    1. Procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventative maintenance and how to obtain replacement parts.
    2. Review data in O&M manuals.

3.03 CONTROL SYSTEMS

A. Startup: This Specification generally requires manufacturer's authorized representative to startup, test, and adjust control systems and demonstrate compliance with requirements. This includes verification of sequences, normal and emergency operations, calibration, interfaces, interlocks, etc.
B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

STATE OF WASHINGTON
COMMISSIONING COMPLIANCE CHECKLIST
LIGHTING & LIGHTING CONTROL SYSTEMS

Project Information	Project Name:		
	Project Address:		
	Commissioning Authority:		
Commissioning Plan	□		Commissioning Plan was used during construction and included items below:
		•	A written schedule including Systems Testing and Balancing, Functional Testing, and Supporting Documentation.
		•	Roles and Responsibilities of the commissioning team.
		•	Functional Test procedures and forms.
Functional Testing	□		Lighting Controls Functional Testing has been completed:
			Lighting controls have been tested to ensure that control devices, components, equipment, and systems are calibrated, adjusted and operate in accordance with approved plans and specifications.
Supporting Documents	□		Systems documentation, record documents and training have been completed or are scheduled.
		•	System documentation has been provided to the owner or scheduled date: _____
		•	Record documents have been submitted to owner or scheduled date: _____
		•	Training has been completed or scheduled date: _____
Commissioning Report	□		Commissioning Report submitted to Owner and includes items below.
		•	Completed Functional Tests documentation.
		•	Deficiencies found during testing required by this section which have not been corrected at the time of report preparation and the anticipated date of correction.
		•	Deferred tests, which cannot be performed at the time of report preparation due to climatic conditions or other circumstances beyond control of Commissioning Authority.
Certification	□		I hereby certify that all requirements for commissioning have been completed in accordance with the Washington State Energy Code, including all items above.
			Building Owner *or* Owner's Representative: _____
			Date: _____

END OF SECTION

SECTION 26 00 30

EXISTING SYSTEMS AND OWNER FURNISHED EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings.
   4. General Conditions.
   2. General Provisions of the Contract.
   5. Architectural Division.
   3. Solicitation Documents.

1.02 WORK INCLUDES

A. Contractor shall perform all work on all existing systems and equipment that require expansion, relocation, modification, and/or repairs as per the drawings and/or specifications

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 RELOCATED OR SERVICED EQUIPMENT

A. From the time that the equipment is disconnected, or taken out of service, until the time that the equipment is started up and commissioned, the equipment shall be the responsibility of the contractor. Any damage occurring during the disconnecting, storing, relocating, re-installing or start-up shall be repaired by the contractor so that the condition of the equipment will be at least as good as when disconnected in the judgment of the engineer.
B. Contractor is responsible to ascertain and submit in writing to the engineer operating condition of existing equipment prior to being taken out of service. If contractor fails to provide a report on the condition and operation – of the existing equipment, then it will be assumed that the existing equipment was fully functional and operating correctly at its full intended capacity at the time of being taken out of service.
C. Accessory items necessary for the proper operation of existing relocated equipment shall be relocated and re-installed per manufacturer's recommendations. The contractor shall verify proper operation of such accessories before disconnecting the equipment. Notify engineer of any accessory items which need to be replaced before relocating the equipment.

3.02 EXPANDED SYSTEMS

A. Any existing system which is expanded as a part of this project shall be expanded per the sizes indicated in the contract documents.
B. Materials used for the expansion of any existing system shall meet the specifications and shall also meet the requirements of local codes.
C. Commissioning of any expanded system means the commissioning of the entire system, both the existing and new components.

3.03 OWNER FURNISHED EQUIPMENT

A. Provide rough-ins and final connections to all Owner furnished equipment including switchgear, circuitry, services, Energy Management System, etc. necessary to connect up equipment after it has be installed in place.
B. Install all electrical items furnished loose with all Owner furnished equipment.
C. See list of owner furnished equipment on cover sheet of drawings.
D. Electrical contractor is responsible for mounting all owner furnished equipment and all wiring noted on the Energy Management drawings. See all "ES" – sheets at end of set. All low-voltage wiring, for the Energy Management Systems, does NOT have to run inside conduits. However, all low-voltage wiring MUST be bundled together, stretched tight and wired-tied to the building structure at a minimum of 3'-0" on center.

END OF SECTION

SECTION 26 05 19

WIRES & CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings.
   2. General Conditions.

1.02 WORK INCLUDES

A. Provide wiring and cables including, but not limited to, feeders, branch circuit power, and lighting.
B. Provide electrical connections to all equipment unless noted otherwise.

1.03 SUBMITTALS

A. No submittals required when using specified materials. Otherwise, Section 26 00 10 "SUBMITTALS" and “SUBSTITUTION OF EQUIPMENT”.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Wire, cable and installation thereof shall be in accord with the NEC and standards specified.
   2. All materials shall be new, without blemish or defect, and UL listed or labeled.
   3. Test power and signal wire and cable according to Section 26 00 20 - "Contract Close-Out and Commissioning".

1.05 REFERENCES

A. Specified references, or cited portions thereof, govern the work.
B. National Electrical Manufacturers Association (NEMA):
   1. WC 3 - Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
   2. WC 5 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
   3. WC 7 - Cross-Linked-Thermosetting-Polyethylene-Insulated. Wire and Cable for the Transmission and Distribution of Electrical Energy.
C. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code 1993 Edition.
D. Underwriters Laboratories, Inc. (UL): Listed and labeled materials.
E. Manufacturers' Catalogs: Specified manufacturers' catalogs are incorporated by reference to same force and effect as if repeated herein in full.

1.06 DELIVERY, STORAGE AND HANDLING

A. Materials shall be suitably packaged by manufacturer to prevent damage during shipment. Damaged materials will not be acceptable for use.
B. Store materials on site in a clean, dry storage area.
C. Handle all materials carefully to preclude damage. Material with damaged insulation shall not be acceptable for use.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Building Wire
   1. Anaconda Wire & Cable Co.
   2. Phelps Dodge Cable & Wire Co.
   3. Crescent.
   4. Pirelli.
   5. General Cable Corp.
   6. Sigma Corra-Clad (MC Cable).
   7. General Electric Co.
   8. Triangle.
   9. Okonite.

B. Joints and Splices - Indent Type Pressure Connector for #8 AWG and Smaller
   1. Buchanan.
   2. Ideal.
   3. Burndy.
   4. Thomas & Betts.

C. Joints and Splices - Insulated Spring Compression Connectors for #10 Awg and Smaller
   1. Buchanan, Bcap.
   2. T & B, Piggy.
   3. Ideal, Wing nut.
   4. 3M, Scotchlok.
   5. ITT Holub, Free Spring.

D. Joints and Splices - Mechanical Compression or Bolted Type Connector for #6 Awg or Larger
   1. AMP, Inc.
   2. Ideal Industries.
   3. Anderson.
   4. ITT Weaver.
   5. Blackburn.
   6. O.Z./Gedney Co.
   7. Burndy Corp.
   8. T & B.
   9. General Electric Co.
   10. 3M Co.

2.02 BUILDING WIRE

A. Thermoplastic insulated building wire: NEMA WC 5, UL-83 ICEA S-61-402 or S-66-524.

B. Color code conductor insulation for #8 AWG or smaller. Standard colors:

	120/240V 1 phase
1. Phase A	Black
2. Phase B	Red
3. Neutral	White
4. Ground	Green

C. Provide 1" wide taped, colored bands at panelboards, cabinets, and boxes for sizes larger than #8 AWG.

2.03 JOINTS & SPLICES

A. Make terminations, taps and splices with an indent type pressure connector with

insulating cover for #8 AWG and smaller.

B. Instead of indent type connectors, insulated spring compression connectors may be used for #10 AWG and smaller.
C. Use mechanical compression or bolted type connector for #6 AWG or larger. Cover connector with insulating tape or heat shrinkable insulation equivalent to 150% conductor insulation.

PART 3 - EXECUTION

3.01 BASIC WIRING

A. All power wiring shall be installed in a raceway.
B. Use no wire smaller than #12 AWG for power and lighting circuits.
C. Use no smaller than #14 AWG for control wiring for fused control circuits.
D. Multiwire branch circuits with a “shared neutral” are NOT allowed for single phase circuits.
The only allowed multiwire branch circuit with a “shared neutral” is a multi-pole individual branch circuit to a single piece of equipment (for example “current carrying conductors that share a common yoke”). Each allowed multiwire branch circuit shall be provided with a means that will simultaneously disconnect all ungrounded conductors at the point where the branch circuit originates.
E. Splice only in accessible junction or outlet boxes. Do <u>not</u> splice in panelboard cabinets and gutters.
F. Neatly train and lace wiring inside boxes, equipment and panelboards.
G. Make conductor lengths for parallel circuits equal.
H. All equipment circuits shall be installed in separate conduits.

3.02 WIRING IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling #4 AWG and larger wires.
B. Install wire in raceway after interior of building has been physically protected from weather, all plumbing, heating and ventilating work likely to injure conductors completed, conduit system is complete and interior of raceway cleaned.

3.03 CONNECTIONS AND TERMINATIONS

A. Identify each conductor in panelboards, junction or pull boxes, or troughs with a permanent pressure sensitive label with suitable numbers or letters for easy recognition. Identify control wiring at each end and in junction boxes with numeric wire number corresponding to control wiring diagram. See Section 26 05 53 - "ELECTRICAL IDENTIFICATION", for identification requirements.
B. Thoroughly clean wire before installing lugs and connectors.
C. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
D. Terminate spare conductors with electrical tape and roll up in box.

3.04 FIELD QUALITY CONTROL

A. See Section 26 00 20 - “Contract Close-out & Commissioning”.

3.05 BUILDING WIRE INSTALLATION CABLE

A. <u>All wiring shall be in conduit, except that MC-Cable may be substituted only as follows;</u>
1. MC-Cable (maximum cable length of 10’-0”) may be installed only for branch circuit wiring to light fixtures in lay-in grid ceilings.

2. MC-Cable (maximum cable lenghts shown on Detail 2/E2) shall be installed inside the front checkout counters.

B. Feeders and branch circuits: Copper, stranded conductor, 600 volt insulation THHN/THWN. (Exception: Wire sizes #10 AWG and smaller shall be solid.)

C. Control Circuits: Copper, solid or stranded conductor, 600 volt insulation, THHN/THWN.

END OF SECTION

SECTION 26 05 33

RACEWAYS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings.
   2. General Conditions.

1.02 WORK INCLUDES

A. Provide raceways for all conductors, including, but not limited to, that required for service, feeders, branch circuit power, and lighting.
B. Provide power raceways to connecting point for all equipment. Make final electrical connections unless noted otherwise.
C. Provide identification of all raceways.

1.03 SUBMITTALS

A. No submittals required when using specified materials. Otherwise, comply with Section 26 00 10 "SUBMITTALS".

1.04 QUALITY ASSURANCE

A. Provide all new materials, without blemish or defect, in accord with standards specified and UL listed or labeled.

1.05 SYSTEM DESCRIPTION

A. Raceways Include:
   1. Rigid Metal conduit and fittings.
   2. Rigid non metallic conduit and fittings.
   3. Intermediate metal conduit and fittings.
   4. Liquidtight flexible metallic tubing and fittings.
   5. Flexible metallic conduit and fittings.
   6. Electrical metallic tubing and fittings.
   7. Liquidtight Flexible conduit and fittings.

1.06 REFERENCES

A. Specified references, or cited portions thereof, current at date of bidding documents unless otherwise specified, govern the work.
B. American National Standards Institute (ANSI):
   1. C80.1 - Rigid Steel Conduit, Zinc coated.
   2. C80.3 - Electrical Metallic Tubing, Zinc coated.
   3. C80.4 - Fittings for Rigid Metal Conduit and Electrical Metallic Tubing.
C. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA): FB 1 - Fittings and Supports for Conduit.
D. National Electrical Manufacturers Association (NEMA):
   1. NEMA TC-3 - PVC Fittings for use with Rigid PVC Conduit and Tubing.

1.07 DELIVERY, STORAGE AND HANDLING

A. Materials shall be suitably packaged by manufacturers to prevent damage during shipment. Damaged materials will not be acceptable for use.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Raceways
   1. Allied Tube and Conduit.
   2. Republic Steel.
   3. Anaconda.
   4. Robintech.
   5. B-line.
   6. Steelduct Conduit Products
   7. Carlon.
   8. Square D.
   9. Certain-Teed Corp.
   10. Triangle.
   11. Electri-Flex
   12. Walker.
   13. ETP.
   14. Wheatland Tube.
   15. International Metal Hose.
   16. Wiremold.
   17. Jones & Laughlin Steel.
   18. Youngstown Steel.

B. Fittings
   1. Carlon.
   2. O.Z./Gedney.
   3. Crouse-Hinds.
   4. RACO.
   5. Killark.
   6. Steel City.

C. Conduit Sealing
   1. Chase Technology-CTC, PR-855.
   2. T & B - Flamesafe.
   3. Dow Corning - Silicone RTV foam 3-6548.
   4. 3M - Fire Barrier.
   5. Nelson - Flameseal.

D. Conduit Supporting Devices
   1. Minerallac.
   2. Crouse-Hinds.
   3. Midwest Electric.
   4. T & B.

2.02 RACEWAYS

A. Conduit:
   1. Steel Rigid Metal: Comply with ANSI C80.1, FS-WW-C-581 and UL-6.
   2. Intermediate Metal: Comply with ANSI C80.1, FS-WW-C-581 and UL-6.
   3. Steel Flexible Metal: Comply with FS-WW-C-566 and UL-1.
   4. Steel Liquidtight Flexible: Comply with FS-WW-C-566 and UL-1.
   5. Rigid Nonmetallic: Comply with NEMA TC-2, PVC, Schedule 40

B. Tubing:
   1. Steel Electrical Metallic (EMT): Comply with ANSI C80.3, FS-WW-C-563 and UL 797.
C. Surface metallic raceway:
   1. Comply with UL E4376 and E41751.

2.03 FITTINGS

A. Rigid and IMC Conduit fittings and conduit bodies:
   1. Comply with ANSI C80.4, ANSI/NEMA FB 1, threaded type.
   2. Locknuts; steel or malleable iron.
   3. Bushings; insulating or insulated throat type.
   4. Couplings; threaded or gland compression malleable iron type. Set screw or indenter type not acceptable.
   5. UL listed hazardous location fittings (with sealing compound).
B. Electrical Metallic Tubing fittings and conduit bodies:
   1. Couplings and Connectors; steel compression type. Set screw type not acceptable. Comply with ANSI/ NEMA FB 1.
C. Flexible conduit fittings and conduit bodies:
   1. Connectors; malleable iron, threadless, squeeze clamp type for nonjacketed conduit.
   2. Connectors; steel or malleable iron compression type with insulated throat and "O" ring assembly for liquidtight conduit.
   3. Comply with ANSI/NEMA FB 1.
D. Nonmetallic conduit fittings and conduit bodies:
   1. Comply with NEMA TC 3.

2.04 CONDUIT SEALING

A. Where conduits and/or electrical devices penetrate fire-rated walls and/or floors, the cavity shall be sealed with intumescent material capable of expanding 5 to 10 times when exposed to temperatures of 250° F. It shall be ICBO, BOCA, and SBCCI (NRB 243) approved ratings per ASTM E-814 (U.L. 1479). Acceptable materials: DOW-CORNING 3-6548 silicone RTV foam or 3-M fire barrier caulk, or 3-M fire barrier 2001 silicone RTV foams.
B. Water Seal:
   1. Seal penetrations of perimeter walls or floors below grade to prevent entry of water. Use materials compatible with wall or floor construction and reviewed by Engineer's Representative. Use premanufactured fittings.
   2. Seal penetrations of roof with flashings compatible with roof design and reviewed by Roofing System Manufacturer and Engineer's Representative.
C. Hazardous Location Seal:
   1. Install conduit sealing fitting on conduits entering the hazardous location. Fill fittings with sealing compound.
   2. Install conduit sealing fittings on conduits entering devices within the hazardous location.

2.05 RACEWAY SUPPORTING DEVICES

A. Suspended conduits less than 1 inch.
   1. For exposed construction, provide strap type hangers supported from beam clamps or threaded rods.
   2. For conduits suspended above ceilings, anchor to building structural steel. When span exceeds NEC limits, provide channel steel between framing members. Tie wiring of conduit to air ducts, or other piping not permitted. Plumber's perforated strap not permitted.
B. Suspended Conduit 1 inch or larger.
   1. Provide threaded rod with "U" type hangers for single conduit.
   2. Provide trapeze hanger assemblies with Unistrut P-1000, Husky HP-200 or Kindorf B-901

and threaded rod for two or more conduits. Anchor conduits to hanger assembly with split pipe clamps.
3. Anchor threaded rod to inserts in concrete or beam clamp on steel structure.

C. Surface Mounted Conduit:
1. Provide one-hole galvanized steel straps for conduits one inch or less manufactured by Appleton, Steel City or RACO. Provide clampbacks on exterior walls below grade or in wet areas.
2. For conduit larger than one inch and all exterior surfaces, use malleable iron pipe straps.
3. For multiple conduits, provide channel anchored to wall with conduit attached to channel with split pipe clamps.

D. Anchoring:
3. Hollow Masonry: Toggle bolts or spider type expansion anchors.
4. Solid Masonry: Lead expansion anchors or preset anchors.
5. Concrete: Self-drilling anchor or powder driven studs.
6. Metal: Machine screws, bolts or welded studs.
7. Wood: Wood screws.

PART 3 - EXECUTION

3.01 INTERFERENCES

A. Coordinate work with other trades so that interference between piping, equipment, structural and electrical work will be avoided.
B. When interference develops, Engineer's Representative will decide which equipment will be relocated; regardless of which apparatus was installed first.

3.02 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

A. In general, conduit shall be concealed within walls, ceilings, and floors. Conduit in spaces such as equipment rooms may be exposed.
B. Size conduit for conductor type installed; 1/2 in. minimum size unless noted otherwise.
C. Arrange conduit to maintain headroom and present a neat appearance.
D. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.
E. Maintain minimum 6 in. clearance between conduit and uninsulated piping. Maintain 12 in. clearance between conduit and heat sources such as flues, and heating appliances.
F. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.
G. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.
H. Do not fasten conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.
I. DO NOT SUPPORT ANY CONDUITS, BOXES OR ANY OTHER ELECTRICAL WORK DIRECTLY FROM UNDERSIDE OF ROOF DECK WITHOUT WRITTEN CONSENT OF ENGINEER'S REPRESENTATIVE.

3.03 CONDUIT INSTALLATION

A. All conduit in finished spaces shall be concealed unless otherwise noted.
B. Cut conduit square using a saw or pipe cutter; de-burr cut ends.
C. Bring conduit to the shoulder of fittings and couplings and fasten securely.
D. Use conduit hubs or sealing locknuts for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations.
E. Install no more than the equivalent of four 90-degree bends between boxes. (Two 90-degree bends for telephone conduits, data conduits, and sound system conduit).

F. Use conduit bodies to make sharp changes in direction, as around beams.
G. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 in. size.
H. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.
I. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.
J. Provide No. 12 AWG insulated conductor or nylon pull string in empty conduit, except sleeves and nipples.
K. Provide UL listed expansion-deflection joints where conduit crosses building expansion or seismic joints.
L. Where conduit penetrates fire-rated walls and floors, provide mechanical fire-stop fittings with UL listed fire rating equal to wall or floor rating, or, at contractor's option, seal opening around conduit in accord with paragraph 2.04.
M. Route conduit through roof openings for piping and ductwork where possible. Provide flashing making waterproof joints where conduits pass through roof or roofing membrane.
N. Maximum Size Conduit in floor slabs: 3/4 in. Do not route conduits to cross each other in slabs. Run larger conduits below floor slabs or above ceilings.
O. Thermally seal conduit where conduits leave heated area and enter unheated area. See 2.04.
P. Wipe plastic conduit clean and dry before joining. Apply full even coat of cement to entire area that will be inserted into fitting. Let joint cure for 20 minutes minimum.

3.04 CONDUIT INSTALLATION SCHEDULE

A. Underground Installations: Rigid steel conduit. Plastic-coated rigid steel conduit. Schedule 40 PVC conduit.
B. Installations In or Under Concrete Slab: Schedule 40 PVC conduit.
C. In Slab Above Grade: Schedule 40 PVC conduit.
D. Exposed Outdoor Locations: Rigid steel conduit. Intermediate metal conduit.
E. Interior Locations Above Floor Slabs: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.
F. Where nonmetallic conduit is used in or below slab or underground, continue the conduit runs above slab or grade using: IMC or rigid steel conduit.
G. Connections to ballasted lighting fixtures, appliances, and equipment with motors or compressors: Flexible Metallic Conduit. Liquidtight flexible conduit in exterior locations in wet locations, and in grease laden areas such as food service areas. Provide green insulated equipment grounding conductor.
H. Hazardous Locations: Intermediate metal conduit. Rigid steel conduit.
I. Interior exposed locations in finished spaces: surface metallic raceway system.
J. Provide a green insulated equipment grounding conductor in all feeder and branch circuit raceways. Size conductor according to NEC Section 250-95.

END OF SECTION

SECTION 26 05 34

BOXES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings.
   2. General Conditions.

1.02 WORK INCLUDES

A. Provide all boxes for the work.
B. Provide coordination of boxes requiring access with General work.
C. General Construction Trades provide access panels for boxes hidden by building construction.

1.03 SUBMITTALS

A. No submittals required when using specified materials. Otherwise, comply with General Conditions Section 26 00 10 "SUBMITTALS".

1.04 QUALITY ASSURANCE

A. Regulatory Requirements
   1. Comply with NFPA.
   2. Provide materials listed/labeled by UL.
   3. National Electric Code.

1.05 SYSTEM DESCRIPTION

A. Boxes include:
   1. Wall and ceiling outlet boxes.
   2. Pull and junction boxes.

1.06 REFERENCES

A. Specified references, or cited portions thereof, current at date of bidding documents unless otherwise specified, govern the work.
B. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA OS-1-Sheet Steel Outlet Boxes, Device Boxes, Covers and Box Supports).
C. National Electrical Manufacturers Association (NEMA): NEMA 250 - Enclosures for Electrical Equipment.
D. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code latest Edition.
E. Manufacturers' Catalogs: Specified manufacturers' catalogs are incorporated by reference to same force and effect as if repeated herein in full.

1.07 DELIVERY, STORAGE AND HANDLING

A. Materials shall be suitably packaged by manufacturer to prevent damage during shipment. Damaged materials not acceptable for use.
B. Store materials on site in a clean, dry storage area.

C. Handle all materials carefully to preclude damage.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Boxes (other than Floor Boxes)
   1. Appleton Electric Co.
   2. Pyle-National
   3. Crouse-Hinds Co.
   4. RACO
   5. General Electric Co.
   6. Square D.
   7. Hoffman Co.
   8. Steel City
   9. Hubbell.
   10. Thomas & Betts Co.
   11. Killark Electric Mfg. Co.
   12. Walker.
   13. O.Z./Gedney Co.
   14. Quazite.

2.02 PULL BOXES AND JUNCTION BOXES

A Comply with 1996 NEC - 370, UL 50 and ANSI/NEMOS 1; galvanized steel.
B. Flush mounted pull boxes: Overlapping cover with flush head retaining screws, prime-coated.
C. Surface mounted boxes: Screw-on or hinged cover. Provide silicon bronze standard retaining screws.
D. Finished Areas: Boxes of 14 gauge steel minimum, galvanized or prime coated.
E. Boxes greater than 144 square inch: Make of 1-1/2 in. X 1-1/2 in. X 1/4 in. galvanized angle covered with 10 gauge galvanized sheet steel riveted or bolted with hinged cover of 11 gage galvanized steel.
F. Boxes larger than 12 inches in any dimension: hinged enclosure.
G. Exterior Below Grade: Non-metallic, sand-gravel polymer base fiberglass reinforced.

2.03 OUTLET BOXES

A. Hot dipped galvanized, 1.25 oz. per sq. ft., sherardized or cadmium plated. Conform to UL 514.
B. Interior boxes: Sheet steel with conduit knockouts, attached lugs for locating. ANSI/NEMA OS 1.
C. Exterior boxes or exposed interior in wet/damp locations: Cast aluminum, deep type, corrosion proof fasteners, watertight, gasketed, threaded hubs.
D. For suspended or surface mounted fixtures:
   1. 4-inch octagonal or square according to devices used. Minimum 1-1/2 in. deep. Furnished with fixture studs. Installed with 3/4 in. minimum depth plaster rings on suspended ceilings. 4 in. octagonal or square for all exposed conduit work with fixture extension pan or deep fixture canopy to enclose the box.
   2. Fixtures listed for thru-way wiring may be used as such without an outlet box.
E. For recessed fixtures:
   1. 4 in. octagonal or square. Minimum 1-1/2 in deep. Complete with blank cover.
   2. Fixtures listed for thru-way wiring may be used as such without an outlet box.
F. Switch and Receptacle Boxes:
   1. Wall: 4 in. square for up to two devices. Single gang with 18 cubic inch minimum capacity for one device. Solid gang boxes for two devices. Complete

with 1 in. minimum depth tile ring where used in exposed tile, paneled walls. Complete with 1 in. minimum depth plaster ring where used In plastered walls. Install with 1/2 in. raised galvanized device covers conduit work. Provide concrete-tight masonry boxes in poured concrete or CMU walls.

2.04 CONDUIT BODIES

A. Galvanized cast metal of type, shape and size to fit location.
B. Constructed with threaded conduit ends, removable cover, corrosion resistant screws.

PART 3 - EXECUTION

3.01 COORDINATION

A. Provide boxes as shown and for splices, taps, wire pulling, equipment connections and code compliance.
B. Locations shown are approximate unless dimensioned. Verify location of boxes and outlets prior to rough-in.
C. Locate boxes to allow access. When inaccessible, provide access doors.
D. Locate boxes to maintain headroom and present a neat appearance.

3.02 INSTALLATION

A. Provide knockout closures to cap unused knockout holes where blanks have been removed.
B. Support all boxes independently of conduit except for cast boxes connected to two rigid conduits both supported within 12 inches of box.
C. Outlet Boxes:
    1. Flush mount outlet boxes in areas other than mechanical rooms, electrical rooms, and above removable ceilings.
    2. Do not install boxes back-to-back in same wall. Provide at least 6 in. separation where possible.
    3. Use multiple gang boxes where more than one device is mounted together. Do not use sectional boxes. Provide barriers to separate different voltage systems.
    4. For boxes mounted in exterior walls, make sure insulation is behind outlet boxes. Do not damage insulation.
    5. For outlets mounted above counters, benches, or backsplashes, coordinate location and mounting heights with units. Where boxes are mounted on sidewalls, at counters and lavatories, hold boxes to front of counter or lavatory for handicapped accessibility.
    6. Adjust outlet mounting height to agree with specified location for equipment served.
    7. Position outlets to locate luminaires as shown on reflected ceiling drawings.
    8. Position outlets and junction boxes in inaccessible ceilings areas within 6 in. of luminaire; accessible through luminaire ceiling opening.
    9. Provide recessed boxes in finished areas; secure to interior wall and partition studs, allow for surface finish thickness. Use stamped steel stud hangers in hollow stud wall, and adjustable steel channel fasteners for flush ceiling boxes.
    10. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
    11. Provide cast boxes for exterior locations & wet locations.

D. Pull and Junction Boxes:
    1. Locate above accessible ceilings or in unfinished areas.
    2. Support independent of conduit.
E. Provide covers for all boxes.

END OF SECTION

SECTION 26 05 53

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings.
   2. General Conditions.
   3. General Provisions of the Contract.
   4. Solicitation Documents.
   5. Section 01.

1.02 WORK INCLUDES

A. Provide identification of manual and automatic operable equipment:
   1. Safety Switches.
   2. Panelboards & Switchboards.
   3. Starters.
   4. Control panels, relay panels, and special junction boxes.
   5. Contactors, relays and time switches.
   6. Manual starters and interval timers.
B. Provide identification of all passive equipment:
   1. Terminal Cabinets.
C. Provide identification of conduit system including boxes.
D. Provide identification of wiring system.

1.03 QUALITY ASSURANCE

A. Comply with:
   1. ANSI A 13.1, Identification of Piping Systems.
   2. Local Rules & Regulations.
   3. National Electric Code. (NEC)

1.04 REFERENCES

A. Specified references, or cited portions thereof, current at date of bidding documents unless otherwise specified, govern the work.
B. American National Standards Institute (ANSI): ANSI A13.1 - Identification of Piping Systems.
C. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code (NEC) 1993 Edition.
D. Underwriters Laboratories, Inc. (UL): All products UL listed and labeled.
E. Manufacturers' Catalogs: Specification manufacturers' catalogs are incorporated by reference to same force and effect as if repeated herein in full.

1.05 SUBMITTALS

A. See Section 26 00 10 “SUBMITTALS”.

PART 2 - PRODUCTS

2.01 EQUIPMENT IDENTIFICATION PLATES

A. See Section 26 00 20 - “Contract Close-out & Commissioning”.

2.02 CONDUIT SYSTEM IDENTIFICATION

A. See Section 26 00 20 - “Contract Close-out & Commissioning”.

2.03 UNDERGROUND-TYPE PLASTIC LINE MARKERS

A. General: Manufacturer's standard permanent, bright-colored, continuous-printed detectable tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried pipe.
   1. Provide multi-ply tape consisting of solid aluminum foil core between 2-layers of plastic tape.

2.04 WIRING SYSTEM IDENTIFICATION

A. Wire Insulation Color: See Section 26 05 19 - "WIRES AND CABLES".
B. Code all wire and cable larger than color coded sizes available from manufacturer by application of electrical plastic tape in colors specified. Apply tape in uniform manner circling wire or cable. Apply tape in all boxes and cabinets. Half-lap tape for length of cable as required by Local Authorities or NEC. Tape shall be 3M, Plymouth or Permacel.
C. Maintain consistent coding throughout installation to ensure proper phase identification.
D. See Section 26 00 20 - “Contract Close-out & Commissioning”.

2.05 MISCELLANEOUS IDENTIFICATION

A. Complete all panel directories completely typewritten. Each circuit shall be identified by location and type of load. Example: Lighting - Office.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Affix Equipment Identification Plates to equipment with stainless steel self tapping screws. Do not use adhesive.

3.02 UNDERGROUND PIPING IDENTIFICATION

A. General: During back-filling/top-soiling of underground gas piping, install continuous underground-type detectable type line marker, located directly over buried line at 6" to 8" below finished grade.

END OF SECTION

SECTION 26 24 00

ELECTRICAL EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings.
   2. General Conditions.

1.02 WORK INCLUDES

A. Provide:
   1. Panelboards.
   2. Contactors.
   3. Safety Switches.
   4. Fuses.

1.03 SUBMITTALS

A. No submittals required when using specified equipment or owner provided equipment, otherwise submit information as outlined in Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Regulatory requirements:
   1. Panelboards:
      a. UL Standard 67.
      b. Fed. Spec. W-P-115A Type 1, Class 1.
      c. NEMA Standards PBI-1977.
   2. Safety Switches:
      a. UL Std. 98.
      b. NEMA Std. KS1-1975.
   3. Contactors:
      a. UL Std. 508.
      b. NEMA Std. 1CSZ-Z11B.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in time to maintain approved construction schedule.
B. Store in safe, dry location. Protect from dust, moisture, weather and extreme temperatures.
C. Follow manufacturer's recommendation for transportation, handling and storage.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
A. Electrical Equipment
   1. Cutler-Hammer.
   2. Siemens-ITE.
   3. GE.
   4. Square D.

B. Fuses
   1. Bussman.

2.02 PANELBOARDS - LIGHTING AND APPLIANCE

A. Circuit breakers panelboards shall meet Federal Spec W-P-115A for Type 1 panels. Panelboard bussing may be tinned-aluminum. Circuit breakers shall be quick-make, quick-break, thermal-magnetic, trip indicating, and have common trip on all multi-pole circuit breakers. Trip indication shall be shown by the breaker handle taking a neutral position between ON and OFF when the breaker is tripped. The ampacity of the circuit breaker shall be stamped in a location visible without removing the front of the panelboard. The minimum circuit breaker interrupting capacity shall be as indicated on plans. Circuit breakers shall be plug on type. All circuit breakers on lighting panels shall be UL labeled "SWD" and "HACR". All circuit breakers serving HID loads shall be so rated. Panelboards shall be equal to the style/type shown on schedules.
B. All terminals shall be UL listed as suitable for the type of conductor specified.
C. Main lugs shall be bolt type.
D. Panelboard bus assemblies shall be enclosed in galvanized or rust-resisting steel cabinets. Fronts shall include doors and cylinder tumbler type locks with catches and spring loaded door pulls. All doors shall be keyed alike. Door hinges shall be concealed when panel doors are closed. Fronts shall not be removable with doors locked. A circuit directory frame and card with clear plastic cover shall be locked on the inside of the front. Door and front shall be of code gauge steel with rust inhibiting primer and gray baked enamel finish.
E. Panelboards shall have solid neutral and equipment grounding bus. Panels designated for electronic equipment (Cpx) shall have 200% neutral bus.

2.03 SAFETY SWITCHES

A. All safety switches shall be the fusible type, horsepower rated, NEMA type, general duty (240V and below) unless otherwise noted on drawings. Note: Heavy duty safety switches shall be provided on all voltages greater than 240V.
B. Enclosures shall be code gauge steel with rust inhibiting primer and gray baked enamel finish. Install safety switches with NEMA 1 enclosures in dry locations and NEMA 3R enclosures in wet locations.
C. Switches shall have quick-make, quick-break operating handle and mechanism which shall be an integral part of the enclosure. Switches shall be lockable in both positions and shall have an interlock to prevent opening switch door with handle in the OFF position. This feature shall have a defeater mechanism.
D. Switch blades shall be visible in OFF position with door open. Switches shall be dead front type with arc suppressors. Lugs shall be UL listed for copper or aluminum. All current carrying parts shall be plated.
E. Switches shall have a solid neutral unless otherwise noted.
F. Switches shall have factory installed kits to prevent the use of other than UL class R fuses.

2.04 LIGHTING CONTACTORS

A. Contactors shall be electrically held and shall switch the load at the voltage required and shall have the quantity of poles required.
B. The contactor shall be continuously rated per pole for all types of ballast and tungsten lighting and resistance loads, and shall not be de-rated for use on high-inrush loads.
C. The contactor shall have double-break, silver-cadmium-oxide power contacts. Auxiliary arcing contacts are not acceptable. all power contacts shall be convertible from N.O. to N.C. or vice-versa. All contacts shall HVAC clearly visible N.O. and N.C. contact-status indicators.

D. The contactor shall be industrial-duty rated for applications to 600 volts maximum.
E. The contactor shall have NEMA type enclosure as required by installation.

2.05 FUSES

A. Circuits 601 to 6000 amperes shall be protected by current limiting time-delay fuses. Fuses shall hold 500% of rated current for a minimum of 4 seconds, clear 20 times rated current in .01 seconds or less and be listed by Underwriters Laboratories, Inc., with an interrupting rating of 200,000 amperes RMS symmetrical. The fuses shall be UL Class L.
B. Circuits 0 to 600 amperes shall be protected by current limiting dual-element fuses. All dual-element fuses shall have separate overload and short-circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284□F. melting point alloy and shall be independent of the short-circuit clearing chamber. The fuse shall hold 500% of rated current for a minimum of 10 seconds (30A, 250V Class RK1 case size shall be a minimum of 8 seconds at 500% of rated current) and be listed by Underwriters Laboratories, Inc., with an interrupting rating of 200,000 amperes RMS symmetrical.
C. Motor circuits - All individual motor circuits with full load ampere ratings (FLA) of 480 amperes or less shall be protected by dual-element fuses. The fuses shall be UL Class RK1, or J, dual-element time-delay.
D. The ampere rating of fuses shall be as required by the load served. Field verify by inspecting the nameplate of the equipment being protected.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with equipment manufacturer's written installation instructions for all equipment.
B. Install equipment with minimum of 3'-6" working clearance measured from front of enclosure.
C. Set equipment true and plumb using a carpenter's level.
D. Support panels adequately in the same manner as described for outlet boxes for different types of construction.
E. Wiring within equipment cabinets shall be done in a neat and workmanlike manner with branch circuit conductors run along the outside edges of the wiring gutters and then horizontally into the terminals.
F. For flush mounted panelboards, stub a minimum of three 3/4" diameter raceways into the ceiling cavity space.
G. Install safety switches which serve as equipment disconnecting means so that equipment maintenance can be performed within sight of the disconnect, if possible.
H. When safety switches are mounted directly to equipment in wet locations, the installation shall be watertight. Install sealing locknuts with rubber O-rings for equipment with knockouts.
I. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std. 486A.
J. Adjust operating mechanisms for free mechanical movement.
K. Touch-up scratched or marred surfaces to match original finishes.
L. Prior to energization of circuitry, check all accessible connections to manufacturer's tightening torque specifications.
M. Prior to energization of equipment, check with ground resistance tester phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.

N. Prior to energization, check equipment for electrical continuity to circuits, and for short-

circuits.

O. Subsequent to wire and cable hook-ups, energize equipment and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.
P. See Section 26 00 20- “Contract Close-out & Commissioning”.
Q. Fuses shall not be installed until equipment is ready to be energized.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings.
   2. General Conditions.

1.02 WORK INCLUDES

A. Provide:
   1. Switches.
   2. Device plates.
   3. Receptacles.

1.03 RELATED WORK

A. Section 26 05 19– “WIRES AND CABLES”.
B. Section 26 05 34 – “BOXES”.

1.04 SUBMITTALS

A. Provide product data in accordance with Section 26 00 10 "Basic Electrical Requirements".

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: All materials: U.L. listed or labeled.

1.06 REFERENCES

A. Specified references, or cited portions thereof, govern the work.
B. National Electrical Manufacturers Association (NEMA):
   1. WD-1 - General Purpose Wiring Devices.
   2. WD-5 - Specific Purpose Wiring Devices.
   3. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code (NEC) Latest Edition.
   4. Underwriters' Laboratories, Inc. (UL): All materials UL listed and labeled.
   5. Federal Specification WC596F (Receptacles) and WS896E (Switches).

1.07 DELIVERY, STORAGE AND HANDLING

A. Materials shall be suitably packaged by manufacturer to prevent damage during shipment. Damaged materials will not be acceptable for use.
B. Store materials on site in a clean, dry storage area.
C. Handle all materials carefully to preclude damage during installation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Arrow-Hart.

B. Leviton.

C. Hubbell.
D. Pass & Seymour.

2.01 WALL SWITCHES

A. Specification Grade, 20A, 120-277 V., quiet type, back and side wired, toggle handle. Color - Ivory. Equal to Hubbell series as follows:
   1. Single pole - #CS-1221
   2. 4-Way - #CS-1224
   3. Double pole - #CS-1222
   4. Pilot Light Switch - #HBL-1221L
   5. 3-Way - #CS-1223
B. Narrow Switches: Equal to “Eagle” #1211-V, 20A, 227V, quiet type, back wired, toggle handle. Color – ivory. Provide Eagle #919 mounting strap and “Pass & Seymour” SNG1 cover plate.

2.02 RECEPTACLES

A. Duplex:
   1. Flush, straight blade, 3 wire grounding, construction series, heavy duty, specification grade, 20 A, 125 V., NEMA 5-20R, capable of being split wired and/or feed thru.
   2. Hubbell #CR-5362 or equal.
   3. Color: Ivory (Gray for “Designated Receptacle).
B. Ground Fault Circuit Interrupter:
   1. Commercial, specification grade feed through type capable of protecting downstream receptacles on same circuit, grounding type, UL class A-Group 1, 20 amp 125 v.
   2. Solid State ground fault sensing and signaling, 5 ma. trip level.
   3. Color: Ivory.
   4. Hubbell #GF-5362 or equal.
C. Isolated Ground:
   1. Single or duplex, 3 wire, construction series, heavy duty specification grade, 20 amp, 125V, NEMA 5-20R.
   2. Color: Orange.
   3. Hubbell CR-5352IG or equal.
D. Telephone/Communication Outlet:
   1. Provide wall box only and provide blank coverplate for locations that are not used.

2.03 DEVICE PLATES

A. Materials:
   1. Finished Spaces: .04 inch thick, type 302, satin finished stainless steel.
   2. Outdoor, Exterior: Cast metal, gasketed. Provide springloaded gasketed door for receptacles.
   3. Surface Devices in Unfinished Areas: Galvanized steel.
B. Use plates manufactured by device manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install wall switches with OFF position down.
B. Install convenience receptacles with grounding pole on top when mounted vertically or with grounding pole on left when mounted horizontally.

C. Install plates on all switch, and receptacle outlets. Install blank plates on all unused boxes.
D. Install devices and plates flush and level.
E. Seal all connections on GFCI with seal coat compound and wrap with two layers tape.

END OF SECTION

SECTION 26 50 00

LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:
   1. Drawings.
   2. General Conditions.
   3. Refer to Section 01 11 00-Summary of Work.

1.02 WORK INCLUDES

A. Provide lighting fixtures.
B. Provide required fixture supports.
C. Provide lamps.

1.03 SUBMITTALS

A. No submittals required on specified equipment or owner furnished equipment otherwise provide: Product data in accordance with Section 26 00 10 “SUBMITTALS”.

1.04 QUALITY ASSURANCE

A. Regulatory requirements.
   1. NEMA Std. Pub. Nos. SH5 and TT1 for pole construction, materials, and hardware.
   2. Building lighting fixtures:
      a. Applicable sections of NEC.
      b. ANSI 132.1
      c. UL 57, 676, 1570, 1571, and 1572.
      d. Fluorescent ballasts shall be CBM labeled.
      e. NEMA Std. Pub. Nos. FA1. LE1 and LE2.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Electronic ballasts
   1. Advance.
B. Lamps
   1. General Electric.
   2. Phillips.
   3. Osram-Sylvania

2.02 FIXTURES

A. Specified on plans.

2.03 BALLASTS

A. All ballasts shall be rated for the circuit voltage shown on plans.
B. All ballasts shall be P thermal rating. Fluorescent ballasts shall have class A sound rating.
C. Ballasts for exterior lighting fixtures shall be suitable for use at temperatures -20°F. and above.

D. Unless otherwise noted, fluorescent ballasts shall be solid state electronic type for use with T8 (Octron or equal) fluorescent lamps. Electronic ballasts shall have a total harmonic distortion of 10% or less.

2.04 LAMPS

A. Provide lamps for all light fixtures as scheduled on drawings.
B. All fluorescent lamps shall contain mercury in reduced amounts allowing them to pass the EPS's "Toxic Characteristic Leaching Procedure" (TCLP) and be so labeled.

PART 3 - EXECUTION

3.01 LIGHTING FIXTURES

A. Provide all plaster frames, angles, channel, hangers and supports required to support lighting fixtures. Fixtures shall be supported independently of ceiling.
B. Exit signs in suspended ceiling areas shall be located in the center of the ceiling tile and oriented so as to provide maximum visibility to escape paths.
C. See Section 26 00 20 - "Contract Close-out & Commissioning".

END OF SECTION